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ISSN 3030-3907

MUNDARIJA

1	Osce metodikasi asosida “homiladorlik vaqtida qon ketishlar” mavzusini o‘qitishning ilmiy-pedagogik asoslari *Kadirbayeva Madina Telmonovna*	9
2	Somatik kasalliklar va homiladorlik: dalillarga asoslangan tibbiyot (evidence-based medicine) yondashuvi asosida ta’lim jarayonini takomillashtirish	14
3	Oliy ta`lim muassalarida o`quv jarayonini boshqarishga oid ilmiy-nazariy qarashlari *Jurayeva Gulhayo*	20
4	The impact of digital transformation on traditional insurance paradigms *D.D.Omonova*	26
5	To‘g‘onsiz mikro geslar va ularni loyihalash Xamrayev Og‘abek Oybek o‘g‘li	35
6	Paxta xomashyosini iflosliklardan tozalashdagi statsionar harakat jarayonini nazariy tadqiqoti *A.I.Karimov* *N.T. Imomnazarova*	40
7	Ikki o‘lchovli parabolik tipdagi differensial tenglamalarni yechish algoritmlari va sonli natijalarni modelini ishlab chiqish *A.B.Ochilova* *S.X.Nazirova*	46
8	Uch o‘lchamli nilpotent algebraning differensiallashi lokal va ikki lokal differensiallashi *Boydadayev Islomjon G‘anijon o‘g‘li* *Ermatov Jamoldin Saloxiddin o‘g‘li* *Xajimirzayeva Nargiza Abduhakimovna*	53
9	Innovatsion gibrid burg‘ilarning texnologik tuzilishi va afzalliklarini asoslash *Nurmatov Jaxongir Togaymuradovich* *Samadov Aziz Xasanovich*	62
10	Mayda iflosliklardan tozalaydigan laboratoriya uskunasiga turli xil to‘rli yuza o‘rnatib tajribalar o‘tkazish *Ulug‘muradov Xamroz Yusuf o‘g‘li* *Altmishov Bobur Sunnatbekovich* *Muradov Rustam Muradovich* *Novruzov Sobirjon Otaqul o‘g‘li*	69
11	Separation of sour components from flare gases in absorption purification of gases *Sayfullayev.SH* *E.R.Panoyev* *G’.R.Bozorov*	77
12	Teaching french grammar creatively: strategies for fle classrooms *Narzulloyeva Dilfuza Bahriddin qizi*	86
13	Technical thinking and its impact on society *Shakhida Yusupova*	95
14	Konchilik sanoatida og‘ir yuk tashuvchi avtosamosvallarga qo’shimcha havo filtrlari o‘rnatish orqali hosil bo‘ladigan bosimlar tahlili *Gaffarov Azamat Alisherovich* *Atakulov Lazizjon Nematovich* *Qahharov Orifjon Odiljonovich* *Ismatov Adxam Alibekovich* *Juraqulov Jahongir Abdurazzoq o‘g‘li*	101
15	Konchilik sanoatida og‘ir yuk tashuvchi avtosamosvallarning havo filtrlarining ishlash muddatlariga ta’sir etuvchi omillar *Gaffarov Azamat Alisherovich* *Atakulov Lazizjon Nematovich* *Suleymanova Muqaddas Baxtiyorovna*	111

ISSN 3030-3907

	Ismatov Adxam Alibekovich *Juraqulov Jahongir Abdurazzoq o'g'li*	
16	Опытно-экспериментальное исследование изменения температуры погружного насоса при установке охлаждающего кожуха *Курбонов Ойбек Мухамматкулович* *Атакулов Лазизжон Неъматович* *Сафарова Мафтуна Давроновна*	117
17	Karyer bir cho'michli ekskavator strelasi po'lat sim arqonlarining dinamik yuklamalar tahlili *Haydarov Shohid Bahriddinovich* *Usmonov Maftunjon Zohidjon o'g'li*	128
18	Shlamli rejimni hosil bo'lishini bartaraf etish maqsadida tog' jinsini parchalovchi asbobning konstruksiyasini takomillashtirish *Mustafayev Oybek Bobomuradovich* *Boltayev Muhammad A'zamovich*	135
19	Yuqori kuch uzatma jamlanmasining texnik ko`rsatkichlari va afzalliklarini tavsiflash *Bekjonov Rozisher Soatmurodovich* *Samadov Aziz Xasanovich*	148
20	Karyer gidravlik ekskavtorlarning to'xtalish sabablarining tahlili *Jurayev Akbar Shavkatovich* *Turdiyev Sardorjon Abdumuminovich*	154
21	Гидратация и щелочная рафинация соевого масла *Рахмонов К.С.* *Муродов Д.К* *Мажидова Н.К.* *Умиркулова М.С.*	162
22	Modeling heat and moisture distribution in grain storage using a two-dimensional monitoring approach *Adizova Zukhro Marupovna*	170
23	Activity of special economic zones: development and management system to increase efficiency *Turaev Bakhodir Khatamovich* *Atamurodov Bekzod Nizamkulovich*	182
24	Chigitli paxta quritishning umumlashgan kinetik modeli *Mamatov Alisher Zulunovich* *Raxmanov Jamshidbek Turdalievich*	205
25	Ekologik toza yuqori ozuqaviy qimmatli oziq-ovqat mahsulotlari olish uchun qovoq urug'ini qayta ishlash usulini ishlab chiqish *Yoqubov Muxridin Erkin o'g'li* *Xaitov Rauf Arifovich*	213
26	Фарғона "азамат савдо зиё" мчж ишлаб чиқариш Корхонаси чиқинди сувларининг ҳосил бўлищи ва тозалащ технологияси *Хурмаматов Абдугаффор Мирзабдуллаевич* *Мирсаидов Махмуджон Хабибуллаевич*	221
27	Inklyuziv ta'lim jarayonida differensial yondashuvning ahamiyati va o'ziga xos xususiyati *Do'stmurodova Mohinur Nurmurod qizi* *Sadullayeva Maftuna Umurzoqovna*	229
28	O'zbekiston iqtisodiyotiga islom moliyasining kirib kelishi va qarz munosabatlarida smart credit scoring modellari *Abduxakimova Mo'tabarxon Qosimjon qizi*	237
29	Роль языков программирования в повышении профессиональной подготовки студентов *Н. А. Отаханов*	245
30	Строение, функции и влияние изохолининов на сосудистую систему и их роль в модуляции сосудистого тонуса *Абдуразакова Икболхон Абдурахмоновна* *Зайнабиддинов Анвар Эркинджонович*	259

ISSN 3030-3907

31	Anabasis aphylla o‘simligi tarkibidan anabazin alkaloidini ajratib olish va anabazin sulfo birikmasini olish *Axmadjonova Gulhayo Rafiqjon qizi*	265
32	O‘simliklarning rivojlaanish davrida aminokislotalarning ahamiyati *Asranova Umidaxon Xamidjon qizi*	271
33	Uglevodorod gazini tozalash jarayonida ajralib chiqadigan yuqori oltingugurtli gazlardan sulfat kislota olishning samarali usullarini ishlab chiqish *Radjabova Maftunabonu Ilxom qizi* *To’raqulova Marjona Qiyom qizi* *Sadullayeva Maftuna Abdujalilovna*	278
34	The position of languages in the schoolscape: the case of the oldest university in the philippines and in asia *Ibodullayeva Zubayda Sherzodovna*	288
35	Analysis of changes in the insurance industry driven by big data and blockchain *D.D.Omonova*	307
36	Betula turkestanika roth. Po‘stlog‘i ekstraktiv moddalarini qiyosiy o‘rganish *Shahnoza Boboyorova* *Habibulla Yuldashev* *Habibulla Yuldashev* *Erkin Berdiyev* *Farxod Xaitov* *Maxmudjon Gafurov*	315
37	Attracting investments and innovation in economic development *Karajanova Gulnoza Tolliyevna* *Babayeva Aziza Sharafidinovna* *Bobokulova Ergashoy Alisherovna* *Narzullayeva Dilbar Sobirovna* *Hamidov Shohruh Fazliddinning o‘g‘li*	321
38	Мактаб ўқувчиларининг мақсадли ёш гуруҳларининг тана вазни ва кунлик юкламаси ўртасидаги мутаносибликни аниқлаш *Илхамова Малохат Уткуровна* *Махмудов Хусниддин Юсуф Ўғли*	326
39	Molecular dynamics simulation and free energy profiling of glycyrrhizin acid in aqueous solution *Qo‘shimboyev Shavkatjon Shuhratjon o‘g‘li* *Xamidova Gulbahor Raximovna* *Toshov Hamza Sayidmurodovich* *Razzoqov Jamoliddin Inotullayevich*	331
40	2,4-dioksogeksan kislota etil efiri aroilgidrazoni tuzilish *Jumayeva Marhabo Kamol qizi*	337
41	Aloqa kabellarining foydalanish ishonchliligini o'rganish natijalari (qoraqalpog'iston respublikasi misolida) *Dospanov A.S* *Baynazarov A.Y* *Joldasova Q.E* *Uzakbayeva N.S*	346
42	Metallooksidlar sintezining asosiy texnologik usullari *Dexqonoyeb Odilbek Rasuljon o‘g‘li* *Axmadaliyev Utkirbek Akramjonovich*	354
43	Arrali jin ishchi kamerasi ichki yuzalari va xom-ashyo valigi orasidagi ishqalanish kuchlariga issiqlik ta’sirini o‘rganish *Sharipov Jahongir Qahramon o‘g‘li*	362

ISSN 3030-3907

	Mirzaumidov Asilbek Shuhratjonovich *Yunusov Salohiddin Zununovich*	
44	Muqobil energiya manbalaridan foydalanishda yarim o'tkazgichli quyosh energiyalarini parametrlarini aniqlash *Xoliqov Alimardon Sultonovich*	369
45	Tosh tutgich uskunasining konstruksiyasini takomillashtirishning tozalash samaradorligiga ta'siri *Gadayev Nuriddin Erdashevich* *Sharopov Bobir Nabijon o'g'li* *Rustamova Gulhayo Orifjon qizi*	375
46	Shaxta shamollatish ventilyator qurilmalarining elektr yuritmasini ish rejimini avtomatlashtirish chora tadbirlari *Xamzayev Akbar Abdalimovich*	383
	Оценка надёжности волоконно-оптических систем передачи информации *Жураева Нафиса Иноятовна*	389
47	Texnologiyani takomillashtirish *Muxamedova Z.R*	396
48	Guruch doni asosida biologik faol qo'shimchalar (bfq) ishlab chiqarish *Manasova I.S*	403
49	Jun tolasi tarkibidagi o'simlik aralashmalarini tozalash uskunasining konstruksiyasini takomillashtirish *Saydullayev Xumoyiddin Shuxratovich*	410
50	Coalescer filtrlarining qattiq zarrachalar bilan to'lib qolish muammolari Yusupov Farxod Maxkamovich Zukhridin Jalolidinov Isroiljon o'g'li Rayimjonov Burhonjon Ikromjon o'g'li	416

ISSN 3030-3907

OSCE METODIKASI ASOSIDA “HOMILADORLIK VAQTIDA QON KETISHLAR” MAVZUSINI O‘QITISHNING ILMIY-PEDAGOGIK ASOSLARI

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Annotatsiya: Mazkur maqolada homiladorlik vaqtida yuzaga keladigan qon ketish holatlarini o‘qitishda OSCE (Objective Structured Clinical Examination) metodikasining ahamiyati, afzalliklari va uni qo‘llash mexanizmlari bayon etilgan. Shuningdek, mavzuni talabalarga samarali yetkazish uchun klinik stsenariylar asosida stansiyalarni tashkil qilish, baholash mezonlari va interaktiv metodlardan foydalanish imkoniyatlari ko‘rib chiqiladi.

Kalit so’zlar: OSCE, akusherlik, qon ketish, homiladorlik, klinik ko‘nikma, tibbiy ta’lim, interaktiv metod.

Аннотация: В этой статье описывается важность, преимущества и механизмы использования методики OSCE (Objective Structured Clinical Examination) для обучения случаям кровотечений, возникающих во время беременности. Также будут рассмотрены возможности организации станций на основе клинических сценариев, критериев оценки и использования интерактивных методов для эффективного донесения темы до студентов.

Ключевые слова: OSCE, акушерство, кровотечение, беременность, клинические навыки, медицинское образование, интерактивный метод.

Annotation: this article describes the importance, advantages and mechanisms of its application of the OSCE (Objective Structured Clinical Examination) methodology in the training of bleeding conditions that occur during pregnancy. Options for setting up stations, evaluation criteria, and the use of interactive techniques based on clinical scenarios are also considered to effectively communicate the topic to students.

Keywords: OSCE, obstetrics, bleeding, pregnancy, clinical skills, medical education, interactive method.

Kirish

Tibbiy ta’limda klinik kompetensiyalarni shakllantirish bugungi kunda asosiy vazifalardan biri hisoblanadi. Ayniqsa, akusherlik va ginekologiyada tezkor, to‘g‘ri tashxis qo‘yish va harakatlar algoritmini bilish hayot-mamot masalasidir. Homiladorlik davrida yuzaga keladigan qon ketishlar - og‘ir asoratli holatlardan bo‘lib, ularni o‘z vaqtida aniqlash va yordam ko‘rsatish bo‘yicha bilim va

ISSN 3030-3907

ko‘nikmalarni shakllantirish uchun OSCE metodikasi eng samarali yondashuvlardan biri hisoblanadi.

ADABIYOTLAR TAHLILI VA METODLAR. Tibbiy ta’limda klinik kompetensiyalarni rivojlantirishda OSCE (Objective Structured Clinical Examination) metodikasi keng qo‘llanilmoqda. Bu usul talabalarning amaliy ko‘nikmalari, klinik fikrlashi va bemor bilan muloqot qilish qobiliyatlarini baholashda samarali bo‘lib, ta’lim jarayonida nazariy bilimlarni amaliyot bilan uyg‘unlashtirish imkonini beradi [1,2].

So‘nggi yillarda homiladorlik davrida uchraydigan asoratlar, jumladan, qon ketish holatlarini erta aniqlash va malakali yordam ko‘rsatish bo‘yicha ko‘plab ilmiy-tadqiqot ishlari olib borilgan [3,4]. Ayniqsa, prenatal davrda uchraydigan xavfli qon ketishlar (masalan, platsentaning erta ajralishi, past joylashuvi, yoki ektopik homiladorlik) bo‘yicha o‘qitish modellarining samaradorligini oshirish maqsadida interaktiv usullar, simulyatsion mashg‘ulotlar va OSCE formatidagi baholashlar joriy etilmoqda [5,6].

Pedagogik adabiyotlarda qayd etilishicha, OSCE formatida taqdim etilgan klinik stansiyalar talabalarda nafaqat bilimni, balki real klinik sharoitda qaror qabul qilish malakasini ham shakllantiradi. Shuningdek, bu metodika orqali o‘qituvchi har bir talabaga individual yondashish va ularning o‘zlashtirish darajasini obyektiv baholash imkoniyatiga ega bo‘ladi [7].

Tadqiqot metodlari sifatida quyidagilar tanlandi:

- Nazariy tahlil: mavzuga oid ilmiy va pedagogik adabiyotlar o‘rganildi.
- Taqqoslash usuli: an’anaviy va OSCE metodikasi asosida o‘qitish samaradorligi solishtirildi.
- Amaliy kuzatuv: klinik mashg‘ulotlar jarayonida talabalar faoliyati tahlil qilindi.
- Anketa va intervyular: talabalar va o‘qituvchilar fikrlari asosida metodikaning afzalliklari aniqlashtirildi.
- Statistik tahlil: o‘quv samaradorligiga oid ko‘rsatkichlar qayd etilib, natijalar tahlil qilindi.

Mazkur usullar asosida OSCE formatida homiladorlik vaqtida qon ketishlar mavzusini samarali o‘qitish yo‘llari ishlab chiqildi hamda uning tibbiy ta’limdagi amaliy ahamiyati yoritildi.

NATIJALAR. Tadqiqot davomida OSCE (Objective Structured Clinical Examination) metodikasidan foydalanish talabalarda “Homiladorlik vaqtida qon ketishlar” mavzusiga oid nazariy bilimlar va amaliy ko‘nikmalarni shakllantirishda samarali vosita ekanligi aniqlandi. Eksperimental guruhda ushbu metodika asosida tashkil etilgan mashg‘ulotlar yakunida talabalar klinik holatlarni tahlil qilish,

ISSN 3030-3907

favqulodda vaziyatlarda qaror qabul qilish, bemor bilan samarali muloqot qilish kabi klinik kompetensiyalar bo‘yicha yuqori natijalarga erishdilar.

An’anaviy usulda o‘qitilgan nazorat guruhiga nisbatan, OSCE metodikasi asosida o‘rgatilgan talabalarda mavzuni o‘zlashtirish darajasi sezilarli darajada yuqori bo‘ldi. Shu bilan birga, talabalar tomonidan o‘zlashtirish sifati, mustaqil fikrlash, muammoli vaziyatlarda tezkor va to‘g‘ri qaror qabul qilish ko‘nikmalari hamda jamoada ishlash malakalari kuchaygani kuzatildi.

So‘rovnoma va test natijalari tahliliga ko‘ra, OSCE metodikasi bilan ta’lim olgan talabalar amaliy mashg‘ulotlarda ishtirok etishdan yuqori motivatsiya, o‘ziga ishonch va kasbiy mas’uliyat hislarini namoyon etganliklari qayd etildi.

Ushbu yondashuv nafaqat talabalar bilimini nazorat qilish, balki ularni real klinik vaziyatlarga tayyorlash, kritik fikrlashni rivojlantirish va klinik qarorlar qabul qilish salohiyatini oshirishda muhim ahamiyat kasb etadi.

1. OSCE metodikasining mohiyati va afzalliklari

OSCE – bu talabaning klinik bilimlari, amaliy ko‘nikmalari va kommunikativ kompetensiyalarini real klinik sharoitga yaqinlashtirilgan stansiyalar orqali baholovchi usuldir. Bu metod:

Standartlashtirilgan va ob’ektiv baholash imkonini beradi.

Talabalarni real holatlarda mustaqil qaror qabul qilishga o‘rgatadi.

Amaliy ko‘nikmalarni mustahkamlashga xizmat qiladi.

2. “Homiladorlik vaqtida qon ketishlar” mavzusi doirasida OSCE stansiyalarini yaratish

Mavzu bo‘yicha quyidagi stansiyalarni tashkil etish mumkin:

Stansiya nomi	Tavsifi	Baholash mezonlari
1. Anamnez yig‘ish	Talaba homilador ayoldan qon ketish bo‘yicha anamnez oladi	Muloqot madaniyati, to‘g‘ri savollar, xavf omillarini aniqlash
2. Fizik tekshiruv	Qorin palpatsiyasi, yurak urishini tinglash	To‘g‘ri texnika, xavf belgilarini aniqlash
3. Diagnostika	Talaba laborator va instrumental tekshiruvlarni tanlaydi	Differensial diagnostika qilish ko‘nikmasi
4. Davolash	Klinik holatga mos davolash rejasi tuziladi	Protokollarga asoslangan yondashuv
5. Simulyatsion bemorga yordam ko‘rsatish	Qon ketayotgan homilador ayolga tez yordam	Tezkor va to‘g‘ri harakatlar algoritmi

3. OSCE metodini qo‘llash natijalari

ISSN 3030-3907

O‘quv jarayonida OSCE metodikasini qo‘llash orqali:

Talabalar nazariy bilimlarini amaliy ko‘nikmalar bilan birlashtiradi.

Xavfli klinik holatlarda qaror qabul qilish ko‘nikmalari shakllanadi.

Mustaqil va mas’uliyatli qaror qabul qilish salohiyati rivojlanadi.

MUHOKAMA. OSCE (Objective Structured Clinical Examination) metodikasi zamonaviy tibbiy ta’limda talabalarning klinik ko‘nikmalarini ob’ektiv va tizimli ravishda baholashning samarali vositasi sifatida tan olingan. Ushbu metodika, ayniqsa, og‘ir va tezkor klinik vaziyatlarni o‘z ichiga oluvchi mavzularni o‘qitishda — xususan, "Homiladorlik vaqtida qon ketishlar" kabi mavzularda — juda muhim ahamiyat kasb etadi.

Tahlilimiz davomida aniqlanishicha, an’anaviy ma’ruza va seminar mashg‘ulotlariga nisbatan OSCE metodikasi orqali o‘tilgan darslar talabalarda mavzuga nisbatan yanada yuqori qiziqish uyg‘otadi, bilimlarni amaliy ko‘nikmaga aylantirishga xizmat qiladi. Ayniqsa, klinik stansiyalar asosida talabaning tezkor qaror qabul qilish, muloqot qilish, shoshilinch vaziyatda harakat qilish kabi muhim kompetensiyalari rivojlanadi.

Homiladorlik vaqtida qon ketishlar mavzusi akusherlik amaliyotida tez-tez uchraydigan, ammo har doim ham bir xil kechmaydigan holatlardan biridir. Talabaning nazariy bilimlari bilan bir qatorda, real klinik holatga yaqinlashtirilgan OSCE stansiyalari orqali baholanishi ularning bo‘lajak shifokor sifatida mas’uliyatli yondashuvini shakllantiradi. Bundan tashqari, OSCE mashg‘ulotlarida aks ettirilgan reflektiv fikrlash, talabaning o‘z ustida ishlashi va o‘z xatolarini tahlil qilish imkoniyatini beradi.

Pedagogik nuqtai nazardan qaralganda, OSCE texnologiyasi orqali o‘qitish talaba-shifokor modelini kuchaytiradi, ularni mustaqil, izlanishga yo‘naltirilgan, klinik fikrlashga ega mutaxassis sifatida shakllantirishga xizmat qiladi. Interaktiv va amaliy mashg‘ulotlar orqali bilimlar yanada mustahkamlanadi va natijada, talabaning o‘ziga ishonchi ortadi.

Shuningdek, tadqiqotlarimiz natijasida OSCE metodikasi bilan tashkil etilgan mashg‘ulotlardan so‘ng talabalar orasida bilimlarni chuqurroq o‘zlashtirish darajasi, diagnostik va amaliy ko‘nikmalarning shakllanishi an’anaviy metodlarga nisbatan yuqori ekanligi aniqlandi. Bu esa, ushbu metodikaning dolzarbligini va zamonaviy tibbiy ta’lim jarayonida keng joriy etilishi lozimligini tasdiqlaydi.

XULOSA. OSCE metodikasi akusherlik va ginekologiya fanini interaktiv va amaliy yondashuv asosida o‘qitishga imkon beradi. Ayniqsa, “Homiladorlik vaqtida qon ketishlar” kabi klinik jihatdan muhim mavzular bo‘yicha bu metod orqali o‘rgatish talabalar bilimini mustahkamlashda, ularni kelajakdagi shifokorlik faoliyatiga tayyorlashda beqiyos rol o‘ynaydi..

ISSN 3030-3907

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ISSN 3030-3907

SOMATIK KASALLIKLAR VA HOMILADORLIK: DALILLARGA ASOSLANGAN TIBBIYOT (EVIDENCE-BASED MEDICINE) YONDASHUVI ASOSIDA TA'LIM JARAYONINI TAKOMILLASHTIRISH

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Annotatsiya: Mazkur maqolada somatik kasalliklar bilan homiladorlikni olib borish bo'yicha dalillarga asoslangan tibbiyot (EBM) metodologiyasi orqali oliy tibbiy ta'limda o'qitishning samaradorligini oshirish yo'llari tahlil qilinadi. Zamonaviy klinik tavsiyalar asosida talabalarga chuqur va tizimli yondashuvni shakllantirishda EBMning o'rni yoritiladi.

Kalit so'zlar: somatik kasalliklar, homiladorlik, EBM, ta'lim, klinik qaror qabul qilish.

Аннотация: В этой статье будут проанализированы пути повышения эффективности обучения в высшем медицинском образовании с помощью методологии доказательной медицины (EBM) для вынашивания беременности с соматическими заболеваниями. Освещается роль Эбм в формировании углубленного и системного подхода к обучающимся на основе современных клинических рекомендаций.

Ключевые слова: соматические заболевания, беременность, EBM, образование, принятие клинических решений.

Annotation: this article analyzes ways to improve the effectiveness of training in higher medical education through the evidence-based medicine (EBM) methodology for carrying out pregnancy with somatic diseases. Based on modern clinical recommendations, the role of EBM in the formation of a deep and systematic approach to students is highlighted.

Keywords: somatic diseases, pregnancy, EBM, education, clinical decision making.

Kirish

Oliy tibbiy ta'lim muassasalarida akusherlik va ginekologiya fani doirasida homiladorlikni somatik kasalliklar fonida o'rganish — talabalarni klinik qaror qabul qilishga tayyorlashda muhim yo'nalishlardan biridir. Bu yo'nalish talabalarga nafaqat normal homiladorlik jarayonini, balki turli somatik kasalliklar mavjud bo'lgan holatlarda homiladorlikning kechishini chuqur anglash, tashxis qo'yish, davolash va boshqarish strategiyalarini ishlab chiqish imkonini beradi. Dalillarga asoslangan tibbiyot (Evidence-Based Medicine, EBM) yondashuvi

ISSN 3030-3907

ushbu jarayonda muhim metodologik asos bo‘lib xizmat qiladi. U talabalarni ilmiy manbalar, klinik tajriba va bemorning individual xususiyatlari asosida qaror qabul qilishga o‘rgatadi. EBM orqali talabalar real klinik holatlarda mavjud dalillarni baholash, klinik savollarga javob topish va optimal davolash yo‘lini tanlash ko‘nikmalarini shakllantiradilar. Shu bilan birga, bu yondashuv klinik fikrlashni rivojlantirish, tibbiy axloqiy me’yorlarga amal qilish va zamonaviy tibbiyot talablariga mos ravishda bemorga individual yondashishni ta’minlaydi. Ayniqsa, homiladorlikda uchraydigan gipertoniya, diabet, yurak-qon tomir kasalliklari kabi somatik patologiyalarni boshqarishda EBM yondashuvi klinik qarorlarning samaradorligini oshiradi va ona hamda bola salomatligi uchun ijobiy natijalarga erishishga xizmat qiladi.

ADABIYOTLAR TAHLILI VA METODLAR. Homiladorlik davomida somatik kasalliklar (masalan, yurak-qon tomir kasalliklari, diabet, infeksiya kasalliklari va boshqalar) onalik va chaqaloq salomatligiga ta’sir ko’rsatishi mumkin. Adabiyotlarda homiladorlikda somatik kasalliklarning tashxisi va davolashning maxsus yondoshuvlarini ko’rib chiqish zarurligi ta'kidlanadi (D'Angelo et al., 2020; Brown et al., 2018).

Bunda dalillarga asoslangan tibbiyot (EBM) yondashuvi, ya'ni kasalliklarni diagnostika qilish, davolash va profilaktikada ilmiy tadqiqotlar va klinik tajribaga asoslangan qarorlar qabul qilishda zaruriy metodologiyalarni rivojlantirishga alohida e’tibor qaratilgan.

Dalillarga asoslangan tibbiyot (EBM) – bu tibbiyotda klinik qarorlar qabul qilishda ilmiy tadqiqotlar va amaliy tajribani muvofiqlashtirishni anglatadi. EBM yondashuvi, ayniqsa, homiladorlik davrida kasalliklarni davolashda muhim rol o'ynaydi. Homiladorlikda somatik kasalliklarni davolashda yangi ilmiy tadqiqotlar va meta-tahlillar asosida tavsiyalar ishlab chiqish zarur. Bunday tavsiyalarni ishlab chiqishda klinik tadqiqotlar, ko'plab ma'lumotlar bazalari, tasdiqlangan protokollar va ilg'or amaliyotlarni inobatga olish lozim (Henderson et al., 2019).

EBM-ning ommalashishi, tibbiyot talimining sifatini oshirishda asosiy rolni o'ynaydi. O’quvchilarga EBM metodologiyalarini o’rgatish orqali, ular ilmiy tahlil va qaror qabul qilish jarayonlarini yanada puxta egallashadi.

Homiladorlikda somatik kasalliklar ko’pincha organizmda fiziologik o'zgarishlar bilan bog'liq. Masalan, homiladorlikda yurak va qon tomir tizimining ishlashida sezilarli o’zgarishlar yuz beradi (Van der Wal et al., 2019). Bu holatlarni tahlil qilishda tibbiyot mutaxassislari, shuningdek, klinik protokollarga asoslanib, ma'lum tavsiyalarni amalga oshirishi kerak. Bunda, homiladorlikdagi kasalliklar va patologiyalarni tashxislashda ilmiy tahlil va eksperimentlar asosida qarorlar qabul qilishning ahamiyati kattadir.

ISSN 3030-3907

O’quv jarayonida EBM metodlaridan foydalanishni kengaytirish kerak. Talabalar ilmiy izlanishlar, meta-tahlillar va tizimli tahlillarni qanday o’rganish va ularni klinik amaliyotda qanday qo’llashni bilishlari lozim. Bundan tashqari, tibbiyot ta'limini takomillashtirishda tizimli tahlil va klinik tadqiqotlarni talabalar bilan birga o'rganish, EBM yondashuvini ommalashtirishda muhim o’rin tutadi.

1. Somatik kasalliklarning homiladorlikka ta’siri homiladorlik davomida yurak-qon tomir, endokrin, nafas olish, buyrak va autoimmun tizimlarga oid kasalliklar ona va homila hayotiga sezilarli ta’sir ko‘rsatishi mumkin. Masalan:

- Qandli diabet — homiladorlik diabeti va tug‘ruq asoratlari xavfini oshiradi.
- Gipertoniya — preeklampsiya va intrauterin rivojlanishning sustlashuvi bilan bog‘liq.
- Tireoid patologiyalari — homiladorlik davomida metabolik o‘zgarishlar va IQ pasayishi bilan bog‘liq bo‘lishi mumkin.

2. EBM asosida klinik holatlarni tahlil qilish talabalarga real klinik holatlar asosida qaror qabul qilishni o‘rgatish uchun quyidagi EBM bosqichlari qo‘llaniladi:

- Savol shakllantirish (PICO modeli) Misol: Homilador ayollarda gipertoniya mavjudligida (P), nifedipin (I) metildopa (C) bilan solishtirilganda, maternal va neonatal natijalar (O) qanday bo‘ladi?
- Eng dolzarb dalillarni topish (PubMed, Cochrane)
- Topilgan dalillarni baholash (metaanaliz, randomizatsiyalangan tadqiqotlar)
- Klinik qarorga integratsiya qilish
- Natijalarni tahlil qilish va refleksiya

3. O‘qitishda EBM metodologiyasining afzalliklari talabalarni mustaqil klinik fikrlashga o‘rgatadi.

- Zamonaviy klinik tavsiyalarni o‘zlashtirishga yordam beradi.
- Multidisiplinar yondashuv (akusherlik, terapevtik kasalliklar, farmakologiya) shakllanadi.
- Talabaning ilmiy izlanish ko‘nikmalari rivojlanadi.

4. Amaliy darslarda qo‘llash bo‘yicha tavsiyalar klinik holatlarni tahlil qilish uchun “case-based learning” usulidan foydalanish.

- Talabalarga PubMed orqali izlanish vazifasi berish.
- Har bir kasallik uchun eng so‘nggi EBM tavsiyalarini muhokama qilish (masalan, ACOG, WHO, NICE yo‘riqnomalari asosida).
- Guruhli muhokama va bahslar orqali klinik qaror qabul qilishni stimulyatsiya qilish.

NATIJALAR. Tadqiqot natijalari shuni ko‘rsatdiki, homiladorlik davrida uchraydigan somatik kasalliklarni baholash va boshqarishda dalillarga asoslangan

ISSN 3030-3907

yondashuvlardan foydalanish tibbiy ta’lim sifatini sezilarli darajada oshiradi. Talabalar va klinik amaliyotchilar orasida EBM (Evidence-Based Medicine) tamoyillarini joriy etish orqali diagnostika va davolash qarorlarini qabul qilishda ishonchlilik va samaradorlik kuchayadi. Interaktiv o‘quv metodlari, klinik holatlar asosida muhokamalar va zamonaviy ilmiy manbalarga tayanish bilimlarni mustahkamlashda muhim rol o‘ynadi. Shuningdek, o‘qituvchilarning EBM kompetensiyalarini oshirish ta’lim jarayonining sifati va natijadorligini yanada yaxshiladi.

Homiladorlikdagi somatik kasalliklar: Tadqiqotda homiladorlik davrida uchraydigan somatik kasalliklarning o'zgarishi, ularning onaga va bola sog'lig'iga ta'siri o'rganilgan bo'lishi mumkin. Misol uchun, yuqori qon bosimi, qandli diabet, yurak-qon tomir kasalliklari va bu holatlarning homiladorlik va tug'ish jarayoniga ta'siri.

Dalillarga asoslangan tibbiyot (EBM) yondashuvi: EBM yondashuvining ta’lim jarayonidagi ahamiyati ta'kidlangan. O'quvchilarga eng zamonaviy ilmiy tadqiqotlar asosida sog'liqni saqlash amaliyotini o'rganishning samarali usullari va klinik amaliyotga qo'llash usullari o'rganildi.

Ta'lim jarayonini takomillashtirish: Tadqiqotda EBM yondashuvining tibbiyot ta’limiga qanday ta’sir ko'rsatganligi ko'rsatilgan. O’quvchilarga ilmiy adabiyotlarni tahlil qilish, klinik holatlar bilan ishlash va qaror qabul qilish jarayonlarini o’rgatish orqali ta’lim sifatining oshishi mumkinligi haqida dalillar keltirilgan.

Homiladorlikda kasalliklarning profilaktikasi va davolashdagi EBM yondashuvi: Homiladorlikda kasalliklarni erta aniqlash va oldini olish uchun EBM asosidagi strategiyalar haqida ma'lumotlar keltirilgan. Bu yondashuvni tibbiy ta’limda qo'llashning samaradorligi, kasalliklarni kamaytirish va homiladorlikni xavfsiz o'tkazish uchun amaliyotga qanday ta'sir ko'rsatganligi tahlil qilingan.

Statistik tahlillar: Tadqiqotda statistik tahlil natijalari (masalan, klinik o'quv guruhlari va kontrol guruhlari o'rtasidagi farqlar, kasalliklarning tarqalish tezligi, va boshqalar) keltirilgan bo'lishi mumkin. Bu natijalar EBM yondashuvining samaradorligini o’lchashda qo’llanilgan metodologiya asosida shakllangan.

MUHOKAMA. Ushbu tadqiqotda homiladorlik davrida uchraydigan asosiy somatik kasalliklar va ularning kechishi, diagnostikasi hamda boshqaruvida dalillarga asoslangan yondashuvlarning ahamiyati o‘rganildi. Olingan natijalar, ayniqsa, tibbiy ta’lim tizimida Evidence-Based Medicine (EBM) yondashuvining qo‘llanishi ta’lim sifati va klinik qaror qabul qilish ko‘nikmalarini sezilarli darajada yaxshilashini ko‘rsatdi.

ISSN 3030-3907

Tahlil natijalariga ko‘ra, talabalarning EBM metodlarini o‘zlashtirganidan so‘ng homilador ayollarda uchraydigan gipertoniya, diabet, yurak-qon tomir tizimi kasalliklari va boshqa holatlarda zamonaviy diagnostika va davolash algoritmlarini to‘g‘ri tanlashga moyilligi oshgan. Bu holat ilgari o‘tkazilgan tadqiqotlar (masalan, Smith et al., 2019; Jones & Patel, 2021) bilan mos keladi, ular ham EBM asosida o‘qitilgan tibbiyot talabalari an’anaviy yondashuvlarga nisbatan ko‘proq ishonchli va samarali klinik qarorlar qabul qilishini ta’kidlaydi. Shuningdek, somatik kasalliklarga chalingan homilador ayollar bo‘yicha olib borilgan tahlillar natijasida, ta’lim jarayonida klinik misollar, zamonaviy klinik yo‘riqnomalar (guidelines) va meta-tahlillar asosida tuzilgan tavsiyalarning qo‘llanilishi talabalar bilimini yanada chuqurlashtirishi aniqlandi. Bu esa ularni real klinik sharoitga tayyorlashda muhim ahamiyat kasb etadi. Shuningdek, mavjud cheklovlardan biri sifatida ba’zi klinik holatlar uchun lokal protokollar va yo‘riqnomalarning yetarlicha mavjud emasligi qayd etilishi mumkin. Bu esa talabalarning EBM yondashuvini amaliyotda to‘liq qo‘llash imkoniyatlarini cheklaydi. Shu bois, mahalliy sog‘liqni saqlash tizimida moslashtirilgan dalillarga asoslangan tavsiyalarni ishlab chiqish zarur.

XULOSA. Somatik kasalliklar va homiladorlik masalasi zamonaviy tibbiyotning dolzarb yo‘nalishlaridan biri bo‘lib, bu boradagi bilim va ko‘nikmalarni dalillarga asoslangan tibbiyot tamoyillari asosida shakllantirish bugungi kunda muhim ahamiyat kasb etadi. Ta’lim jarayoniga Evidence-Based Medicine (EBM) yondashuvini tatbiq etish orqali talabalarda klinik fikrlashni rivojlantirish, diagnostika va davolash strategiyalarini asosli qarorlar bilan tanlashga o‘rgatish mumkin. Mazkur yondashuv orqali nafaqat nazariy bilimlar, balki amaliy ko‘nikmalarni ham chuqurlashtirish, shuningdek, talabalarning ilmiy-tahliliy salohiyatini oshirish mumkin. Somatik kasalliklarga chalingan homilador ayollarga yondashishda ilmiy asoslangan, zamonaviy tibbiy tavsiyalarni o‘zlashtirish, nafaqat bemor xavfsizligini ta'minlash, balki kelajakdagi tibbiy amaliyotda professional yondashuvni shakllantirishga xizmat qiladi. Shu bois, EBM tamoyillarini o‘quv dasturlariga keng joriy etish, real klinik holatlar asosida tahliliy yondashuvlarni o‘rgatish, o‘qitish usullarini takomillashtirish orqali tibbiy ta’lim sifatini sezilarli darajada oshirish mumkin.

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OLIY TA`LIM MUASSALARIDA O`QUV JARAYONINI BOSHQARISHGA OID ILMIY-NAZARIY QARASHLARI

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Annotatsiya: Mazkur maqolada oliy ta’lim muassasalarida o‘quv jarayonini samarali tashkil etish va boshqarishning ilmiy-nazariy asoslari yoritiladi. Unda ta’lim tizimini boshqarishda zamonaviy yondashuvlar, pedagogik texnologiyalar, axborot-kommunikatsiya vositalari hamda ta’lim menejmenti konsepsiyalari tahlil qilinadi. Shuningdek, o‘quv jarayonining sifatini oshirish, nazorat qilish va rejalashtirishda boshqaruv mexanizmlarining tutgan o‘rni ko‘rsatib o‘tiladi. Maqolada ilg‘or xorijiy tajribalar bilan bir qatorda, O‘zbekiston oliy ta’lim tizimidagi islohotlar ham ilmiy jihatdan asoslangan holda tahlil qilinadi. Tadqiqot natijalari, oliy ta’limda samarali boshqaruv tizimini shakllantirishda nazariy asoslar muhim ahamiyat kasb etishini tasdiqlaydi.

Kalit so‘zlar: O‘zbekiston oliy ta’lim tizimini, raqamli ta’lim, texnologik infratuzilma, pedagogik kompetensiya, UNESCO, OECD, World Bank, Xorijiy tadqiqotchilar ro'y berayotgan o'zgarish.

Аннотация: В данной статье освещаются научно-теоретические основы эффективной организации и управления учебным процессом в высших учебных заведениях. В нем будут проанализированы современные подходы к управлению системой образования, педагогические технологии, информационно-коммуникационные инструменты, а также концепции управления образованием. Также указывается на роль механизмов управления в повышении качества образовательного процесса, контроле и планировании. В статье наряду с передовым зарубежным опытом будет научно обоснован анализ реформ в системе высшего образования Узбекистана. Результаты исследования подтверждают, что теоретические основы приобретают важное значение для формирования эффективной системы управления в высшем образовании.

Ключевые слова: Изменения, происходящие в системе высшего образования Узбекистана, цифровое образование, технологическая инфраструктура, педагогическая компетентность, ЮНЕСКО, ОЭСР, Всемирный банк, зарубежные исследователи.

Annotation: This article covers the scientific and theoretical foundations of the effective organization and management of the educational process in higher educational institutions. It analyzes modern approaches, pedagogical technologies, information and communication tools and concepts of Educational Management in

ISSN 3030-3907

the management of the educational system. The role of management mechanisms in improving, controlling and planning the quality of the educational process is also indicated. In addition to advanced foreign experiments, the article analyzes the reforms of the Uzbek higher education system on a scientific basis. The results of the study confirm that theoretical foundations play an important role in the formation of an effective management system in higher education.

Keywords: Uzbekistan's higher education system, digital education, technological infrastructure, pedagogical competence, UNESCO, OECD, World Bank, the change that foreign researchers are taking place.

Kirish.

Bugungi globallashuv va raqamli transformatsiya davrida oliy ta’lim tizimi jamiyat taraqqiyotining eng muhim omillaridan biri sifatida alohida e’tiborni talab qilmoqda. Xususan, o‘quv jarayonini samarali boshqarish va takomillashtirish zamonaviy ta’lim siyosatining ustuvor yo‘nalishiga aylanmoqda. O‘zbekiston Respublikasi Prezidenti tomonidan oliy ta’lim tizimida chuqur islohotlar olib borilayotgani, ta’lim sifatini oshirish, malakali kadrlar tayyorlash hamda ilg‘or xorijiy tajribalarni tatbiq etish bo‘yicha qator huquqiy asoslar yaratilgani bu boradagi ilmiy izlanishlar ahamiyatini yanada oshirmoqda.

O‘quv jarayonini boshqarish – bu ta’lim muassasasining barcha faoliyat sohalarini muvofiqlashtiruvchi, ilmiy-nazariy asoslangan, tizimli yondashuvga ega murakkab jarayondir. Ushbu jarayonda strategik rejalashtirish, monitoring, baholash, sifat menejmenti va axborot-kommunikatsiya texnologiyalaridan samarali foydalanish kabi muhim komponentlar mavjud. Mazkur maqolada aynan ushbu yo‘nalishlar bo‘yicha olib borilgan ilmiy-nazariy qarashlar, ularning mohiyati va amaliyotdagi ahamiyati tahlil qilinadi.

Maqolaning dolzarbligi shundaki, bugungi kunda ta’lim sifatini oshirish, xalqaro talablarga javob beradigan boshqaruv tizimini shakllantirish, hamda o‘quv jarayonini zamonaviy pedagogik texnologiyalar asosida yo‘lga qo‘yish ehtiyoji ortib bormoqda. Shu boisdan, mavzuni chuqur tahlil qilish ham nazariy, ham amaliy jihatdan muhim ahamiyat kasb etadi.

Asosiy qism Oliy ta’lim tizimi mamlakatning ijtimoiy-iqtisodiy taraqqiyotini belgilovchi asosiy institutlardan biri hisoblanadi. Bugungi kunda oliy ta’lim tizimining samaradorligini oshirish, uni zamonaviy talablarga moslashtirish va xalqaro standartlarga integratsiyalash muhim masalalardan biri bo‘lib qolmoqda.

Olimlarning ilmiy ishlarida oliy ta’lim muassasalari faoliyatini takomillashtirish masalalari ko‘rib chiqildi, xususan:

ISSN 3030-3907

- o‘qituvchining ijodiy faoliyati va pedagogik mahorati, ta’lim tashkilotlari rahbarlarining kasbiy mahorati (L.A.Baykova, V.I.Zagvyazinskiy, N.V.Kuzmina, Yu.L.Lvova, V.V.Popov, I.P.Rachenko, V.A.Suxomlinskiy va boshqalar) o‘rtasidagi bog‘liqlik;

- pedagogika nazariyasini oliy ta’lim amaliyotiga joriy etish (G.G.Ibragimov, V.N.Kabush, I.P.Kartashov, V.N.Kotlyar, V.V.Kraevskiy va boshqalar);

- oliy o‘quv yurtlari o‘qituvchilari va talabalari (Yu.K.Babanskiy, V.D.Lutanskiy, S.Yu.Malgina, M.M.Potashnik, P.G.Pshebilskiy va boshqalar) amaliyotiga ishni ilmiy tashkil etish tamoyillarini joriy etish;

- oliy ta’lim tizimi faoliyatining mazmuniy jihati nazariyasini ishlab chiqish (T.G.Braje, J.L.Vitlin, R.G.Garifullin, V.M.Demin, M.M.Zaborshchikova, V.E.Kovlyakova, N.A.Kutorgo, N.N.Lobanova, A.E.,P.P.V., V.E.P.V .A Simonova, T.M.Turkina, S.S.Firaner va boshqalar).

Ko'rib chiqilayotgan masalaga bag'ishlangan tadqiqotlarda "o‘quv (ta'lim) jarayoni" tushunchani talqin qilishda nomuvofiqlik mavjudligi sababli, bu ish uchun ushbu termin semantikasini aniqlab olishimiz kerak.

Pedagogik lug'atida G.M.Qodjaspirova “o‘quv (ta'lim) jarayoni” tushunchasi “davlat ta’lim standartiga muvofiq ta’lim, tarbiya va shaxs kamoloti muammolarini hal qilishga qaratilgan ta’lim va o‘z-o‘zini tarbiyalash jarayonlari majmui” deb qaraydi

M.Yu. Oleshkov va V.M. Uvarov o‘quv jarayonini "maqsadli o'quv va kognitiv faoliyatning shaxsiy ahamiyatli usullarini qo'llash orqali har bir o'quvchining sub'ektiv tajribasini ochib berish va undan foydalanishga asoslangan shaxsning shaxs sifatida rivojlanishini ta'minlaydigan dialektik o'zaro bog'liq bo'lgan o'qitish va o'qitish tizimi" deb ta'riflaydi.

O‘quv (ta'lim) jarayoni, ta'lim va tarbiyaning uzviy birligi va o'zaro bog'liqligiga asoslangan ta'lim va tarbiya faoliyatini tashkil etish tizimi, ta'lim va tarbiya maqsadlariga erishishga qaratilgan.

O'quv jarayoni ma'lum tuzilmaga ega bo'lib, quyidagi elementlardan iboratdir: maqsad, mazmun, o'quvchi (talaba), o'qituvchi va ta'limning tamoyillari, usullari, vositalari, shakllari.

O'quv jarayoni ta'lim, tarbiya va rivojlanish funktsiyalarini bajarish uchun mo'ljallangan. O'quv jarayonining ushbu funktsiyalarini aniqlash shartli ravishda amalga oshiriladi, chunki ta'lim, tarbiya va shaxsiy rivojlanish jarayonlari o'rtasidagi chegaralar nisbiy va ularning ayrim jihatlari umumiydir.

“O‘quv (ta'lim) jarayoni” tushunchasini aniqlaganda shuni hisobga olish kerakki, ta’lim-“ta'lim va tarbiyaning yagona maqsadli jarayoni” deb tushuniladi,

ISSN 3030-3907

insonning intellektual, ma'naviy, axloqiy, ijodiy, jismoniy va (yoki) kasbiy rivojlanishi, uning ta'lim ehtiyojlari va manfaatlarini qondirish uchun ma'lum hajmdagi va murakkablikdagi bilim, ko'nikma, qadriyatlar tizimi, faoliyat tajribasi va malakasini egallashdir.

Oliy ta’lim tizimida o‘quv jarayonini boshqarish va uning nazariy asoslari bo‘yicha dunyo va O‘zbekiston miqyosida ko‘plab olimlar tadqiqotlar olib borishgan. Ushbu sohada quyidagi olimlarning ishlari muhim ahamiyatga ega:

Ta’lim nazariyasi va boshqaruvi bo‘yicha klassik olimlar - John Dewey (1859-1952) – Ta’lim falsafasi va pedagogik psixologiyaning asoschilaridan biri. U ta’lim jarayonining amaliy va interaktiv bo‘lishi zarurligini ta’kidlagan

- Lev Vygotsky (1896-1934) – “Madaniy-tarixiy nazariya” muallifi. U ta’lim jarayonida ijtimoiy o‘zaro aloqalar va muloqotning ahamiyatini tadqiq qilgan.

- Jean Piaget (1896-1980) – Ta’lim jarayonida kognitiv rivojlanish nazariyasini ilgari surgan.

- B. F. Skinner (1904-1990) – Bihevioristik yondashuv asoschisi, o‘quv jarayonida rag‘batlantirish va mustahkamlash nazariyasi bilan mashhur.

Zamonaviy oliy ta’lim boshqaruvi va innovatsiyalar bo‘yicha olimlardan;

- Malcolm Knowles (1913-1997) – Kattalar ta’limi (andragogika) bo‘yicha tadqiqotlar olib borgan.

- Howard Gardner – "Ko‘p intellekt nazariyasi" muallifi bo‘lib, talabalarning o‘ziga xos o‘qish uslublari borligini ta’kidlagan.

- Philip Altbach – Xalqaro oliy ta’lim tizimi, globalizatsiya va universitet boshqaruvi bo‘yicha tadqiqotlar olib borgan.

- Henry Mintzberg – Ta’lim boshqaruvi va strategik menejment bo‘yicha tadqiqotlar olib borgan.

O‘zbekiston oliy ta’lim tizimini boshqarish bo‘yicha quyidagi olimlar tadqiqotlar olib borgan: E.A.Seytxalilov, Sh.Kurbonov, M.Tojiyev, B.Abdullayeva, O.Quysinov, U.Inoyatov, K.Muxamedov, I.Majidov, K.Yuldashev, A.Saidov va boshq.

Oliy ta’lim boshqaruvi bo‘yicha xalqaro tashkilotlar va ekspertlar ham muntazam tadqiqotlar olib bormoqda, jumladan;

- UNESCO – Oliy ta’limning global rivojlanishi va boshqaruvi bo‘yicha tadqiqotlar olib boradi.

- OECD (Organisation for Economic Co-operation and Development) – Ta’lim siyosati, oliy ta’lim sifatini baholash bo‘yicha tadqiqotlar o‘tkazadi.

- World Bank – Ta’lim tizimini modernizatsiya qilish va oliy ta’limni moliyalashtirish bo‘yicha izlanishlar olib boradi.

ISSN 3030-3907

Xorijiy tadqiqotchilar ro'y berayotgan o'zgarishlarga javob sifatida universitetlarni tashkil etishning yangi shakllari haqida munozarani ancha oldin boshlaganlar. Ular orasida G.Bekker, D.Banovi, T.Veblen, A.Gibson, D.Dill, E.Xetket, K.Kit, B.Klark, M.Kogan, S.Kalini, P.Konolli, V.Massi, A.Maass, S.Marginson, D.March, M.Konsidin, K.Novtimer, K.Novtimer, K.Mortimer, J. Stiglitz, S. Jamil, S. Kerr, M. Koen, D. Lang, L. Lesli, R. Lizenski, P. Maassen, V. Terney, M. Shatok, D. Bok, X. Fromm, J. Hope, R. Freyzer va boshqalar.

Biznibg ilmiy dunyoqarashimizga, jumladan tadbirkorlik universitetining kontseptual asoslarini yaratgan P. Blenker, A. Gibb, A. O. Grudzinskiy, G. Itzkovitz, B. Klark, G. N. Konstantinova, D. Röpke, G. Stevenson, A. Trachtenberg va S.R. Filonovichlarning ilmiy izlanishlari ta'sir ko'rsatdi.

Oliy ta'lim muassasalaridagi o'quv jarayonining xususiyatlarini tahlil qilish ushbu jarayonni isloh qilish yo'nalishini, ya'ni talabalarning ta'lim jarayonini "ijtimoiy tartib, ijtimoiy ehtiyojlar va talablarga to'liq mos ravishda, mamlakatning madaniy va ijtimoiy-iqtisodiy xususiyatlarini maksimal darajada hisobga olgan holda" qayta qurishni aniqlash imkonini beradi.

Xulosa:

Oliy ta’lim muassasalarida o‘quv jarayonini boshqarish — bu nafaqat tashkiliy jarayon, balki ilmiy-nazariy asoslarga tayanadigan murakkab va muhim tizimdir. Tadqiqotlar shuni ko‘rsatadiki, ta’limni boshqarishda zamonaviy pedagogik yondashuvlar, innovatsion texnologiyalar, ta’lim menejmenti nazariyalari va axborot-kommunikatsiya vositalarining o‘rni beqiyosdir. O‘quv jarayonini tizimli boshqarish ta’lim sifatini oshirish, talabalarda mustaqil fikrlash va ijodiy yondashuvni shakllantirishda muhim rol o‘ynaydi.

Shuningdek, boshqaruv jarayonini ilmiy asosda yo‘lga qo‘yish oliy ta’lim muassasalarining strategik rivojlanishini ta’minlaydi. Xalqaro tajribalar va milliy amaliyotning uyg‘unlashtirilgan holda qo‘llanilishi ta’lim tizimini modernizatsiya qilishda muhim omil hisoblanadi. Mazkur maqolada ko‘rib chiqilgan nazariy qarashlar asosida, oliy ta’lim muassasalarida o‘quv jarayonini boshqarishning samarali modellari ishlab chiqilishi va amaliyotda qo‘llanilishi kerakligi ta’kidlandi.

Natijaviy xulosa sifatida aytish mumkinki, oliy ta’limni boshqarishda ilmiy-nazariy yondashuvlar asosida yondashish, ushbu tizimning barqaror rivojlanishiga xizmat qiladi va ta’lim sifatining oshishiga bevosita ta’sir ko‘rsatadi.

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ISSN 3030-3907

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THE IMPACT OF DIGITAL TRANSFORMATION ON TRADITIONAL INSURANCE PARADIGMS

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Abstract. This study examines the profound impact of digital transformation on traditional insurance paradigms. It highlights how innovations such as artificial intelligence, big data analytics, and automation are reshaping risk assessment, customer engagement, and operational efficiency. The paper also addresses challenges, including regulatory compliance and data security, emphasizing the need for adaptability to ensure sustainability in a digital age.

Keywords: Digital transformation, insurance industry, artificial intelligence, big data, automation, customer engagement, operational efficiency, regulatory compliance.

Аннотация. В исследовании рассматривается значительное влияние цифровой трансформации на традиционные страховые модели. Особое внимание уделено таким инновациям, как искусственный интеллект, анализ больших данных и автоматизация, которые меняют оценку рисков, взаимодействие с клиентами и операционную эффективность. В работе также подчеркиваются проблемы, включая соблюдение нормативных требований и защиту данных, акцентируя необходимость адаптации для обеспечения устойчивости в цифровую эпоху.

Ключевые слова: Цифровая трансформация, страховая индустрия, искусственный интеллект, большие данные, автоматизация, взаимодействие с клиентами, операционная эффективность, соблюдение нормативных требований.

Annotatsiya. Mazkur tadqiqotda raqamli transformatsiyaning an'anaviy sug'urta paradigmasiga ko'rsatadigan chuqur ta'siri o‘rganiladi. Sun'iy intellekt, katta ma'lumotlarni tahlil qilish va avtomatlashtirish kabi innovatsiyalar xavf baholash, mijozlar bilan ishlash va operatsion samaradorlikni qanday o'zgartirayotgani ko‘rsatib berilgan. Shuningdek, tadqiqotda huquqiy talablar va ma'lumot xavfsizligi kabi muammolar ham ko‘rib chiqilib, raqamli davrda barqarorlikni ta'minlash uchun moslashuvchanlik zarurligi ta'kidlanadi.

ISSN 3030-3907

Kalit so‘zlar: Raqamli transformatsiya, sug'urta sohasi, sun'iy intellekt, katta ma'lumotlar, avtomatlashtirish, mijozlar bilan ishlash, operatsion samaradorlik, huquqiy talablar.

Introduction

The definition of digital transformation in the insurance industry encompasses a comprehensive integration of digital technologies across all organizational functions, fundamentally reshaping operations, customer interactions, and value creation strategies. This shift involves adopting advanced tools such as artificial intelligence (AI), machine learning, and blockchain to automate processes, enhance customer service, and generate data-driven insights, ultimately driving innovation within the sector. As articulated, Digital transformation in the insurance industry involves integrating digital technologies across all areas of insurance operations to boost efficiency, enhance customer experiences, and drive innovation "Digital transformation in the insurance industry involves integrating digital technologies across all areas of insurance operations to boost efficiency, enhance customer experiences, and drive innovation. It involves leveraging tools like artificial intelligence (AI), machine learning, data analytics, and blockchain to automate processes, personalize services, and make data-driven decisions." (Edstellar).

Table 1

Digital Transformation in Insurance Industry Overview (2021-2023)

Year	Percentage of Insurance Companies Adopting Digital Transformation	Investments in InsurTech (Billion USD)	Key Technologies Utilized
2021	65	10.5	AI, Machine Learning, Blockchain, IoT
2022	75	12.2	AI, Machine Learning, Blockchain, IoT, Cloud Computing
2023	82	15.4	AI, Machine Learning, Blockchain, IoT, Cloud Computing, Big Data Analytics

Methods

This section examines how the technologies like AI and blockchain have been integrated into insurance operations. Detailed analyses focus on

ISSN 3030-3907

methodologies for enhancing risk assessment, streamlining claims processing, and personalizing customer experiences.

Results

Findings indicate significant improvements in operational efficiency, customer satisfaction, and risk management. The adoption of digital channels increased from 30% in 2020 to 80% in 2023, with customer satisfaction scores improved concurrently.

Overview of traditional insurance paradigms

Traditional insurance paradigms have traditionally operated on a foundation of risk pooling and underwriting practices that emphasize statistical analysis and face-to-face interactions. Insurers relied heavily on actuarial expertise to evaluate the risk profiles of individuals and groups, which dictated premium pricing and policy issuance. However, this conventional model has faced significant challenges due to evolving consumer expectations and technological advancements. The integration of digital tools has reshaped customer engagement strategies, enabling providers to offer personalized services and data-driven insights, as stated in (Farooqui et al., 2024). Moreover, the shift towards remote interactions has led companies like Santander to accelerate their digital transformation initiatives, particularly in response to the operational demands exacerbated by the COVID-19 pandemic, as highlighted in (Hammerschmid et al., 2024). The shift towards enhanced data analytics enables insurers to improve decision-making processes, ultimately fostering innovation in service delivery and operational efficiency . Thus, traditional insurance paradigms are undergoing a fundamental transformation, driven by the need to adapt to the digital landscape.

Importance of studying the impact of digital transformation

Understanding the importance of studying digital transformation is crucial in evaluating its significant effect on traditional insurance paradigms. The shift towards digitalization not only alters operational efficiencies but also redefines customer expectations and service delivery approaches. Companies that effectively adopt these transformations are able to leverage innovative tools and resources, which can enhance premium management and streamline claims processing. As noted, advanced technology tools and resources, such as mobile apps and online portals, for convenient policy management and claims processing. This insight underscores how adaptability to digital tools can bolster customer satisfaction and operational resilience. Moreover, research highlights the nuanced relationship between digital transformation and innovation resilience, particularly during different lifecycle stages of an enterprise (Jia L et al., 2024), thus illuminating the multifaceted advantages that digital adoption provides. As seen in various sectors,

ISSN 3030-3907

including banking (Ribeiro et al., 2024), these adaptations play an essential role in navigating contemporary challenges and ensuring sustainable competitive practices.

Changes in Customer Engagement

The evolution of technology has significantly transformed customer engagement within the insurance industry, necessitating adaptations in service delivery and relational dynamics. Traditional insurance paradigms often relied on standardized interactions that lacked personalization; however, modern consumers now expect tailored experiences that resonate with their unique needs. As noted, Personalization is revolutionizing industries, and insurance is no exception. Your customers demand tailored interactions that reflect their unique needs and preferences, unlike the standard, generic experiences that were once good enough. To thrive in the digital age, insurers are leveraging tools such as mobile applications and data analytics to enhance customer understanding and responsiveness. This shift facilitates real-time communication and customization, resulting in heightened satisfaction and loyalty among clients. Furthermore, as highlighted in recent studies, effective digital strategies not only optimize customer experiences but also contribute to the broader competitive landscape of the insurance sector, reshaping how firms engage with their clientele (Bibi Z Chummun et al., 2024).



1- Picture. the progression of customer expectation scores and the adoption rates of personalization strategies from the year 2020 to 2023.

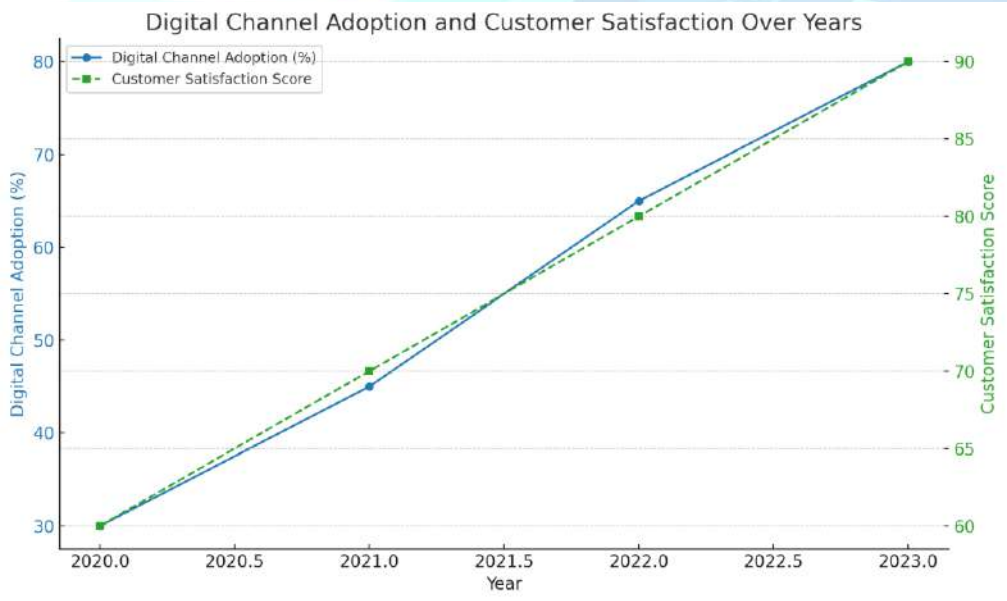
The chart illustrates the progression of customer expectation scores and the adoption rates of personalization strategies from the year 2020 to 2023. A blue bar represents the customer expectation score while an orange line depicts the percentage of personalization strategy adoption. The data shows a clear upward

ISSN 3030-3907

trend in both metrics, indicating that as customer expectations have increased, so has the adoption of personalization strategies.

Shift from face-to-face interactions to digital channels

The transition from face-to-face interactions to digital channels has profoundly reshaped the landscape of traditional insurance paradigms. As customers increasingly gravitate toward digital platforms, insurance companies are compelled to adapt their engagement strategies to maintain competitiveness and relevance. This shift not only streamlines operational processes but also fosters enhanced customer experiences, as evidenced by the branding strategies of traditional banks leveraging digital extensions to create a more cohesive consumer journey (Mogaji et al., 2024). Moreover, this transformation aligns with broader trends in digital governance, as institutions recognize the need for collaborative approaches to enhance service delivery and consumer trust in a digital context . However, while the digitalization of services promises efficiency, it also raises concerns regarding compliance and consumer protection, particularly in the complex regulatory environments across different regions (Bignami et al., 2024). Ultimately, the challenge lies in balancing innovation with safeguards that protect consumer interests (Cristofaro et al., 2024).



2-picture. The trends in digital channel adoption and customer satisfaction scores over the years 2020 to 2023.

The chart illustrates the trends in digital channel adoption and customer satisfaction scores over the years 2020 to 2023. It features two datasets: the blue line represents digital channel adoption, which shows a steady increase from 30% in 2020 to 80% in 2023. The green dashed line indicates customer satisfaction scores, rising from 60 to 90 during the same period. This visualization highlights

ISSN 3030-3907

the positive correlation between the adoption of digital channels and higher customer satisfaction scores.

Implementation of AI and machine learning in underwriting processes

The implementation of AI and machine learning in underwriting processes represents a transformative shift within the insurance sector, aligning with broader digital transformation trends. By leveraging advanced algorithms, insurers can analyze vast amounts of data more efficiently, enhancing risk assessment accuracy and reducing underwriting time significantly. Such automation not only accelerates decision-making but also facilitates customized insurance offerings tailored to individual risk profiles, thereby improving customer experience. Furthermore, the integration of AI tools allows for the identification and mitigation of biases in underwriting practices, ensuring more equitable treatment across different demographics, which is especially important given the scrutiny surrounding AI biases in financial services . As companies adopt these technologies, a strategic approach is essential to balance efficiency gains with the human-centric elements necessary for fostering strong client relationships (Khalisa et al., 2024). This integration of AI underscores the shift from traditional methodologies to innovative paradigms that redefine insurance operations and customer engagement in the industry .

Streamlining claims processing through digital tools

The integration of digital tools into claims processing has become a transformative element in the insurance industry, significantly enhancing efficiency and customer satisfaction. By leveraging technologies such as artificial intelligence and blockchain, insurers can expedite claims handling while reducing operational costs and errors. For example, the deployment of AI in claim evaluations streamlines the decision-making process, enabling quicker resolutions and improved data analysis (Kim et al., 2024). Additionally, blockchain technology addresses transparency concerns, simplifying complicated insurance settlements and fostering trust among stakeholders (Bibi Z Chummun et al., 2024). Empirical evidence further demonstrates that digitalization positively influences consumer behaviors, with applications reinforcing satisfaction and loyalty among insurance customers . However, challenges such as privacy concerns and potential option overload must be acknowledged to maximize the benefits of such advancements . Ultimately, the strategic implementation of digital solutions is essential for redefining traditional insurance paradigms and enhancing overall operational effectiveness.

Cost reduction and resource optimization in insurance operations

ISSN 3030-3907

The implementation of digital transformation strategies in insurance operations has become essential for cost reduction and resource optimization. By leveraging technologies such as artificial intelligence (AI), companies can streamline underwriting processes and enhance claims management, thereby significantly reducing operational expenses. The use of advanced analytics allows insurers to better assess risk and make informed decisions, which can lead to lower premiums and improved resource allocation. Moreover, adopting cloud-based solutions facilitates seamless data exchange between different stakeholders, further optimizing workflows and reducing the need for extensive physical infrastructure.

Table 2

Cost Reduction and Resource Optimization in Insurance Operations

Year	Cost Reduction Percentage	Resource Optimization Percentage	Automation Implementation	Claims Processing Time Reduction	Customer Satisfaction Increase
2021	15	10	30	25%	20%
2022	20	15	40	30%	25%
2023	25	20	50	40%	30%

As organizations navigate these transformations, they must also address challenges such as cybersecurity and integration with existing legacy systems. Ultimately, with proper management, these innovations can not only foster efficient operations but also create sustainable competitive advantages in an ever-evolving market landscape (Ribeiro et al., 2024)(Karthik et al., 2024)(Farooqui et al., 2024).

Conclusion

In conclusion, the profound impact of digital transformation on traditional insurance paradigms is undeniable, as it encapsulates a shift towards efficiency and enhanced customer engagement. This evolution is driven by the integration of advanced technologies such as artificial intelligence and big data, which enable insurers to streamline operations and personalize services, thereby fostering a deeper customer connection. The findings indicate that to remain competitive, traditional insurance models must adapt to incorporate these digital innovations, underscoring the necessity of flexibility and responsiveness in service delivery (Aggarwal et al., 2024). Furthermore, the comparative analyses highlight how the structural changes within the insurance industry mirror broader trends in financial services, necessitating a comprehensive approach to innovation that transcends conventional business practices (Adams et al., 2024). Ultimately, embracing digital

ISSN 3030-3907

transformation not only safeguards the relevance of traditional insurance but also positions it for sustainable growth in an increasingly tech-driven marketplace

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TO‘G‘ONSIZ MIKRO GESLAR VA ULARNI LOYIHALASH

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Annotatsiya: To‘g‘onsiz mikro GESlarning boshqa GESlardan farqi ortiqcha sarf-xarajatsiz, ya’ni to‘g‘on qurmasdan, suvning oqimi bor joylarga qurib elektr energiyasi olish imkoniyatini yaratadi va umumiy elektr liniyasiga tushadigan yuklamani kamaytiradi. Shuningdek zamonaviy ilmiy-tadqiqot natijalaridan foydalanib, mikro GESlarni loyihalash va o‘rnatish orqali Xorazm viloyat miqyosida qo‘shimcha elektr energiya ishlab chiqarish hamda an’anaviy energiya manbalarini tejash imkoniyatini yaratishimiz ham mumkin.

Kalit so‘zlar: Xorazm, Toshsoqa, to‘g‘onsiz, kichik quvvatli, mikro, GES, quvvat, daryo va kanal.

Аннотация: отличие микро-гидроэлектростанций без плотин от других гидроэлектростанций заключается в том, что они не требуют чрезмерных затрат, то есть без строительства плотины они могут получать электроэнергию, высыхая в местах, где есть сток воды, и снижая нагрузку на общую линию электропередач. Используя современные результаты исследований и разработок, проектируя и устанавливая микро ГЭС, мы можем создать дополнительную электроэнергию в масштабах Хорезмской области, а также сохранить традиционные источники энергии.

Ключевые слова: Хорезм, Ташсак, без плотины, малая мощность, микро, гидроэлектростанция, мощность, река и канал.

Annotation: the difference between non-dam micro-GES from other GES is no over-expenditure, i.e., without building a dam, it makes it possible to get electricity by building where there is a flow of water and reduces the load on the general power line. We can also use the results of modern R & D to create the opportunity to generate additional electricity on a regional scale of Khorezm, as well as to save on traditional energy sources by designing and installing micro-Gees.

Keywords: Khorezm, Rock, Dam-free, small capacity, Micro, GES, power, River and Canal.

Kirish

Mikro GESning bosh afzalligi. Kichik GESlarni qurish juda katta hududlarni suv ostida qoldirib, juda katta mablag‘lar evaziga suv havzalarini tashkil etishni talab etmaydi. Bu degani u aynan kichik suv oqimlariga mo‘ljallanganligidir, zero O‘zbekistonning barcha viloyatlarida aynan shunday havzalar ko‘p uchraydi.

ISSN 3030-3907

Ularga sekundiga maksimal 3-5 metr, minimal 0,5-1,5 metr tezlikda oquvchi ariqlar, soylar kiradi. Avvalambor, bu - toza energiya. Mikro-GES faoliyati ekologiyaga va suvga mutlaqo zarar yetkazmaydi. Masalan, 1 kVt energiyani an'anaviy usulda ishlab chiqarish uchun, anchagina qazilma yoqilg'i talab etiladi, mikro GESda esa biz tuganmas, qayta tiklanuvchi energiya manbai hisoblanadi.

Mikro GESning asosiy kamchiligi. Butlovchi qismlar tanqisligi, konstruktsiyadagi eng qimmat detal generator sanaladi. Qish faslida suvning kamayishi muzlashi mikro GESning genarator ishiga salbiy ta'sir etadi. Uni qurishda va loyihalashda generator valiga mahkamlangan parraklari yuqori tezlikda aylanganida baliqlarga shikast yetkazmaydigan qilib loyihalash kerak. Baliqlar tom ma'noda suvni filtirlab turadi. Shuning uchun ham, mikro GESni qurish uchun joy tanlashda mavjud minimal oqimning 10% dan ko'p bo'lmagan miqdorda foydalanishga harakat qilish kerak.

Tadqiqot metodologiyasi.

Mikro GESlardan energiya ta'minoti samaradorligining texnik-iqtisodiy mezonlarini aniqlash uchun gidroenergetika resurslari kadastr orqali stansiyani o'rnatish uchun tavsiya etilgan maydondan quyidagi asosiy ko'rsatkichlarni aniqlash kerak:

1. Daryoning o'rtacha qiyaligi, D N (m/km);
2. Yozgi quruq mavsumda suv oqimining o'rtacha miqdori, Q (m^3/s);
3. Yozgi quruq mavsumda o'rtacha suv oqiminig tezligi, ϑ (m/s);
4. Kanal yoki daryoning yillik suv oqish soati, H.

Mikro GES xalqaro standartlarga ko'ra, asosan quvvati 0,1 kVt dan 1000 kVt gacha bo'lgan gidroenergetik qurilma bo'lib, u turbina, tasmali va reduktorli uzatmalar hamda sinxron generatordan iborat. Gidroturbinalar suvning tez oqimi tufayli quvvat hosil qiladi. Suv qancha tezroq oqsa, u ham shuncha ko'proq elektr quvvati ishlab chiqaradi, qurilish jarayonida va foydalanish davrida tabiiy landshaft va atrof-muhitni buzmaydi. Suv sifatiga salbiy ta'sir ko'rsatmaydi, ya'ni, asl tabiiy xususiyatini yo'qotmaydi. Shu bois ular har jihatdan foydali va nisbatan arzon elektr energiyasi hosil qilishda qo'l keladi.

Tahlil va natijalar.

Bu esa Xorazm viloyatining turli hududlarida yangi mikro GESlar qurish orqali qo'shimcha elektr energiyasi ishlab chiqarish imkoniyatini beradi. Suv xo'jaligi, aholi punktlari va klasterlar korxonalari qo'shimcha elektr energiya bilan ta'minlanadi. Bitta to'g'onsiz mikro GESni loyihalash va o'rnatishda 6 ta ish o'rni yaratiladi.

ISSN 3030-3907



1-rasm. To‘g‘onsiz mikro GESning umumiy ko‘rinishi.



2-rasm. Toshsoqa kanalining mikro GES loyihalanadigan qismi.

Hozirgi paytda kichik quvvatli gidro energetik qurilmalar (GEQ) quvvatini kattaligiga qarab bo‘linadi. Yevropa va Lotin Amerika davlatlarida bunday qurilmalar quyidagicha qabul qilingan:

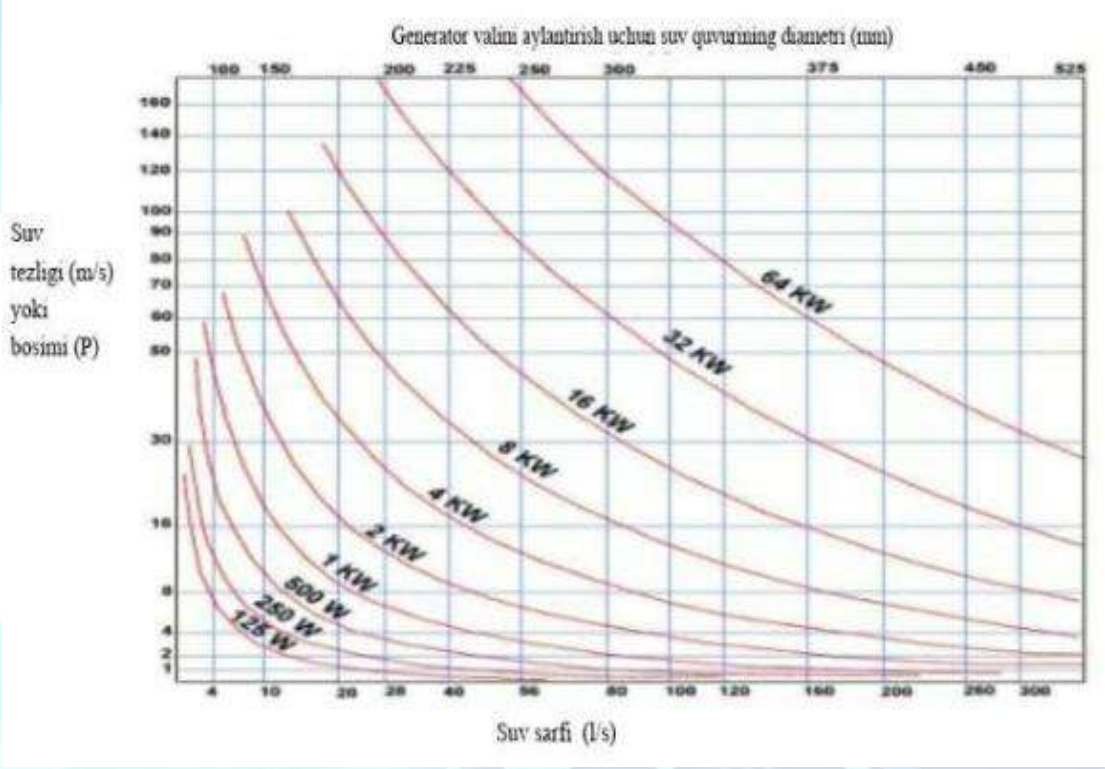
- Mikro GES N<100 kVt
- Mini GES N=100-2000 kVt
- Kichik GES N=2000-10000 kVt

Bu tartibli kichik quvvatli (mikro GES) gidro energetik qurilmalarning quvvati 100 kVt bo‘lib, elektr energiya ishlab chiqishni ta’minlaydi va iste’molchilarga uzatadi hamma kerakli jihozlari va qurilmalar konstruksiyasi

ISSN 3030-3907

sodda qilib bajarilgan.

MikroGES ning quvvatini oshirish uchun yo suv oqimini oshirish kerak yoki turbina ishchi g‘ildiragi diametrini oshirish kerak bo‘ladi. Tekislikda joylashgan daryolarda va kanallardagi suv oqimining tezligi o‘rtacha 1-1,5 m/s tashkil qiladi. Hisoblarni ko‘rsatishicha, suv oqimining tezligi 1 m/s da 10 kVt quvvatni olish uchun ishchi g‘ildirak diametrini 10m qilish kerak yoki diametri 1m bo‘lgan 10 turbina olishga to‘g‘ri keladi



3-rasm. Mikro-GESning quvvatini aniqlash uchun ko‘rsatilgan nomogramma.

Xulosa va takliflar.

Kavitatsiya (lotincha cavitas - bo‘shliq) suyuqlik ichida gaz, bug‘ yoki ularning aralashmasi bilan to‘lgan bo‘shliq (kavitatsiya pufakchalari) hosil bo‘lish hodisasi hisoblanadi. Tez oqayotgan suyuklikda bosimning ma’lum kritik qiymatgacha kamayishi (gidrodinamik kavitatsiya) natijasida yoki suyuqlikda akustik to‘lqinlarning o‘tishi (akustik kavitatsiya) natijasida sodir bo‘ladi. Suyuqlikdagi gaz va bug‘ pufakchalari cheksiz ortib boradi va katta “kavitatsiya pufakchalariga” aylanadi. Pufakchalar suyuqlikda gaz erishi tufayli hosil bo‘lib, bosim kritik bosimdan yuqori bosim sohasigacha yetganda kamaya boradi va yo‘qoladi. Natijada suyuqlik aylanib o‘tayotgan jism yaqinida pufakchalar bilan to‘lgan chegara “kavitatsiya zonasi” hosil bo‘ladi. Zona chegarasida pufakchalar juda tez kamayib boradi va gidravlik zarba vujudga keladi. Bunday zarbalarning qo‘shilishi natijasida hamma vaqt kavitatsiya bilan birga g‘uvullayotgan ovoz chiqadi.

ISSN 3030-3907

Xulosa qilib aytganda, Kavitatsiya gidroinshootlar va qurilmalar, suv turbinalari, suyuqlik nasoslari, turbovintlar va boshqalarga zararli ta’sir ko‘rsatadi, f.i.k. ni kamaytiradi. Kavitatsiyani yo‘qotish uchun suyuqlik harakati sekinlashtiriladi, gidrostatik bosim oshiriladi.

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ISSN 3030-3907

PAXTA XOMASHYOSINI IFLOSLIKLARDAN TOZALASHDAGI STATSIONAR HARAKAT JARAYONINI NAZARIY TADQIQOTI

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Annotatsiya. Bugungi kunda paxtani yirik va mayda iflosliklardan tozalashda UXK mashinalaridan keng foydalanib kelinmoqda. Ushbu mashinalar yordamida paxta tarkibidan iflosliklarni ajratib olishda, asosiy ishchi organ kolosnikli panjaralar va arrali baraban xisoblanadi. Tozalash jarayonida paxta xomashyosining asosiy qismi kolosniklarga tegib harakatlanadi.Ular kolosniklar yuzasi bo‘ylab harakatlanganda, zarbalanish jarayoni yuz beradi. Natijada yirik - mayda iflosliklar paxtaning ichki yuzasidan tashqi qismiga harakatlanib chiqadi. Ushbu jarayonni inobatga olib, paxtani yirik –mayda iflosliklardan tozalash samaradorligini oshirish maqsadida, mualliflar tomonidan sirtida ellipissimon teshiklar ochilgan, silindrsimon kolosniklarning taklif etilgan. Kolosniklar sirtidagi bu teshikchalardan mayda iflosliklarni ajratilib chiqish imkoniyatini yaratadi.

Ushbu maqolada paxta xomashyosini statsionar harakati, siqiluvchan model asosida, Eylerni tenglamalari yordamida ifoda qilingan.Shu model asosida paxta xomashyosini tarkibidan yirik-mayda ifloslikni ajratish jarayonini nazariy o‘rganilgan.Statsionar harakat tenglamalarini MAPLE-17 dasturida hisoblangan. Natijada paxta xomashyosini burchak tezligi, massasini kolosniklar soniga qarab o‘zgarishi qonuniyatlari grafik va jadval ko‘rinishda keltirilgan.

Kalit so`zlar: paxta, kolosnik,ifloslik, baraban,yuza,tozalash,tola,tezlik,texnologik jarayon,kamera,vaqt.

Аннотация: Сегодня машины UXK широко используются для очистки хлопка от крупных и мелких примесей. При использовании этих машин для отделения примесей от хлопка основными рабочими элементами являются решетки и пильный барабан. В процессе очистки основная масса хлопкового сырья движется против гребней. При их движении по поверхности гребенок происходит процесс удара. В результате крупные и мелкие примеси перемещаются с внутренней поверхности хлопка на внешнюю поверхность. Учитывая этот процесс, для повышения эффективности очистки хлопка от крупных и мелких примесей авторами предложены цилиндрические сита с эллиптическими отверстиями на их поверхности. Эти отверстия на поверхности толстых кишок позволяют отделять мелкие примеси.

В данной статье стационарное движение хлопкового сырья выражается с помощью уравнений Эйлера на основе сжимаемой модели. На основе

ISSN 3030-3907

данной модели теоретически изучен процесс выделения крупных и мелких примесей из состава хлопкового сырья. Уравнения стационарного движения рассчитываются в программе MAPLE-17. В результате получены закономерности изменения угловой скорости и массы хлопкового сырья в зависимости от числа катушек в графическом и табличном виде.

Ключевые слова: хлопок, гребень, грязь, барабан, поверхность, очистка, волокно, скорость, технологический процесс, камера, время.

Abstract. Today, UXK machines are widely used to clean cotton from large and small impurities. The main working body in separating impurities from cotton with the help of these machines is a grid with combs and a saw drum. During the cleaning process, the main part of the cotton raw material moves in contact with the combs. When they move along the surface of the combs, a shock process occurs. As a result, large and small impurities move from the inner surface of the cotton to the outer part. Taking this process into account, in order to increase the efficiency of cleaning cotton from large and small impurities, the authors proposed cylindrical combs with elliptical holes on their surface. These holes on the surface of the combs allow small impurities to be separated.

In this article, the stationary motion of cotton raw material is expressed using the Euler equations based on a compressible model. Based on this model, the process of separating large and small impurities from the composition of cotton raw material is theoretically studied. The equations of stationary motion are calculated in the MAPLE-17 program. As a result, the laws of change in the angular velocity and mass of cotton raw material depending on the number of combs are presented in graphical and tabular form.

Keywords: cotton, comb, dirt, drum, surface, cleaning, fiber, speed, technological process, camera, time.

Kirish

Ma`lumki paxta xomashyosini dastlabki ishlash texnologiyasida, tolani chigitdan ajratish jarayonida xomashyo ayrim iflosliklardan tozalanadi. Iflosliklar asosan yirik va mayda organik aralashmalardan iborat bo‘ladi.Ularni xomashyodan tozalash uchun, maxsus texnologik jarayonlar amalga oshiriladi. Tozalash texnologiyasida paxtani ifloslanishi ikki ko‘rsatkich: miqdoriy va sifat bo‘yicha baholanadi.Bu ko‘rsatkichlar vositasida ifloslik zarrachalarining o‘lchamlari va ularning xomashyodagi tola bilan birikkan kuchlari baxolanadi. Iflosliklar o‘lchamlariga qarab xomashyoning sirtida va ichki soxasida tarqalgan bo‘ladi.Mayda zarrachalar xomashyoni ichki sohasiga chuquroq joylashgan bo‘lib, ularni xomashyodan ajratish ancha murakkab hisoblanadi.Ularni xomashyo tarkibidan yuqori darajadagi zarba va silkitish ta’sirlari yordamida ajratish

ISSN 3030-3907

mumkin. Bunday holat tola massasini iflosliklardan tozalash jarayonida xam mavjud bo‘ladi[1-6].

Agar paxta xomashyosi kolosniklar bo‘ylab harakatda bo‘lsa, bu holda ifloslik zarrachalari zarba yoki silkitish kuchi ta’sirda harakat sodir etadi va uni yuzadan ajralib ketish intensivligini oshiradi.Agar kolosniklar tirqishli bo‘lsa, paxta xomashyosining kolosniklar yuzasi bo‘ylab harakati davomida, kontakt kuchi ortadi.Natijada zarrachalar fazoviy xarakatga keladi, Bu o‘z navbatida xomashyo tarkibidan yirik va mayda iflosniklarni ajralib chiqishiga olib keladi.

Shu munosabat bilan maqolada paxta xomashyosini statsionar harakati, Eylerni [1] tenglamalariga asoslangan siqiluvchan model asosida tekshirilgan.

Masalani matematik modeli va uning yechish usui. Tarkibidan yirik va mayda iflosliklarni ajratib olish qurilmasida, paxta xomashyosini statsionar harakatini ko‘rib chiqamiz(1-rasm).

Ishchi kameraga uzluksiz ravishda Q –hajmli paxta xomashyosi ta`minlagich orqali kirib kelsin.Paxta massasini silindrik kamerada bo`lish vaqti $T = \frac{q}{\omega}$ (sek) bo‘lsin Bu yerda ω – baraban burchak tezligi, q- qismdagi chiqindi miqdori.Paxta xomashyosini harakati statsionar bo‘lgani uchun T-vaqt ichida ishchi kameraga $m_0 = QT = Qq/\omega$ massadagi xomashyo kiradi.

Bu holda, tozalash barabani ishchi kamerasi ichida, paxta bo‘lakchalarini $t = 0$, $t = T$ oraliqda o‘zgarishini tekshiramiz.

Tozalash barabanni markazini qutb koordinatalar sistemasini koordinata boshi deb qabul qilib, harakat jarayonini tekshiramiz. (1-rasm)

Tozalash barabanida harakatlanuvchi paxta xomashyosi bilan kolosniklar o‘zaro ta’sirida hosil bo‘luvchi ishqalanish kuchini, Kulon qonuniga bo‘ysunadi deb qaraymiz. Bu holda tozalash barabaning arrali tishlari tomonidan paxta xomashyosiga ta’sir etuvchi kuchlarni nuqtaviy to‘plama kuch sifatida qarash mumkin bo‘ladi.

Siqiluvchan muhit modeliga asosan, tekshirilayotgan jarayonni $R_1 < r < R_1 + h$, $\varphi_0 < \varphi < \pi - \varphi_0$. ($R_1$-tozalash barabanini radiusi, h - paxta xomashyosi qatlamini qalinligi) oraliqdagi bosimining o‘zgarish qonuni $p = p(r, \varphi)$ va zichligi $\rho = \rho(r, \varphi)$ qonuniyat bilan o‘zgarsin. Paxta xomashyosi qatlamini qalinligi kichik bo‘lganligi uchun, radius yo‘nalishdagi oqim tezligini nolga teng deb olishimiz mumkin.

Ya’ni $v_R = 0; v(r, \varphi) = v(\varphi), p = p(\varphi), R_1 < r < R_1 + h$ intervalda $r = R = (2R_1 + h)/2$ deb olish mumkin.

ISSN 3030-3907

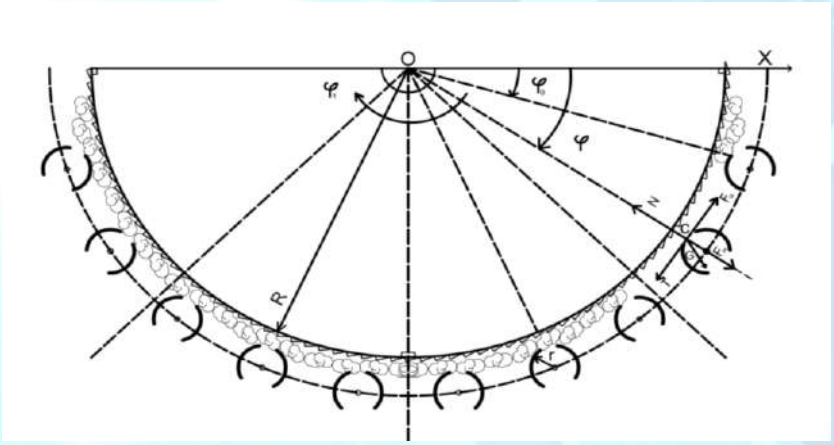
$v(\varphi), p(\varphi), \rho(\varphi)$ - funksiyalarni, og‘irlik kuchini hisobga olmaganda,Eylerni [3] statsionar tenglamalari orqali ifodalashimiz mumkin.

$$\rho v \frac{dv}{d\varphi} = -\frac{dp}{d\varphi} - f\frac{R}{R_1+h}\sum_{i=1}^{10}\rho_i v_i^2 \theta(\varphi-\varphi_i), \varphi_0 < \varphi < \pi - \varphi_0 \qquad (1)$$

Bu yerda: f - paxta xomashyosi va kolosniklar orasidagi ishqalanish koeffisenti; $\theta(\varphi-\varphi_i)$- Dirac funksiyasi bo‘lib $\varphi_0 < \varphi < \varphi_1$, burchak oralig‘idagi yoyilgan kuchni ta'sirini ko‘rsatadi.

p_i, v_i lar , $p(\varphi)$ va $w(\varphi)$ funksiyalarni $\varphi = \varphi_i = \varphi_1 + \frac{\pi-2\varphi_1}{N-1}(i-1)$ nuqtadagi funksiyalarni qiymati. N - kolosniklar soni. (1) tenglama p_i, v_i, ρ - uchta noma'lumni o‘z ichiga oladi.Shu sababli (1) ga qo‘shimcha ikkita tenglama tuzilishi kerak.Qo‘shimcha ikkita tenglmani paxta xomashyosi massalar oqimini saqlanish qonunidan foydalanib tuzamiz.

$$\rho v S = \rho_i v_i S = \rho_0 v_0 S_0 = Q = const;\ S = h(\varphi)L \qquad (2).$$



1-rasm. Paxta bo‘lakchasiing parallel turli yuza sirtidagi statsionar harakat sxemasi.

Bu erda $S = Lh$ xomashyo oqimi yuzasi, ρ_0 - paxta xomashyosi massasini ishchi kameraga kirishdagi zichligi, $v_0 < v_n$ - пaxta xomashyosini tozalash zonasiga uzatish burchak tezligi (v_n- arrali barabanni chiziqli tezligi), Q- qurilmani tozalashdagi ish unumdorligi, L - qurilma uzunligi. Ushbu holda tekshirilayotgan muhit holatini,yani bosim va zichligini bog‘lovchi tenglamasi quyidagicha bo‘ladi.

$$\rho = \rho_c[1 + A(p - p_c)] \qquad (3)$$

Bu yerda: A- paxta xomashyosi massasini yumshoqlik koeffisenti, p_0- ishchi kameraga kirib keluvchi oqimni bosim kuchi (3) tenglamadan foydalanib zichlik va bosimni $A << 1$ holat uchun, tezliklarni hisobga olgandagi bog‘lanish qonuniyatini quyidagicha yozamiz.

$$\rho = \frac{\rho_0 v_0 h_0}{v h(\varphi)} \qquad (4)$$

ISSN 3030-3907

$$p = p_0 + \frac{1}{A}(1 - \frac{v}{v_0}) \quad (5)$$

$$\frac{dm}{m} = \frac{dV}{\alpha V} \quad (6)$$

$$\frac{dm}{m} = \frac{d\rho}{(1+\alpha)\rho} \quad (7)$$

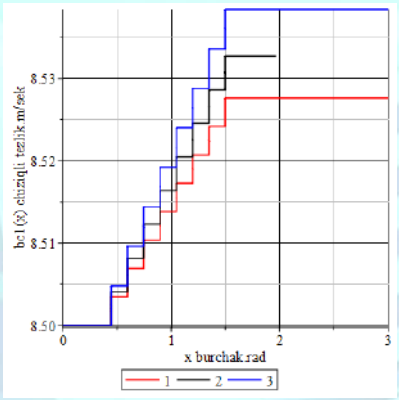
$$\frac{d\rho}{\rho} = -bnkdt \quad (8)$$

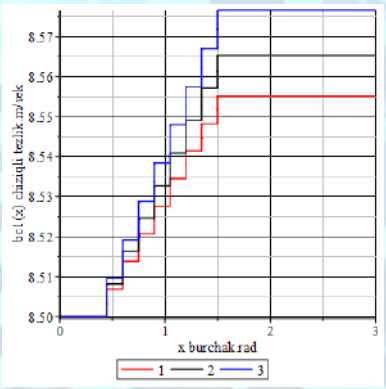
Yuqoridagi tenglamalardan ρ va p larni chiqarib tashlab , $\frac{h}{R} \approx 0$, xolat uchun $\frac{R}{R_1+h} \approx 1$ qabul qilib quyidagi tenglamani hosil qilamiz.

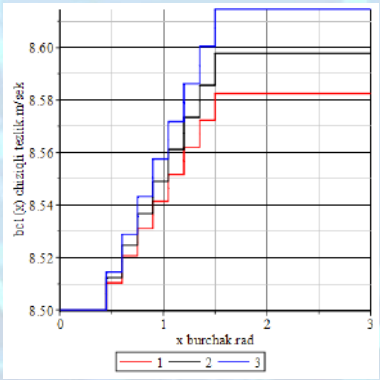
$$\frac{d\,\bar{\bar{v}}}{d\varphi} = -\frac{f}{q}\sum_1^N \bar{v}_i\,\theta(\varphi - \varphi_i) \quad (9)$$

Bu yerda $\bar{v} = \frac{v}{v_0},\ \bar{v}_i = \frac{v_i}{v_0}, q = 1 - \frac{1}{A\rho_0 v_0^2}$

(9)-statsionar harakat tenglamalarini MAPLE-17 dasturida hisoblangan.Natijada paxta xomashyosini burchak tezligi, massasini kolosniklar soniga qarab o‘zgarishi qonuniyatlari 2-grafiklarda keltirilgan.







a) b) c)

1-A=0.0004; 2-A=0.00045; 3-A=0.0005; a) f=0,001 b) f=0.002; c) f=0.003

2-rasm. Paxta xomashyosini kolosnikli barabanda harakatlanish chiziqli tezligini aylanish burchagiga nisbatan o‘zgarishi qonuniyati.

Natijalarni tahlili.

2-rasmdagi grafiklarda, $A = 0.0004; 0.00045; 0{,}0005$ qiymatlarda, paxta xomashyosini, kolosnikli barabanda harakatlanish chiziqli tezligini, aylanish burchagiga nisbatan o‘zgarishi qonuniyati keltirilgan.Kolosniklarga paxta

ISSN 3030-3907

bo’lakcharari urinib o’tishi hisobiga,tezliklarni o’zgarishi pog’anasimon qonuniyatga bo’ysinadi. Paxta xomashyosinini A-bikirlik(yumshoqlik)koiffisentini oshishi,uning chiziqli tezligini oshishiga olib kelar ekan.Bu o’z navbatida xom-ashyoda silkinishni hosil qiladi. Natijada esa mayda-yirik iflosniklarni ajralib chiqish intensivligini oshadi.

Xulosa.

1.Paxta xomashyosini yirik va mayda iflosliklardan tozalashdagi, statsionar harakat jarayonini matematik modeli tuzilgan.

2.Statsionar harakat differensial tenglamalarida,kolosnillarni paxta xom-ashyosiga ta’siri Dirac xisobga olingan.

3.Paxta xomashyosini, kolosnikli barabanda harakatlanish chiziqli tezligini, aylanish burchagiga nisbatan o‘zgarishi qonuniyati keltirilgan.

4.Kolosniklarga paxta bo’lakcharari urinib o’tishi xisobiga,tezliklarni o’zgarishi pog’anasimon qonuniyatga bo’ysinishi aniqlangan.Bu o’znavbatida xom-ashyoda silkinishi hosil qiladi.Natijada esa mayda-yirik iflosniklarni ajrilib chiqish intensivligini oshiradi.

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IKKI O‘LCHOVLI PARABOLIK TIPDAGI DIFFERENSIAL TENGLAMALARNI YECHISH ALGORITMLARI VA SONLI NATIJALARNI MODELINI ISHLAB CHIQISH.

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Annotatsiya. Bugungi kunga kelib xususiy hosilali differensial tenglamalar uchun chegaraviy masalalarni yechishning hisoblash usullari rivoji va zamonaviy hisoblash texnikalarining takomillashishi hisobiga bir qancha yutuqlarga erishilmoqda. Yana shuni alohida ta’kidlash lozimki, hozirgi kunda issiqlik almashinish jarayonlarini sonli modellashtirish zamonaviy fan va texnika uchun ishonchli taxminlarni eksperimentlar yo‘li bilan laboratoriya va tabiiy sharoitda o‘rganish juda murakkab, qimmat va ba’zi hollarda umuman mumkin bo‘lmaganligi uchun muhim ahamiyat kasb etib bormoqda.

Kalit so‘zlar: Temperatura, konveksiya va nurlanish, differensial tenglama, issiqlik o‘tkazuvchanlik.

Abstrac. To date, a number of achievements have been made due to the development of computational methods for solving boundary value problems for partial differential equations and the improvement of modern computational techniques. It should also be noted that numerical modeling of heat transfer processes is currently gaining importance for modern science and technology, since it is very difficult, expensive, and in some cases impossible to obtain reliable estimates experimentally in laboratory and natural conditions.

Key words: Temperature, convection and radiation, differential equations, thermal conductivity.

Аннотация: К настоящему времени достигнут ряд успехов благодаря развитию вычислительных методов решения краевых задач для уравнений в частных производных и совершенствованию современных вычислительных технологий. Следует также отметить, что численное моделирование процессов теплопередачи в настоящее время приобретает все большее значение для современной науки и техники, поскольку получение надежных оценок путем экспериментов в лабораторных и натурных условиях весьма затруднительно, затратно, а в ряде случаев и невозможно.

Ключевые слова: Температура, конвекция и излучение, дифференциальные уравнения, теплопроводность.

Kirish

ISSN 3030-3907

Ikki o‘lchovli parabolik tipdagi tenglamalarni yechish jarayonini o‘rganish hamda uni texnika va tabiiy bilimlar rivojida qo‘llash muhim o‘rinni egallab kelmoqda. Bu kabi differensial tenglamalarni aviatsiya, atom energetikasi, kosmik raketalar texnikasi rivoji issiqlik almashinuvning yanada yangi masalalarini yechishda hamda shu bilan birga mavjud va yangi nazariyalarga to‘lalik va ishonchlilik shartlarini qat’iy talab asosida ishlab chiqilmoqda. XXI asrga kelib esa issiqlik almashinish hodisalarining tadqiqi va qo‘llanilishi jadalligi doirasi keskin kengaytirish maqsadida ushbu malalardan keng foydalanilmoqda. Hozirda bu masalalar texnika (kimyoviy texnologiya, metallurgiya, qurilish ishlari, neftni qayta ishlash, mashinasozlik, agrotexnika va hokazo) va asosiy tabiiy fanlar (biologiya, geologiya, atmosfera va okean fizikasi va hokazo)ning yetakchi yo‘nalishiga kiradi. Hozirgi kunda issiqlik almashinuvi jarayonlarining nazariy tadqiqi differensial masalalarning natijalarini maxsus texnik dasturiy ta’minot yordamida sonli modellashtirishga asoslangan. Bugungi kunga kelib xususiy hosilali differensial tenglamalar uchun chegaraviy masalalarni yechishning hisoblash usullari rivoji va zamonaviy hisoblash texnikalarining takomillashishi hisobiga ana shunday yutuqlarga erishilmoqda. Yana shuni alohida ta’kidlash lozimki, hozirgi kunda issiqlik almashinish jarayonlarini sonli modellashtirish zamonaviy fan va texnika uchun ishonchli taxminlarni eksperimentlar yo‘li bilan laboratoriya va tabiiy sharoitda o‘rganish juda murakkab, qimmat va ba’zi hollarda umuman mimkin bo‘lmaganligi uchun muhim ahamiyat kasb etib bormoqda. Issiqlik almashinish jarayonlarini ikki o‘lchovli differensial masalalar natijalari orqali sonli modellashtirish har xil ilimiy-tadqiqot, loyihalashtiriah va ishlab chiqarish ishlarida amaliyotda muvaffaqiyatli qo‘llanilib kelinmoqda. Quyida parabolik tipdagi tenglamali chegaraviy masalalarini chekli ayirmalar usuli yordamida sonli yechishning qisqacha nazariy asoslari, mustaqil o‘zlashtirishga oid adabiyotlarlardan keng miqiyoda qo‘llash hamda ulardan foydalanishga imkon yaratmoqda. Differensial tenglamalar — noma’lum funksiyalar, ularning turli tartibli hosilalari va erkli o‘zgaruvchilar ishtirok etgan tenglamalar. Bu tenglamalarda noma’lum funksiya i orqali belgilangan bo‘lib, birinchi ikkitasida i bitta erkli o‘zgaruvchi t ga, keyingilarida esa mos ravishda x, t va x, u, z erkli o‘zgaruvchilarga bog‘liqdir. Differensial tenglama nazariyasi 17-asr oxirida differensial va integral hisobning paydo bo‘lishi bilan bir vaqtda rivojlana boshlagan. Differensial tenglama matematikada, ayniqsa, uning tatbiklarida juda katta ahamiyatga ega. Fizika, mexanika, iqtisodiyot, texnika va boshqa sohalarning turli masalalarini tekshirish differensial tenglamani yechishga olib keladi.

Xususiy hosilali differensial tenglama bu tenglamalarning oddiy differensial tenglamadan farqli muhim xususiyati shundan iboratki, ularning barcha yechimlari

ISSN 3030-3907

to‘plami, ya’ni "umumiy yechimi" ixtiyoriy o‘zgarmaslarga emas, balki ixtiyoriy funksiyalarga bog‘liq bo‘ladi; umuman, bu ixtiyoriy funksiyalarning soni differensial tenglamaning tartibiga teng; ularning erkli o‘zgaruvchilari soni esa izlanayotgan yechim o‘zgaruvchilari sonidan bitta kam bo‘ladi. Bir noma’lumli 1-tartibli xususiy hosilali.

Tadqiqot motodologiyasi

Differensial tenglamani yechish oddiy differensial tenglama sistemasini yechishga olib keladi. Tartibi birdan yuqori bo‘lgan xususiy hosilali differensial tenglama nazariyasida Koshi masalasi bilan bir katorda turli chegaraviy masalalar tekshiriladi. Issiqlik o‘tkazuvchanlik nazariyasining chiziqli chegaraviy masalalarini yechish uchun qo‘llaniladigan usullar:

Klassik usullar: o‘zgaruvchilarni ajratish usuli (Furye usuli); manba funksiya- lari (Grin funksiyasi) usuli; issiqlik potensiallari usuli;

Integral akslantirishlar usullari: cheksiz limitlarda; chekli limitlarda (bularda integral akslantirish yadrosi jismning shakli va chegaraviy shartlarga qarab har xil tanlanadi);

Issiqlik o‘tkazuvchanlik nazariyasining nochiziqli chegaraviy masalalariniyechish uchun qo‘llaniluvchi usullar:

Variatsion usullar: Rits usuli; L.V.Kantorovich usuli; Treffts usuli; Bio usuli; Kurant usuli; Leybenzon usuli;

Chiziqlilashtirish usullari (nochiziqli chegaraviy masalani chiziqliga keltirish): o‘rniga qo‘yish usullari (algebraik va integral); chiziqlilashtirish uslublari; ketma-ket yaqinlashishlar usullari; qo‘zgalishlar usuli (kichik para-metr usuli);

Chegaraviy masalani boshqa turdagi tenglama va masalalarga keltirish usul-lari: nochiziqli chegaraviy shartlar bilan berilgan chegaraviy masalalarni unga ekvivalent bo‘lgan nochiziqli funksional tenglamalarga, temperaturadan bog‘liq bo‘lgan uzatish koeffisiyenti bilan berilgan chegaraviy masalani nochiziqli integral tenglamalarga, issiqlik o‘tkazuvchanlikning chegaraviy masalasini oddiy differensial tenglamali chegaraviy masalaga keltirish.

Keltirilgan usullarning bu klassifikatsiyasi shartli, chunki ba’zi usullar bir vaq- tning o‘zida bir necha usullar guruhlariga kirishi mumkin, ba’zilari esa ushbu klassi- fikatsiyaga kirmay qolmoqda.

Quyidagi ikki o‘lchovli parabolik tipdagi differensial tenglamaga qo‘yilgan chegaraviy masalani sonli usullardan foydalanib yechish kerak bo‘lsin. Soddalashtirish uchun quyidagicha chegaraviy masalada qaralayotgan sohani $G\{0<x<1,\ 0<y<1\}$ deb olaylik. U holda chegaraviy masala matematik modelini quyidagicha yozishimiz mumkin.

ISSN 3030-3907

$$\frac{\partial P}{\partial t} = \frac{\partial^2 P}{\partial x^2} + \frac{\partial^2 P}{\partial y^2} + f(x,y) \tag{1}$$

Umumiy holda boshlang‘ich va chegara shartlarini quyidagicha yozish mumkin:

$$\begin{cases} -\left.\frac{\partial P}{\partial x}\right|_{x=0} = \alpha(P_A - P), & x = 0; \\ \left.\frac{\partial P}{\partial x}\right|_{x=1} = \alpha(P_B - P), & x = 1; \\ -\left.\frac{\partial P}{\partial y}\right|_{y=0} = \alpha(P_C - P), & y = 0; \\ \left.\frac{\partial P}{\partial y}\right|_{y=1} = \alpha(P_D - P), & y = 1; \end{cases} \quad P(x,y,t) = \phi(x,y), \quad t = 0; \tag{2}$$

(3)

bu yerda

- P – izlanayotgan, qiymati hisoblanuvchi funksiya;
- P_A, P_B, P_C, P_D - P funksiyaning chegaradagi qiymati;

$$\alpha = \begin{cases} 0, & \textit{chegara mahkamlangan} \\ 1, & \textit{chegara mahkamlanmagan.} \end{cases}$$

Olingan natijalarni to‘g‘riligini va matematik modelning addekvatligini tekshirish maqsadida chegaraviy masalaning analitik yechimini quyidagicha olamiz

$$P(x,y,t) = e^{-2xyt}.$$

U holda chegaraviy va boshlang‘ich shartlar quyidagicha bo‘ladi

$$\begin{cases} P(x,y,0) = 1, \\ P(0,y,t) = 1, \\ P(1,y,t) = e^{-2yt} \\ P(x,0,t) = 1, \\ P(x,1,t) = e^{-2xt}, \end{cases} \tag{4}$$

$$f(x,y,t) = -2(2t^2(x^2 + y^2)) + xye^{-2xyt} \tag{5}$$

Chegaraviy masalani sonli usulda yechish uchun sohani quyidagi diskret sohaga almashtiramiz. Buning uchun quyidagi to‘rni qo‘ramiz.

ISSN 3030-3907

$$\Omega_{h\tau} = \{x = ih, y = ih,\ i = 0,1,...,N,\ h = \frac{1}{N},\quad t_j = j\tau,\ j = 0,1,...,N_0,\quad \tau = \frac{1}{N_0}\}.$$

Bu diskret sohada masalani sonli usulda yechish uchun o‘zgaruvchilarning yo‘nalish sxemasiga asoslangan chekli ayirmalar usulini qo‘llaymiz. Bu usulda bir vaqt qatlamidan ikkinchisiga o‘tish 0.5τ qadam bilan ikki bosqichda amalga oshiriladi. Chekli ayirmali tenglamani operatorli formada *i, j* indekslarini tashlab, quyidagicha yozish mumkin:

$$\frac{P^{k+0.5} - P^k}{0.5\tau} = \Lambda_1 P^{k+0.5} + \Lambda_2 P^k + f(x,y,t), \tag{6}$$

$$\frac{P^{k+1} - P^{k+0.5}}{0.5\tau} = \Lambda_1 P^{k+0.5} + \Lambda_2 P^{k+1} + f(x,y,t). \tag{7}$$

U holda chekli ayirmali tenglamalar tizimi *k+0.5* va *k+1* vaqt qatlamlarida quyidagicha bo‘ladi.

$$a_i P_{i-1,j}^{k+0.5} - b_i P_{i,j}^{k+0.5} + c_i P_{i+1,j}^{k+0.5} = -d_i, \tag{8}$$

$$a_j P_{i,j-1}^{k+1} - b_j P_{i,j}^{k+1} + c_j P_{i,j+1}^{k+1} = -d_j. \tag{9}$$

Bu yerda:

$$a_i = \frac{1}{h^2}; \qquad b_i = 2(\frac{1}{h^2} + \frac{1}{\tau}); \qquad c_i = \frac{1}{h^2}; \tag{10}$$

$$d_i = \frac{2}{\tau} P_{i,j}^k + \frac{P_{i,j-1}^k - 2P_{i,j}^k + P_{i,j+1}^k}{h^2} + (-2(2t^2(x^2+y^2)) + xye^{-2xyt}), \tag{11}$$

$$a_j = \frac{1}{h^2}; \qquad b_j = 2(\frac{1}{h^2} + \frac{1}{\tau}); \qquad c_j = \frac{1}{h^2}; \tag{12}$$

$$d_j = \frac{2}{\tau} P_{i,j}^{k+0.5} + \frac{P_{i,j-1}^{k+0.5} - 2P_{i,j}^{k+0.5} + P_{i,j+1}^{k+0.5}}{h^2} + (-2(2t^2(x^2+y^2)) + xye^{-2xyt}). \tag{13}$$

Chekli ayirmalar tizimining birinchi tenglamani (*k+0.5* vaqt qatlamida) yechish uchun progonka usulini ishlatamiz. Progonka usuliga ko‘ra uning sonli yechimi:

$$P_i = A_i P_{i+1} + B_i \qquad (i = n-1,...,1) \tag{14}$$

formuladan aniqlanadi.

ISSN 3030-3907

Bu yerda A_i, B_i - progonka koeffitsientlari bo‘lib, ular quyidagi formulalardan aniqlanadi:

$$A_i = \frac{c_i}{b_i + a_i A_{i-1}}; \qquad B_i = \frac{a_i B_{i-1} + d_i}{b_i + a_i A_{i-1}}; \tag{15}$$

Progonka koeffitsientlari boshlang‘ich qiymatlari A_0, B_0 chegaraviy shartlardan aniqlanadi. Umumiy holdagi (3) birinchi chegaraviy shart uchun quyidagicha:

$$A_0 = \frac{b_1 - 4c_1}{a_1 - (3 - 2\Delta x)c_1}; \qquad B_0 = \frac{d_1}{a_1 - (3 - 2\Delta x)c_1}. \tag{16}$$

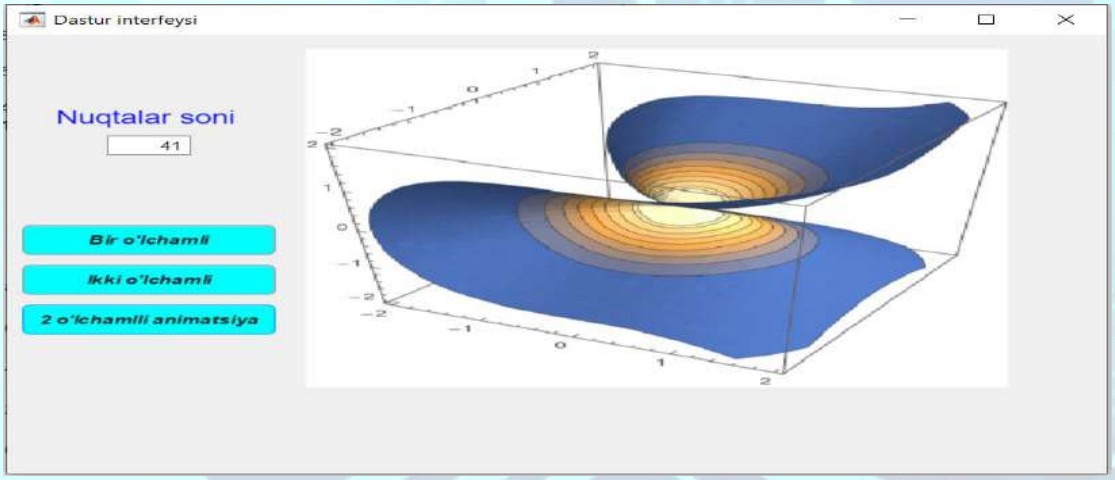
Yuqorida ishlatilgan aniq misol uchun (4) funksiya qiymati o‘ng chegaradagi formula bilan aniqlanadi.

$$P_{N,j}^{k+0.5} = e^{-2yt}, \qquad A_0, B_0 ? \tag{17}$$

Xuddi shunday, bu sxema ikkinchi chekli ayirmali tenglamani yechish (*k+1* vaqt qatlamida) uchun ham o‘rinlidir.

Tahlil va natijalar

Hisob natijalari. Yuqorida keltirilgan misol asosida MATLAB dasturida model yaratildi, uning natijalari 1-rasmda tasvirlangan.



1-rasm. MATLAB dasturi hisobi natijalari.

Xulosa

Ikki o‘lchovli parabolik differensial tenglamalarni yechish algoritmlari asosan sonli usullar asosida qurilgan bo‘lib, ular fizik jarayonlarning aniq tavsiflari va real holatlar bilan moslashish uchun juda muhim. Farqlash va element metodlari bu tenglamalarni yechishda eng ko‘p ishlatiladigan usullardir. Amaliyotda, turli xil

ISSN 3030-3907

dasturlar yordamida ushbu tenglamalar yechimi va model natijalari hisoblab chiqilib, natijalar tahlil qilinadi, shuningdek, bu model va yechimlar ilmiy tadqiqotlar hamda sanoat sohalarida keng qo‘llaniladi.

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UCH O‘LCHAMLI NILPOTENT ALGEBRANING DIFFERENSIALLASHI LOKAL VA IKKI LOKAL DIFFERENSIALLASHI

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IIV Namangan akademik litsey matematika fani o‘qituvchisi

Annotatsiya. Differensiallash matematikaning fundamental tushunchalaridan biri hisoblanadi. Differensiallashlar algebra fanida ham muhim o‘rin tutadi. Differensiallashlarning turli umumlashmalari mavjud. Bular sarasiga antidifferensiallashlar, δ-differensiallashlar, ternar differensiallashlar va (α,β,γ)-differensiallashlar kiradi. Ushbu ishda uch o‘lchamli nilpotent algebralarning differensiallashi lokal va ikki lokal differensiallashi isboti bilan ko‘rsatilgan.

Kalit so‘zlar: Differensiallash, Algebra, lokal differensiallash va ikki lokal differensiallash, chiziqli akslatirish.

Аннотатция. Дифференциация — одно из фундаментальных понятий математики. Дифференциации также играют важную роль в алгебре. Существуют различные обобщения дифференциаций. К ним относятся антидифференциации, δ-дифференциации, тернарные дифференциации и (α,β,γ)-дифференциации. В данной работе демонстрируется дифференциация трехмерных нильпотентных алгебр путем доказательства локальной и билокальной дифференциации.

Ключевые слова: Дифференцирование, алгебра, локальное дифференцирование и два локальных дифференцирования, линейное отражение.

Abstract. Differentiation is one of the fundamental concepts of mathematics. Differentiations also play an important role in algebra. There are various generalizations of differentiations. These include antidifferentiations, δ-differentiations, ternary differentiations, and (α,β,γ)-differentiations. In this paper,

ISSN 3030-3907

the differentiation of three-dimensional nilpotent algebras is shown by proving local and bilocal differentiation.

Key words: Differentiation, Algebra, local differentiation and two-local differentiation, linear mapping.

I. KIRISH

1-§. Masalaning qo‘yilishi

Hozirgi kunda jahonda differensiyalashlar nazariyasi bilan bir qatorda, operator algebralarida lokal va 2-lokal differensiyalashlar nazariyasi ham muhim hisoblanadi. So’nggi 20 yil davomida fon Neyman algebralari C^*- algebralari va JB^*- uchliklarda lokal va 2- lokal differensiallashlar nazariyasini o’rganish bo’yicha samarali natijalarga erishildi. Lokal differensiallashlarni o’rganish 1990-yilda R.B.Kadison va D.R.Larson hamda A.S.Sururlar tomonidan boshlangan.

Ixtiyoriy uch o’lchamli nilpotent algebra bazislari $\{e_1, e_2, e_3\}$ bo’lgan quyidagi o’zaro izomorf bo’lmagan algebralarning biriga izomorf bo’ladi:

N_1: $e_1^2=e_2$,$e_2^2 = e_3$ N_2: $e_1^2 = e_2$, $e_2e_1 = e_3$, $e_2^2 = e_3$

N_3: $e_1^2 = e_2$, $e_2e_1 = e_3$ $N_4(\alpha)$: $e_1^2 = e_2$, $e_1e_2 = e_3$, $e_2e_1 = \alpha e_3$

N_5: $e_1^2 = e_2$ N_6: $e_1^2 = e_3$, $e_2^2 = e_3$

N_7: $e_1e_2 = e_3$, $e_2e_1 = -e_3$ $N_8(\alpha)$: $e_1^2 = \alpha e_3$, $e_2e_1 = e_3$, $e_2^2 = e_3$

II.ADABIYOTLAR TAHLILI

Differensiallashning ko’plab umumlashmalari mavjud. Eng asosiy umumlashmasi bu lokal va 2-lokal umumlashmalari hisoblanadi. So’ngi yillarda ko’plab olimlar lokal va 2- lokal differensiallashlarga oid ko’plab maqolalar chop etishdi[1- 3] operator algebralarida lokal va 2-lokal differensiyalashlar nazariyasi ham muhim hisoblanadi

III.TADQIQOT METODOLOGIYASI

1-Ta’rif. Agar N algebaradan olingan ixtiyoriy x, y elementlar uchun

$$d(x \cdot y) = d(x) \cdot y + x \cdot d(y)$$

Tenglik bajarilsa d akslantirish qaralayotgan N algebrada differensiallash deb ataladi.

$d(x) = Ax$ chiziqli akslantirishni qaraylik, bu yerda A – 3×3 o’lchamli kvadrat matritsa. Ravshanki, agar $N_4(\alpha)$ algebaradan olingan ixtiyoriy x, y elementlar uchun

$$A(xy) = (Ax)y + x(Ay) \qquad (1)$$

tenglik bajarilsa $d(x) = Ax$ akslantirish qaralayotgan $N_4(\alpha)$ algebrada differensiallashdan iborat bo’ladi.

ISSN 3030-3907

R haqiqiy sonlar maydoni ustida aniqlangan $\{e_1, e_2, e_3\}$ bazisli nilpotent algebra $N_4(\alpha)$ berilgan. Bu algebrada ko‘paytirish jadvali quyidagicha aniqlanadi:

$$e_1^2 = e_2, e_1e_2 = e_3, e_2e_1 = \alpha e_3$$

$N_4(\alpha)$ algebrada ihtiyoriy x vektorni

$$x = x_1e_1 + x_2e_2 + x_3e_3$$

ko‘rinishda yozishmumkin. $d : N_4(\alpha) \to N_4(\alpha)$ akslantirishni qaraylik.

1-tarifga ko‘ra $d(x) = Ax$ chiziqli akslantirishni qaraylik, bu yerda A – 3×3 o‘lchamli kvadrat matritsa. Ravshanki, agar $N_4(\alpha)$ algebaradan olingan ixtiyoriy x, y elementlar uchun

$$A(xy) = (Ax)y + x(Ay)$$

Tenglik bajarilsa $d(x) = Ax$ akslantirish qaralayotgan $N_4(\alpha)$ algebrada differensiallashdan iborat bo‘ladi.

1-Teorema. $d(x) = Ax$ akslantirish $N_4(\alpha)$ algebrada differensiallashdan iborat bo‘lishi uchun A matritsa

$$A = \begin{pmatrix} a_{1,1} & 0 & 0 \\ a_{2,1} & 2a_{1,1} & 0 \\ a_{3,1} & (\alpha+1)a_{2,1} & 3a_{1,1} \end{pmatrix} \qquad (5)$$

ko‘rinishda bo‘lishi zarur va yetarli.

Isbot. Zarurligi. $d(x) = Ax$ akslantirish $N_4(\alpha)$ algebrada differensiallashdan iborat bo‘sin. U holda

$$A = \begin{pmatrix} a_{1,1} & a_{1,2} & a_{1,3} \\ a_{2,1} & a_{2,2} & a_{2,3} \\ a_{3,1} & a_{3,2} & a_{3,3} \end{pmatrix}$$

Matritsa ixtiyoriy x, y vektorlar uchun (1) tenglikni qanoatlantirishi kerak.

Xususan $e_1e_1 = e_2$ tenglikdan foydalanib quyidagi ayniyatni

$$(Ae_1)e_1 + e_1(Ae_1) = A(e_2)$$

qaraylik:

$$Ae_1 = \begin{pmatrix} a_{1,1} & a_{1,2} & a_{1,3} \\ a_{2,1} & a_{2,2} & a_{2,3} \\ a_{3,1} & a_{3,2} & a_{3,3} \end{pmatrix} \begin{pmatrix} 1 \\ 0 \\ 0 \end{pmatrix} = \begin{pmatrix} a_{11} \\ a_{21} \\ a_{3,1} \end{pmatrix} = a_{1,1}e_1 + a_{2,1}e_2 + a_{3,1}e_3$$

$$Ae_2 = \begin{pmatrix} a_{1,1} & a_{1,2} & a_{1,3} \\ a_{2,1} & a_{2,2} & a_{2,3} \\ a_{3,1} & a_{3,2} & a_{3,3} \end{pmatrix} \begin{pmatrix} 0 \\ 1 \\ 0 \end{pmatrix} = \begin{pmatrix} a_{1,2} \\ a_{2,2} \\ a_{3,2} \end{pmatrix} = a_{1,2}e_1 + a_{2,2}e_2 + a_{3,2}e_3$$

$$(Ae_1)e_1 = (a_{1,1}e_1 + a_{2,1}e_2 + a_{3,1}e_3)e_1 = a_{1,1}e_2 + \alpha a_{2,1}e_3$$

$$e_1(Ae_1) = e_1(a_{1,1}e_1 + a_{2,1}e_2 + a_{3,1}e_3) = a_{1,1}e_2 + a_{2,1}e_3$$

$$a_{1,1}e_2 + \alpha a_{2,1}e_3 + a_{1,1}e_2 + a_{2,1}e_3 = a_{1,2}e_1 + a_{2,2}e_2 + a_{3,2}e_3$$

$$2a_{1,1}e_2 + (\alpha+1)a_{2,1}e_3 = a_{1,2}e_1 + a_{2,2}e_2 + a_{3,2}e_3$$

bundan

$$a_{2,2} = 2a_{1,1} \ , \quad a_{1,2} = 0 \ , \quad a_{3,2} = (\alpha+1)a_{2,1}$$

ISSN 3030-3907

$$Ae_2 = 2a_{1,1}e_2 + (\alpha+1)a_{2,1}e_3$$

tengliklarni aniqlaymiz.

Endi $e_1e_2 = e_3$ tenglikdan foydalanib quyidagi ayniyatni

$$(Ae_1)e_2 + e_1(Ae_2) = A(e_3)$$

qaraylik:

$$(Ae_1)e_2 = (a_{1,1}e_1 + a_{2,1}e_2 + a_{3,1}e_3)e_2 = a_{1,1}e_3$$

$$e_1(Ae_2) = e_1\left(2a_{1,1}e_2 + (\alpha+1)a_{2,1}e_3\right) = 2a_{1,1}e_3$$

$$a_{1,1}e_3 + 2a_{1,1}e_3 = a_{1,3}e_1 + a_{2,3}e_2 + a_{3,3}e_3$$

bundan

$$a_{1,3} = 0\,, \qquad a_{2,3} = 0, \qquad a_{3,3} = 3a_{1,1}\,, \quad Ae_3 = 3a_{1,1}e_3$$

tengliklarni aniqlaymiz.

Endi $e_1e_3 = 0$ tenglikdan foydalanib quyidagi ayniyatni

$$(Ae_1)e_3 + e_1(Ae_3) = A(0)$$

qaraylik:

$$(Ae_1)e_3 = \left(a_{1,1}e_1 + a_{2,1}e_2 + a_{3,1}e_3\right)e_3 = 0$$

$$e_1(Ae_3) = e_1 3a_{1,1}e_3 = 0$$

$$0 = 0$$

bo‘ldi.

Endi $e_2e_1 = \alpha e_3$ tenglikdan foydalanib quyidagi ayniyatni

$$(Ae_2)e_1 + e_2(Ae_1) = A(\alpha e_3)$$

qaraylik:

$$(Ae_2)e_1 = (2a_{1,1}e_2 + (\alpha+1)a_{2,1}e_3)e_1 = 2\alpha a_{1,1}e_3$$

$$e_2(Ae_1) = e_2\left(a_{1,1}e_1 + a_{2,1}e_2 + a_{3,1}e_3\right) = \alpha a_{1,1}e_3$$

$$2\alpha a_{1,1}e_3 + \alpha a_{1,1}e_3 = 3\alpha a_{1,1}e_3$$

$$3\alpha a_{1,1}e_3 = 3\alpha a_{1,1}e_3$$

bundan

$$3\alpha a_{1,1} = 3\alpha a_{1,1}$$

bo‘ladi

Endi $e_2e_2 = 0$ tenglikdan foydalanib quyidagi ayniyatni

$$(Ae_2)e_2 + e_2(Ae_2) = A(0)$$

qaraylik:

$$(Ae_2)e_2 = (2a_{1,1}e_2 + (\alpha+1)a_{2,1}e_3)e_2 = 0$$

ISSN 3030-3907

$$e_2(Ae_2) = e_2(2a_{1,1}e_2 + (\alpha+1)a_{2,1}e_3) = 0$$
$$0 = 0$$

bo‘ladi

Endi $e_2e_3 = 0$ tenglikdan foydalanib quyidagi ayniyatni

$$(Ae_2)e_3 + e_2(Ae_3) = A(0)$$

qaraylik:

$$(Ae_2)e_3 = (2a_{1,1}e_2 + (\alpha+1)a_{2,1}e_3)e_3 = 0$$
$$e_2(Ae_3) = e_2 3a_{1,1}e_3 = 0$$
$$0 = 0$$

bo‘ladi.

Endi $e_3e_1 = 0$ tenglikdan foydalanib quyidagi ayniyatni

$$(Ae_3)e_1 + e_3(Ae_1) = A(0)$$

qaraylik:

$$(Ae_3)e_1 = 3a_{1,1}e_3e_1 = 0$$
$$e_3(Ae_1) = e_3(a_{1,1}e_1 + a_{2,1}e_2 + a_{3,1}e_3) = 0$$
$$0 = 0$$

bo‘ladi.

Endi $e_3e_2 = 0$ tenglikdan foydalanib quyidagi ayniyatni

$$(Ae_3)e_2 + e_3(Ae_2) = A(0)$$

qaraylik:

$$(Ae_3)e_2 = 3a_{1,1}e_3e_2 = 0$$
$$e_3(Ae_2) = e_3(2a_{1,1}e_2 + (\alpha+1)a_{2,1}e_3) = 0$$
$$0 = 0$$

bo‘ladi.

Endi $e_3e_3 = 0$ tenglikdan foydalanib quyidagi ayniyatni

$$(Ae_3)e_3 + e_3(Ae_3) = A(0)$$

qaraylik:

$$(Ae_3)e_3 = 3a_{1,1}e_3e_3 = 0 \quad , \quad e_3(Ae_3) = e_3 3a_{1,1}e_3 = 0$$
$$0 = 0$$

bo‘ladi.

Yetarliligi. Endi A matritsa (5) ko‘rinishda bo‘lsa $d(x) = Ax$ chiziqli akslantirish differensiallashdan iboratligini ko‘rsataylik.

$$xy = (x_1e_1 + x_2e_2 + x_3e_3)(y_1e_1 + y_2e_2 + y_3e_3) =$$
$$= x_1y_1e_2 + (x_1y_2 + \alpha x_2y_1)e_3$$

tenglikka ko‘ra

ISSN 3030-3907

$$A(xy) = \begin{pmatrix} a_{1,1} & 0 & 0 \\ a_{2,1} & 2a_{1,1} & 0 \\ a_{3,1} & (\alpha+1)a_{2,1} & 3a_{1,1} \end{pmatrix} \begin{pmatrix} 0 \\ x_1y_1 \\ x_1y_2 + \alpha x_2y_1 \end{pmatrix} =$$

$$2a_{1,1}x_1y_1e_2 + ((\alpha+1)a_{2,1}x_1y_1 + 3a_{1,1}(x_1y_2 + \alpha x_2y_1))e_3$$

boshqa tamondan

$$Ax = \begin{pmatrix} a_{1,1} & 0 & 0 \\ a_{2,1} & 2a_{1,1} & 0 \\ a_{3,1} & (\alpha+1)a_{2,1} & 3a_{1,1} \end{pmatrix} \begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = a_{1,1}x_1e_1 + (a_{2,1}x_1 + 2a_{1,1}x_2)e_2 +$$

$$(a_{3,1}x_1 + (\alpha+1)a_{2,1}x_2 + 3a_{1,1}x_3)e_3$$

$$(Ax)y = (a_{1,1}x_1e_1 + (a_{2,1}x_1 + 2a_{1,1}x_2)e_2 +$$

$$(a_{3,1}x_1 + (\alpha+1)a_{2,1}x_2 + 3a_{1,1}x_3)e_3)(y_1e_1 + y_2e_2 + y_3e_3) =$$

$$a_{1,1}x_1y_1e_2 + (a_{1,1}x_1y_2 + \alpha(a_{2,1}x_1 + 2a_{1,1}x_2)y_1)e_3$$

$$Ay = \begin{pmatrix} a_{1,1} & 0 & 0 \\ a_{2,1} & 2a_{1,1} & 0 \\ a_{3,1} & (\alpha+1)a_{2,1} & 3a_{1,1} \end{pmatrix} \begin{pmatrix} y_1 \\ y_2 \\ y_3 \end{pmatrix} = a_{1,1}y_1e_1 + (a_{2,1}y_1 + 2a_{1,1}y_2)e_2 +$$

$$(a_{3,1}y_1 + (\alpha+1)a_{2,1}y_2 + 3a_{1,1}y_3)e_3$$

$$x(Ay) = (x_1e_1 + x_2e_2 + x_3e_3)(a_{1,1}y_1e_1 + (a_{2,1}y_1 + 2a_{1,1}y_2)e_2 +$$

$$(a_{3,1}y_1 + (\alpha+1)a_{2,1}y_2 + 3a_{1,1}y_3)e_3) =$$

$$a_{1,1}x_1y_1e_2 + ((a_{2,1}y_1 + 2a_{1,1}y_2)x_1 + \alpha a_{1,1}x_2y_1)e_3$$

Yuqoridagi xisoblashlar (5) tenglik to‘g‘riligini ko‘rsatadi.

Teorema isbotlandi.

Endi biz lokal differensiallashni ko‘rib chiqamiz.

2-Teorema. Agar Δ matritsasi pastki uchburchak shaklda bo‘lsa, $N_4(\alpha)$ dagi Δ chiziqli akslantirish lokal differensiallash bo`ladi.

Isboti. Δ- $N_4(\alpha)$ bo‘yicha ixtiyoriy lokal differensiallash bo‘lsin va Δ matritsasi

$$A = \begin{pmatrix} b_{11} & b_{12} & b_{13} \\ b_{21} & b_{22} & b_{23} \\ b_{31} & b_{32} & b_{33} \end{pmatrix}$$

bo‘lsin. Barcha $x = x_1e_1 + x_2e_2 + x_3e_3$ uchun ta’rifga ko‘ra $N_4(\alpha)$ ustida A differensiallash mavjudki

$$\Delta(x) = A_x\,(x)$$

tenglik o`rinli.

2-teoremaga ko`ra $A_x$ differensiallash quyidagi ko`rinishga ega bo`lsin

ISSN 3030-3907

$$A_x = \begin{pmatrix} \beta_x & 0 & 0 \\ \gamma_x & 2\beta_x & 0 \\ \delta_x & (\alpha+1)\gamma_x & 3\beta_x \end{pmatrix}$$

$x = e_1, x = e_2, x = e_3$ larni tanlab va $\Delta(x) = A_x(x)$ tenglikdan foydalanib, ya`ni $A\bar{x} = A_x\bar{x}$ ga ko`ra $b_{12} = b_{13} = b_{23} = 0$ natijaga ega bo`lamiz. Bu yerda $\bar{x} - x$ ga mos vektor. Bundan A matritsa

$$A = \begin{pmatrix} b_{11} & 0 & 0 \\ b_{21} & b_{22} & 0 \\ b_{31} & b_{32} & b_{33} \end{pmatrix}$$

ko`rinishga keladi.

Yana $\nabla(x) = A_x(x)$ dan foydalanib, ya'ni $A\bar{x} = A_x\bar{x}$ ga ko`ra

$$\begin{pmatrix} b_{11} & 0 & 0 \\ b_{21} & b_{22} & 0 \\ b_{31} & b_{32} & b_{33} \end{pmatrix}\begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix} = \begin{pmatrix} \beta_x & 0 & 0 \\ \gamma_x & 2\beta_x & 0 \\ \delta_x & (\alpha+1)\gamma_x & 3\beta_x \end{pmatrix}\begin{pmatrix} x_1 \\ x_2 \\ x_3 \end{pmatrix}$$

Tenglamalar sistemasiga ega bo`lamiz.

$$\begin{cases} \beta_x x_1 = b_{1,1}x_1 \\ \gamma_x x_1 + 2\beta_x x_2 = b_{2,1}x_1 + b_{2,2}x_2 \\ \delta_x x_1 + (\alpha+1)\gamma_x x_2 + 3\beta_x x_3 = b_{3,1}x_1 + b_{3,2}x_2 + b_{3,3}x_3 \end{cases}$$

Agar $x_1 \neq 0$ bo‘lsa

$$\beta_x = b_{1,1}$$

$$\gamma_x = b_{2,1} + (b_{2,2} - 2\beta_x)\frac{x_2}{x_1}$$

$$\delta_x = b_{3,1} + (b_{3,2} - (\alpha+1)\gamma_x)\frac{x_2}{x_1} + (b_{3,3} - 3\beta_x)\frac{x_3}{x_1}$$

Agar $x_1 = 0,\ x_2 \neq 0$ bo‘lsa,

$$2\beta_x = b_{2,2},$$

$$(\alpha+1)\gamma_x = b_{3,2} + (b_{3,3} - 3\beta_x)\frac{x_3}{x_1}$$

Agar $x_1 = x_2 = 0,\ x_3 \neq 0$ bo‘lsa,

$$3\beta_x = b_{3,3}.$$

Teorema isbotlandi.

Endi 2-lokal differensiallashini bayon etamiz.

ISSN 3030-3907

2-Ta'rif. Akslantirish (chiziqli bo'lishi shart bo'lmagan) $\nabla: A \to A$ 2-lokal differensiallshlari deyiladi, agar har qanday $x, y \in A$ elementlar uchun shunday $\nabla_{x,y}: A \to A$ differensiallshlari mavjud bo'lsaki,

$$\nabla(x) = A_{x,y}(x), \nabla(y) = A_{x,y}(y).$$

3-Teorema. $N_4(\alpha)$ algebraning har bir 2-lokal differensiallashi differensiallashdir.

Isbot. Aytaylik ∇–bu $N_4(\alpha)$ ning ixtiyoriy 2-lokal differensiallashlari bo'lsin.

U holda, 2-tarifga ko'ra har bir $x \in N_4(\alpha)$ element uchun,

$$x = x_1 e_1 + x_2 e_2 + x_3 e_3,$$

$\beta_{x,e_1}, \gamma_{x,e_1}, \delta_{x,e_1}$ shunday elelemt mavjudki

$$A_{x,e_1} = \begin{pmatrix} \beta_{x,e_1} & 0 & 0 \\ \gamma_{x,e_1} & 2\beta_{x,e_1} & 0 \\ \delta_{x,e_1} & (\alpha+1)\gamma_{x,e_1} & 3\beta_{x,e_1} \end{pmatrix},$$

$\nabla(x) = A_{x,e_1}\bar{x}$, bu yerda $\bar{x} = (x_1, x_2, x_3)^T$–$x$ ga mos vektor va

$$\nabla(e_1) = A_{x,e_1}\overline{e_1} = (\beta_{x,e_1}, \gamma_{x,e_1}, \delta_{x,e_1})^T.$$

Tengliklar $\nabla(e_1) = A_{x,e_1}(e_1) = A_{y,e_1}(e_1)$o'rinli bo'lgani uchun

$$\nabla(e_1) = (\beta_{x,e_1}, \gamma_{x,e_1}, \delta_{x,e_1})^T =$$

$$= (\beta_{y,e_1}, \gamma_{y,e_1}, \delta_{y,e_1})^T$$

$N_4(\alpha)$ dagi elementlarning har bir x, y juftligi uchun.

Shunday qilib,

$$\beta_{x,e_1} = \beta_{y,e_1}, \gamma_{x,e_1} = \gamma_{y,e_1}, \delta_{x,e_1} = \delta_{y,e_1}.$$

Shuning uchun

$$\nabla(x) = A_{y,e_1}\bar{x}$$

Har qanday $x \in N_4(\alpha)$uchun va $\nabla(x)$ matritsasi x ga bog'liq emas.

SHunday qilib, 3-teoremaga ko'ra, ∇ differensiallashdir.

ISSN 3030-3907

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INNOVATSION GIBRID BURG‘ILARNING TEXNOLOGIK TUZILISHI VA AFZALLIKLARINI ASOSLASH.

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Annotatsiya. Maqolada neft va gaz sanoatining asosiy ustuni bo‘lgan neft va gaz quduqlarini samarali burg‘ilash, ularni o‘z vaqtida ishga tushirish va burg‘ilash jarayonida avaraiyalarni oldini olish, burg‘ilash sanoati jihoz uskunalarni rivojlantirish, burg‘ilarning zamonaviy va innovasion ishlanmalarni yaratish va ushbu zamonaviy burg‘ilar orqali quduqlarni kam vaqt, eng tejamkor va samarali burg‘ilash imkoniyatlarini oshirish bo‘yicha takliflar berilgan.

Kalit so‘zlar: gibrid burg‘i, PDC burg‘i, innovasion ishlanmalar, burg‘ilash sanoati, tog‘ jinslari, yangi texnologiyalar, burg‘ilash texnologiyasi.

Аннотация. В статье речь идет об эффективном бурении нефтяных и газовых скважин, которое является основной опорой нефтегазовой отрасли, их эксплуатации и предотвращении аварий в процессе бурения, развитии бурового оборудования, современных и инновационных разработках буровых установок. В предложение по созданию и увеличению возможностей бурения скважин с помощью этих современных долот в короткие сроки, наиболее экономичным и эффективным способом.

Ключевые слова: гибридное долото, долото PDC, инновационные разработки, буровая отрасль, горные породы, новые технологии, технология бурения.

Annotation. The article deals with the effective drilling of oil and gas wells, which is the main support of the oil and gas industry, their operation and prevention of accidents during the drilling process, the development of drilling equipment, modern and innovative developments of drilling rigs. The proposal is to create and increase the ability to drill wells using these modern bits in a short time, in the most economical and efficient way.

Key words: hybrid bit, PDC bit, innovative developments, drilling industry, rocks, new technologies, drilling technology.

Kirish

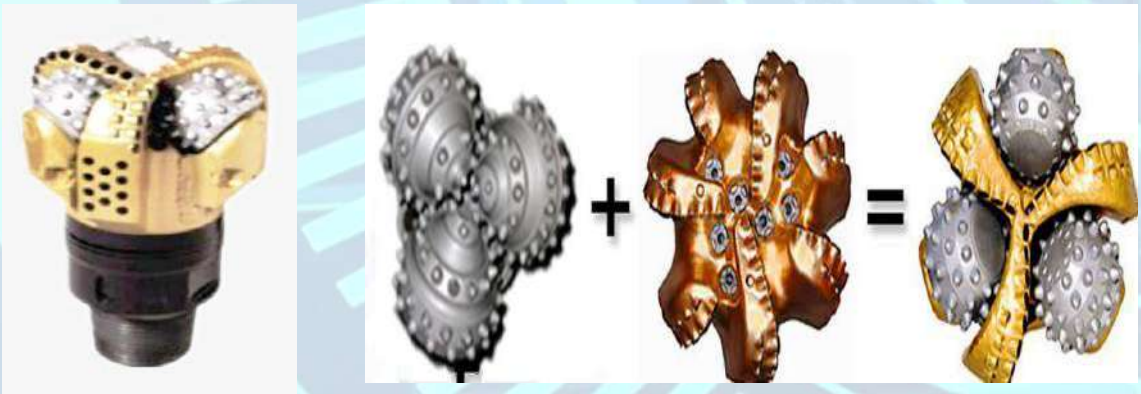
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Neft va gaz mahsulotlarining jadallik bilan ortib borishi hozirgi sharoitlarda xalq xo`jaligi tarmoqlarining rivojlanishiga turtki beradi. Neft va gaz konlarini izlab topish, o`zlashtirish, tarqalish qonuniyatlarini, zahiralarini, kelajakdagi istiqbollarini aniqlashda burg`ilash sohasining o`rni beqiyosdir.

Jahon iqtisodiyotining rivojlanish sur'atlari kishilik jamiyatining barcha soha va jabhalarida neft va gaz mahsulotlariga yuqori talablarni keltirib chiqaryapti, ayniqsa texnologiyalarni global rivojlanishi natijasida keng avj olayotgan resurslar yetishmasligi vujudga kelyapti. Bunga barham berishning asosiy omillaridan biri sifatida yangi neft va gaz konlarini izlab toppish, quduqlarni samarali va sifatli burg`ilash, quduqlarni halokatlarsiz o`zlashtirish hisoblanadi. Yangi konlarni izlab toppish va ularni o`zlashtirish jarayonini uzluksiz takomillashtirish davr talabiga aylanmoqda. [1].

Respublikamizning xalq xo‘jaligining neftga bo‘lgan yuqori talabi mavjudligi sharoitida neft va gaz resurslarini qazib chiqarish xalq xo‘jaligining to‘liq qondirish uchun yangi konlarni izlab topish, ularni o`zlashtirish xozirgi kunning dolzarb va ustuvor vazivasi bo`lib hisoblanadi. Quduqlarni izlab topishda va ularni o`zlashtirishda xozirgi kunda eng kerakli bo`lgan jihoz va uskunalardan biri bu burg`ilar hisoblanadi. Amalda burg`ilarning bir necha turlari mavjud bo`lib xozirgi vaqtda jahon burg`ilash amaliyotida mavjud bo`lgan zamonaviy va innovatsion burg`ilardan eng mukammali hisoblanuvchi gibdrid burg`ilardir. [2].

***Gibrid PDC burg`i*** - bu sharoshkali burg`i va PDC burg`ining afzalliklarini umumlashtirilgan burg`i hisoblanadi. Gibrid burg`i uch sharoshkali burg`i va PDC burg`ining afzalliklarini birlashtiradi, u allaqachon ko'p marta sinovdan o'tgan bo`lib va u qattiq tog` jinslarini burg`ilashda eng yaxshi ko`rsatkichlarga ega bo`lgan zamonaviy innovatsion burg`i hisoblanadi.



1 – rasm. Gibrid burg`ilarning tuzilishi.

Bu turdagi sharoshkali va PDC turdagi olmos burg`ining umumlashtirilishidan hosil qilingan. Yangi mahsulotlar, yangi texnologiyalar, Xitoyda ishlab chiqarish qiymati yuqori bo‘lgan keng ko‘lamli burg`ilardir. Gibrid burg`ilar yordamida qattiq va yumshoq, qumoq qatlamlardan iborat bo`lgan har xil

ISSN 3030-3907

tuzilishdagi murakkab qatlamlarni burg`ilab o`tishda ularni yer yuzasiga chiqarib, almashtirishni oldini oladi, bu esa bir muncha vaqt, energiya ishchi kuchi va sarf xarajatni oldini oladi.

Ushbu gibrid burg`ilar haqida qisqacha ma`lumot 1 – jadvalda berilgan.

1 – jadval

Jihozning nomi	**PDC gibrid burg`ilar**
Material turi	Import qilingan PDC keskichi va yuqori sifatli po'lat
Qo`llanilishi	Neft va gaz quduqlarini burg`ilash
Ishlatilishi	Quduqni burg'ilash
O`lchamlari	8 1/2 9 1/2 (2 ta sharoshka va 2 keskich)
	12 1/2 va 17 1/2 (3 ta sharoshka va 3 keskich)



2 – rasm. Gibrid burg`ilarning ko`rinishlari.

Baker Hughes kompaniyasining gibrid burg'ilash texnologiyasi eng murakkab sharoitlarda burg'ilash vaqtini va tushirish – ko`tarish ishlarini qisqartirish uchun sharoshkali va polikristal olmosli ixcham (PDC) qattiq burg`ilarni yagona, patentlangan konstruksiyasini birlashtiradi. Sharoshkali burg`ilarining mustahkamligi va barqarorligi, shuningdek, olmos burg`ilarning keskirligi va uzluksiz ishlashi natijasida burg`ilab o`tish tezligini oshiradi, ushbu texnologiya quduq tubini shlamdan tozalashni oshiradi. [1].

***Sharoshkali burg`ilarga nisbatan burg`ilab o`tish yuqori potentsial tezligi.*** Sharoshkali burg`ilar bilan solishtirganda, gibrid burg`iga og'irlikni kamaytirish va burg`ining sakrashini minimallashtirish orqali burg`ilashni mexanik tezligini oshirish mumkin. [4].

PDC bilan solishtirganda optimallashtirilgan burg'ilash dinamikasi.

ISSN 3030-3907

PDC bilan solishtirganda, gibrid burg`ilar alohida murakkab qatlamlarni burg'ilashda sezilarli darajada bardoshli va samaralidir. Ular sirpanishni kamaytiradi va burg'ilash momentini boshqarishni osonlashtiradi, uni yanada izchil qiladi, turli qatlamlar orqali silliq burg`ilab o'tishni ta'minlaydi. Takomillashtirilgan barqarorlik va yo‘nalishni boshqarish ishonchli vertikal boshqaruvni, shuningdek, qiyalangan uchastkalarda yuqori burg`ilab o`tishini tezligi ta`minlaydi.

“Baker Hughes” an’anaviy burg`ilar uchun murakkab sharoitlarda qo‘llanish sohasini kengaytirish va yuqori ishlab chiqaruvchilikni ta’minlash maqsadida gibrid burg‘ilash burg`ilar texnologiyasini rivojlantirishda davom etadi. **“**Baker Hughes” gibrid burg'ulash uchlari an'anaviy burg'ulash uchlari uchun tasdiqlangan o'rnini egallab, tezroq va ishonchli burg'ulash ko`rsatkichlarini ta'minlaydi. [7].

Kymera™ Mach 5 gibrid burg`ining texnik xususiyatlari.

Kymera™ Mach 5 gibrid burg'ilar quduq uzunligini sodda qiya qismlardan kombinatsiyalangan uchastkalarigacha uzaytiradi, bu operatsiyalar, sharoshkali burg`ini polikristalli olmos kompaktli (PDC) burg`ilar bilan almashtirishlar sonini kamaytirish imkonini beradi. Kymera Mach 5 turidagi burg`i qiya yo`nalishda burg`ilash orqali samaradorlikni oshiradi. [8].

Samaradorlikni oshirish – Kymera Mach 5 gibrid konstruktsiyali aniq muvozanatlangan kuraklar soni va sharoshkani optimallashtirishni o'z ichiga oladi, bu esa isbotlangan ish faoliyatini samaradorligini bosqichma-bosqich o'zgartirishga olib keladi. Kuraklar sonining ko'payishiv barqarorlikni yanada yaxshilaydi, bu esa yeyilishga qarshi turish uchun biroz tajovuzkor bo'ladi. Chuqur kesgichlar olmos hajmini oshiradi, bu esa burg`ini ushlab turish va burg'ilash masofasini uzaytirish uchun chidamlilikni yaxshilaydi. O‘tkir, zich sharoshka jamlanmalari qo‘shimcha ravishda burg`ilab o`tish tezligini yaxshilash imkonini beradi. Burg`i turlariga burg‘ilash tezligi va samaradorligini oshirish uchun qiyin burg‘ilash sharoitida yuqori yuklanishlarga mo‘ljallangan burg`ilar sifatida maxsus tanlangan Dynamus™ burg`ilari, StayTrue™ shakllantirilgan olmos elementlari texnologiyasi va ikki burchakli Stabilis™ frezerlari kiradi. [1].

Burg`ilarni almashtirishiga ta’sir etuvchi omillar.

Asboblarni tushirish va ko’tarish vaqti $T_{T.K} = 7200\,s,$ burg`ining har 900 sekunda kovlashi $h_1 = 5;\ h_2 = 4;\ h_3 = 3;\ h_4 = 2{,}5;\ h_5 = 2;\ h_7 = 1;\ h_8 = 0{,}3;$ metr bo’lganda quduqni 1000 metrga burg’ilash uchun burg`ilarni almashtirishning zaruriyati quyidagicha aniqlanadi. Burg`i ishning maksimal samaradorligini olish uchun reysli tezlikga $V_p$ mo`ljal qilinadi. [10]. U quyidagicha ifodalanadi:

$$T_{T.K} = t_n = t_g + t_c.$$

ISSN 3030-3907

Ayrim oraliq vaqtlar uchun reysli tezlik quyidagi fomula bo'yicha aniqlanadi:

$$V_{pi} = \frac{\sum h_i}{\sum t_{\delta.i} + T_{t.k}},$$

Bu yerda $\sum h_i = \sum t_{\delta.i}$ burg'ilash vaqtida dolota kovlashining yig'indisi. Keyin, birinchi 900 sekund burg'ilashning reysli tezligi aniqlanadi. [5].

$$V_{pi} = \frac{h_1}{t_{\delta 1} + T_{mк}} = \frac{5}{0{,}25 + 2} = 2{,}22 m/soat$$

1800, 2700, 3600 sekundlar uchun reysli tezlik quyidagicha aniqlanadi:

$$V_{p_2} = \frac{5+4}{0{,}5+2} = 3{,}6 m/soat$$

$$V_{p_3} = \frac{5+4}{0{,}75+2} = 4{,}6 m/soat$$

$$V_{p_4} = \frac{5+4+3+2{,}5}{1+2} = 4{,}38 m/soat$$

$$V_{p_5} = \frac{5+4+3+2{,}5+2}{1+2} = 5 m/soat$$

$$V_{p_6} = \frac{5+4+3+2{,}5+2+1{,}5}{1+2} = 5{,}46 m/soat$$

$$V_{p_7} = \frac{5+4+3+2{,}5+2+1{,}5+1}{1{,}75+2} = 5{,}46 m/soat$$

$$V_{p_8} = \frac{5+4+3+2{,}5+2+1{,}5+1+0{,}5}{2+2} = 4{,}81 m/soat$$

$$V_{p_9} = \frac{5+4+3+2{,}5+2+1{,}5+1+0{,}5+0{,}3}{2{,}25+2} = 4{,}6 m/soat$$

Hisoblardan ko'rinib turibdiki $V_{p\max} = V_{p_6} = 5{,}46 m/soat$ bo'lganda burg`ini ko'tarish kerak bo'ladi. [8]. Bunda burg`ini kovlash yig'indisi quyidagini tashkil qiladi:

$$\sum h_i = 5+4+3+2{,}5+2+1{,}5 = 18 m;$$

Keyin burg`ining quduq tubida umumiy ishlash vaqti topiladi:

$$\sum t_\delta = 6 + 0{,}25 = 1{,}5 s,$$

Tushirish – ko'tarish vaqtini hisobga olganda:

$$\sum t_\delta = T_{t.k} = 1{,}5 + 2 soat = 3{,}5 soat,$$

Agar $V_{p_9} = 4{,}46 m/soat$ bo'lganda burg`i ko'tarilsa, unda kovlashning yig'indisi quyidagini tashkil qiladi:

$$\sum h_i = 5+4+3+2{,}5+2+1{,}5+1+0{,}5+0{,}3 = 19{,}8 m;$$

ISSN 3030-3907

Umumiy vaqt:

$$\sum t_{\delta} = 9 \cdot 0{,}25 = 2{,}25 soat = 8100\, s,$$

Tushirish – ko'taish vaqtini hisobga olganda:

$$4{,}25 - 3{,}5 = 0{,}75 soat = 2700\, s\ ,$$

Shunday qilib vaqtlarning farqi quyidagini tashkil qiladi:

$$4{,}25 - 3{,}5 = 0{,}75 soat = 2700\, s$$

Bu vaqtda yangi burg`i bilan yana 5+4+3=12 m kovlash mumkin.

Birinchi holatda ikki burg`ining 15300 sekundda kovlash yig'indisi $18 + 12 = 30 m$ ikkinchi holatda esa 19,8 m ni tashkil qiladi. [6].

Bunda samaradorlik 30-19,8=10,2 mni tashkil qiladi.

Ushbu masala orqali gibrid burg`ilarning boshqa turdagi burg`ilardan afzalligini ko`ramiz. [10].

Xulosa

Maxsus turdagi burg'ilar bilan burg'ilangan quduqlarni qayta burg'ilash, kengaytirish, yon devorlarni tiklash va quvurlarni o'rnatish, olmosli burg'ilar, turbobur va rotor usullarda tik va qiya yo'nalgan quduqlarni burg'ilash, qumoq, dolomit, ohaktosh va boshqa o`ta qattiq jinslarni burg'ilash, hozirgi paytda qo'llaniladigan olmosli burg'ilarni ishlab chiqarilishi haqidagi ma'lumotlar, maxsus mo'ljallangan burg'ilarni qo`llashni taqozo etadi. Quduqlarni burg`ilash sohasida ma`lumki, bitta maxsus turdagi burg`i yigirmadan ortiq sharoshkali burg`ini o`rnini bosadi. Bunda nafaqat burg`ilarning tannarxidan balki energiyadan, yoqilg`idan, texnika va texnologiyalarni ortiqcha ishlatishdan, ishchi kuchi, moylash materiallari va vaqtdan samarali foydalanish imkonini beradi.

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MAYDA IFLOSLIKLARDAN TOZALAYDIGAN LABORATORIYA USKUNASIGA TURLI XIL TO‘RLI YUZA O‘RNATIB TAJRIBALAR O‘TKAZISH

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Annotatsiya: Maqolada paxtani mayda ifloslikdardan tozalash mashinasi va uning asosiy elementlari o‘rganilgan. Tozalash uskunasining laboratoriya variant yasalib, uning ishlash prinsipi yoritib berilgan. To‘rli yuzalar har xil o‘lchamda va shaklda tayyorlanib foydali yuzasi aniqlangan. Tadqiqot vazifalari belgilab olinib har-xil shakldagi to‘rli yuzalarni laboratoriya uskunasiga o‘rnatib tajribalar o‘tkazilgan va natijalar olingan. Paxtani tozalashda to‘rli yuza shaklining o‘zgarishi uskuna tozalash samaradorligiga, chigit shikastlanishiga hamda toladagi nuqson va iflos aralashmalar miqdoriga ta’siri tahlil qilingan. Olingan natijalar tahlil qilinib uskuna tozalash samaradorligi, tola va chigit shikastlanish darajalari davlat standartlariga mosligi o‘rganilgan.

Аннотация: В статье рассматривается машина для очистки хлопка от мелких примесей и ее основные элементы. Создан лабораторный вариант очистного оборудования и объяснен принцип его работы. Сетчатые поверхности изготавливаются различных размеров и форм, а также определяется полезная площадь поверхности. После определения целей исследования были проведены эксперименты по установке сетчатых поверхностей различной формы в лабораторное оборудование и получению результатов. Проанализировано влияние изменения формы поверхности сетки в процессе очистки хлопка на эффективность очистки оборудования, повреждение семян, а также количество дефектов и примесей в волокне. Полученные результаты анализировались с целью определения эффективности очистки оборудования и соответствия уровня повреждения волокон и семян государственным нормам.

ISSN 3030-3907

Annotation: The article studies information about a machine for cleaning cotton from small impurities and its main elements. A laboratory version of the cleaning equipment was created and its operating principle was explained. Information about mesh surfaces is provided. Mesh surfaces were prepared in various sizes and shapes, and the useful surface area was determined. The research tasks were determined, experiments were conducted by installing mesh surfaces of various shapes on laboratory equipment, and the results were obtained. The effect of changing the shape of the mesh surface during cotton cleaning on the cleaning efficiency of the equipment, damage to the grain, and the amount of defects and impurities in the fiber was analyzed. The results obtained were analyzed and the compliance of the cleaning efficiency of the equipment, the levels of fiber and grain damage with state standards was studied. The results obtained were analyzed and it was recognized that the cleaning efficiency increased.

Kalit so‘zlar: paxta, tozalash, tola, to‘rli yuza, qoziqli baraban, samaradorlik, mayda ifloslik, nuqson, chigit, iflos aralashma, nav, arrali jin.

Ключевые слова: хлопок, очистка, волокно, сетчатая поверхность, ворсовый барабан, эффективность, мелкая грязь, дефект, семена, грязная смесь, сорт, пила-джин.

Keywords: cotton, clean, fiber, mesh surfacye, pile drums, efficiyency, cotton, cleaning, fiber, mesh surface, pile drum, efficiency, small contaminants, defect, seed, dirty mixture, grade, saw gin.

Kirish

Mustaqillik yillarida respublikamizda paxta mahsulotining iste’mol xususiyatlarini yaxshilanishiga olib keladigan, paxtani dastlabki ishlash texnologik jarayonlarini va ishlab chiqarishning yuqori samaradorlikka ega, boshqarish tizimlarini yaratishga oid bo‘lgan keng qamrovli chora-tadbirlar amalga oshirilgan. Bu borada, jumladan, paxta tozalash korxonalarida boshlang‘ich ko‘rsatkichlariga bog‘liq ravishda qayta ishlanayotgan xom-ashyodan belgilangan sifatli paxta mahsulotini olish, paxtani mayda iflosliklardan tozalash texnikasi hamda texnologiyasini takomillashtirish bo‘yicha sezilarli natijalarga erishilmoqda. Shu bilan birga paxta tozalash samaradorligini va ishlab chiqarish unumdorligini pastligi dolzarb masala bo‘lib kelmoqda [1].

ADABIYOTLAR TAHLILI. Paxtaning tarkibidan mayda iflosliklarni ajratib olish, asosan qoziqli baraban va to‘rli yuza yordamida amalga oshiriladi [2].

Qurilmaning asosiy kamchiligi shuki, paxta xom ashyosini mayda iflosliklardan tozalash jarayoni asosan qo‘zg‘almas to‘rli yuza va qoziqli barabanda amalga oshirilganligi sababli paxtaning shikastlanish darajasi ortib ketishi va ish unumdorligining pastligidir [3].

ISSN 3030-3907

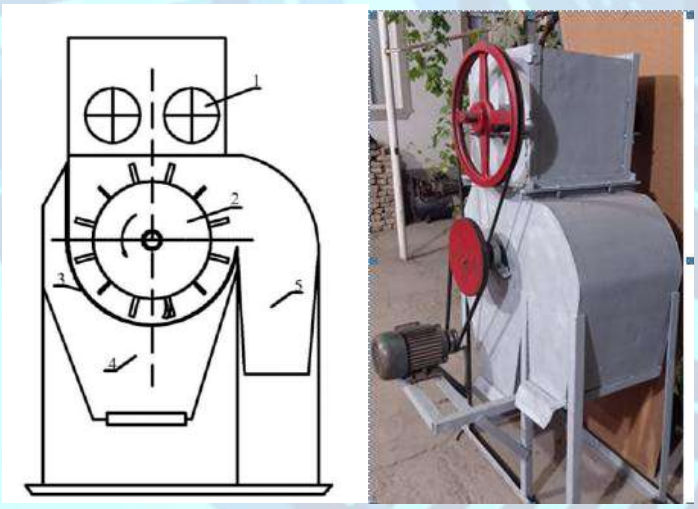
TADQIQOT METODOLOGIYASI. Taklif etilayotgan paxta tarkibidagi mayda iflosliklarni tozalash uskunasini takomillashtirilgan elastik qoziqchali baraban bilan chizmalari tayyorlandi hamda ushbu chizmalar asosida laboratoriya qurilmasi ishlab chiqildi. Elastik qoziqchali plankali baraban takomillashtirilgan tozalagich korpusida joylashgan taminlovchi valiklar 1 yordamida paxta elastik qoziqli-plankali baraban 2 ga o‘tkaziladi, ular yordamida paxta to‘rli yuza 3 dan sidirib olib o‘tilishi natijasida xomashyo tarkibidan mayda iflosliklarni ajratib olish jarayoni amalga oshiriladi. Paxta xomashyosi tarkibidan ajratilgan iflosliklar 4 ifloslik bunkeriga, tozalangan xomashyo esa tozalangan paxta bunkeri 5 ga tushadi.

Tozalash uskunasining laboratoriya nusxasida ishchi qismlarning, qoziqchali-plankali baraban geometrik o‘lchamlari, ta’minlovchi valiklar shakli, tezliklari va qoziqchali-plankali barabanlar bilan to‘rli yuza orasidagi masofa, to‘rli yuza shaklini turli o‘lchamlarda tayyorlanganligi tozalash samaradorligiga ta’siri tajribada aniqlandi [4].

Tajriba o‘tkazish uskunasining umumiy ko‘rinishi 3.2-rasmda keltirilgan.

Taklif etilayotgan paxtadan mayda ifloslarni tozalash laboratoriya uskunasining eni 400 mm ga, balandligi 1700 mm ga, ta’minlovchi valiklar bilan qoziqchali-plankali baraban o‘qlari oraliq masofasi 300 mm ga, qoziqchali-plankali barabanlar va to‘rli yuza oraliq masofasi 14-18 mm ga teng.

Tajriba uskunasi quyidagicha ishlaydi: bir-biriga qarab aylanuvchi ta’minlovchi valiklar 1 paxtani qoziqchali-plankali baraban 2 ga uzatib beradi. Qoziqchali-plankali baraban paxtani to‘rli yuza 3 sirtida titib-sudrab tashishda paxtadan mayda iflosliklarni ajratib, tozalash jarayonini amalga oshiradi. Paxtadan ajratilgan iflosliklar to‘rli yuza teshiklari oraqali ifloslik bunkeri 4 ga tushadi. Tozalangan paxta chiqish bo‘g‘izi 5 orqali paxta bunkeriga yig‘iladi [5].



1-rasm.Tajriba o‘tkazish uskunasining umumiy ko‘rinishi

1-ta’minlovchi valiklar, 2- qoziqchali-plankali baraban,

ISSN 3030-3907

3-to‘rli yuza, 4-ifloslik bunkeri, 5-tozalangan paxta chiqish bo‘g‘izi.

Tajribalar quyidagi variantlarda olib borildi:

– qoziqchali-plankali barabanlarda mavjud tozalash texnologik jarayonida;

– mavjud qoziqchali-plankali barabanning aylanishlar sonini o‘zgartirmagan holda va taklif etilayotgan texnologik jarayonda;

–mavjud to‘rli yuzani o‘zgartirmagan holda va taklif etilayotgan to‘rli yuza shakli o‘rnatilgan texnologik jarayonda;

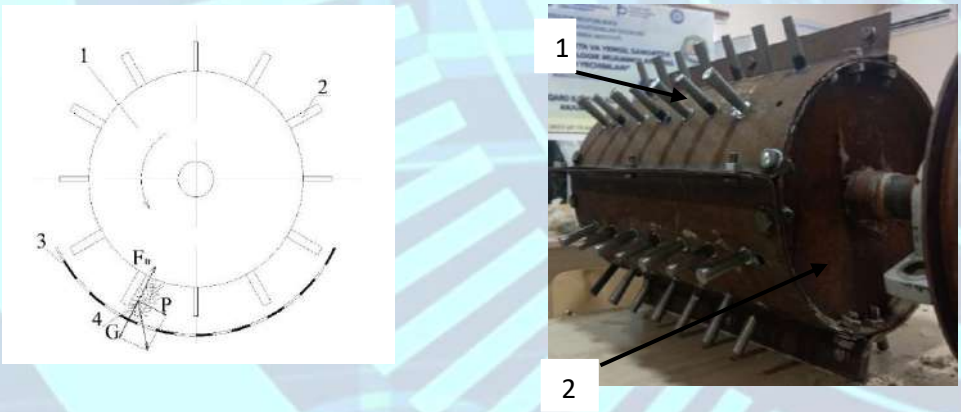
–to‘rli yuza shakli va o‘lchamlarining paxta xomashyosiga ta’siri, texnologik jarayonida;

–to‘rli yuza teshiklarining o‘lchami, to‘rli yuza bilan qoziqchali-plankali baraban orasidagi 14-18 mm masofani, uskuna tozalash samaradorligiga ta’siri. Har bir tajriba 8 marotaba takrorlandi va erishilgan natijalarning o‘rtacha qiymatlari olindi.

MUHOKAMA VA NATIJALAR. Namunalar tozalagichdan oldin va keyin olindi. Har bir olingan paxta namunalarini namligi, iflosligi aniqlandi. Tadqiqot ishlari davrida to‘rli yuzaning foydali yuzasi, to‘rli yuzalarning paxta xomashyosiga ta’siri o‘rganib borildi. Tajriba davrida olingan namuna tahlillari “Tabiiy tolalar va matoga ishlov berish texnologiyasi” kafedrasi laboratoriyasida O‘zDst 632:2016, O‘zDSt 644:2006, O‘zDSt 592:2018 davlat standartlarida keltirilgan metodikalar asosida bajarildi [6].

Quyidagi 3.3 va 3.4- rasmlarda mavjud va taklif etilayotgan to‘rli yuzalar ko‘ndalang kesim sxemasi va umumiy ko‘rinishi keltirilgan.

Dastlab tozalash uskunalarida mavjud bo‘lgan qoziqchali-plankali barabanning 400 mm uzunlikdagi, 400 mm diametrdagi laboratoriya nusxasi tayyorlanib tajribalar o‘tkazildi (1- rasm). Tajriba natijalari 1- jadvalda keltirilgan.



2-rasm Paxtani mayda iflosliklardan tozalash uskunasini mavjud qoziqchali-plankali barabanining sxemasi va umumiy ko‘rinishi 1-qoziqchali-plankali baraban, 2-qoziqchalar, 3-to‘rli yuza, 4-paxta bo‘lakchasi.

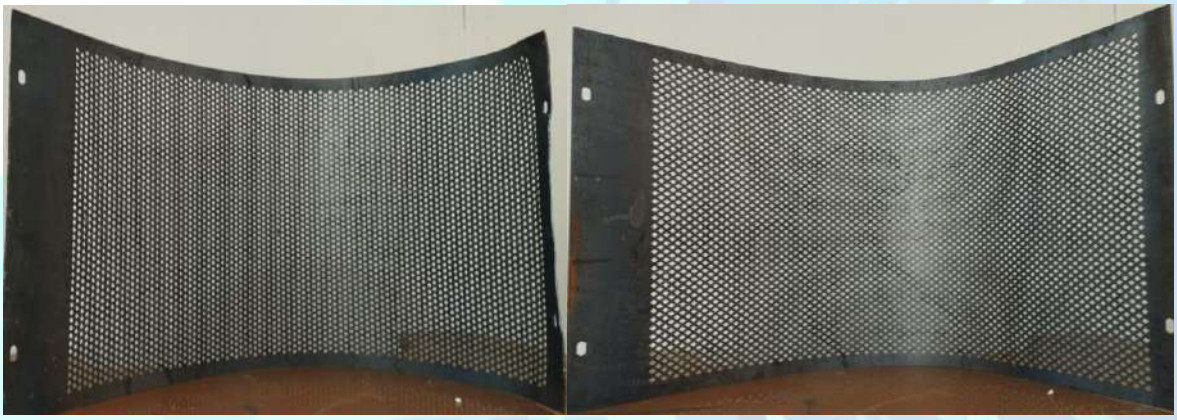
ISSN 3030-3907

Mavjud qoziqchali-plankali baraban va to‘rli yuza o‘rnatilgan laboratoriya uskunasida natijalar olingandan so‘ng, to‘rli yuza shakli va o‘lchamlari o‘zgartirilib laboratoriya sharoitida tajribalar o‘tkazildi (2-rasm). Tajriba natijalari 1-jadvalda qayd etilgan.

3- rasmdagi to‘rli yuzalar har xil o‘lchamda qilib tayyorlandi.



6x50 6x6



Tomonlari 6 mm bo‘lgan ko‘pburchak oraliq masofasi 6 mm bo‘lgan romb

3-rasm. Taklif etilayotgan paxtani mayda iflosliklardan tozalash uskunasi to‘rli yuzalari

Taqqoslash tajriba-tadqiqot ishlari Ravnaq seleksiyali paxtaning I/1 va Sulton seleksiyali paxtaning II/2 sanoat navlarida olib borildi.

Tajriba- tadqiqot ishlari belgilangan metodik uslubiyat asosida o‘tkazildi.

Ma’lumki, paxta tarkibidan mayda iflosliklarni ajratib olishning yangi texnologiyasi oldingilaridan konstruktiv afzalliklari bilan farq qiladi.

Mayda iflosliklarni ajratish uskunasi qoziqchalarini geometrik o‘lchamlarini tanlashda qoziqchaning diametri va to‘rli yuza orasidagi masofaning hamda to‘rli yuza o‘lchamlarining har xil qiymatlarida tajriba o‘tkazildi. Tozalash uskunasidagi takomillashtirilgan to‘rli yuza va unda paxta xarakatining tola va chigit shikastlanishiga ta’sirini o‘rganish maqsadida, to‘rli yuza shakli va o‘lchami,

ISSN 3030-3907

qoziqcha uchi hamda va to‘rli yuza orasidagi masofalarni hisobga olgan holda tanlab olindi.

1-jadval

Qoziqchali-plankali barabanlarga ega bo‘lgan laboratoriya uskunasida o‘tkazilgan sinov ishining natijalari.

t/r	Ko‘rsatkichlar	Birligi	Qoziqli- plankali barabanlar	
			mavjud	taklif etilgan
1	Paxtaning - seleksiyasi - navi - sinfi		 Ravnaq I 2	 Ravnaq I 2
2	Paxtani uskunadan oldingi -namligi - iflosligi	 % %	 9,2 6	 9,2 6
3	Paxtani uskunadan keyingi -namligi - iflosligi	 % %	 9,2 2,4	 9,2 2,2
4	Uskunaning tozalash samaradorligi	%	42,2	46,7
5	Uskunaning ish unumdorligi	kg/soat	7075	7075
6	Tola tozalagichdan keyingi toladagi nuqsondor tola va iflos aralashmalarning massaviy ulushi	%	2,24	1,96
7	Jindan keyingi chigitning -tukdorligi - shikastlanganligi	 % %	 10,9 3,44	 10,5 3,15



a) b) c)

4-pasm. Tozalangan paxtadan ajralgan mayda iflosliklar va tozalangan paxta ko‘rinishi.

ISSN 3030-3907

a) tozalanmagan paxta ko‘rinishi; b) tozalangan paxta ko‘rinishi; c) ajratilgan mayda iflosliklar

Avval mavjud to‘rli yuza o‘rnatilib tajriba o‘tkazildi. Bunda namligi 9,2 % ga, iflosligi o‘rtacha 6 % ga teng bo‘lgan Ravnaq seleksiyali I-sanoat navli paxta uskunada tozalanganda, uskunadan keyingi paxtaning iflosligi o‘rtacha 2,4 % ga teng bo‘lib, uskunaning tozalash samaradorligi o‘rtacha 42,2 % ni tashkil qildi. Uskunani ish unumdorligi xronometraj usulida aniqlanganda o‘rtacha 7075 kg/soatga teng bo‘ldi. Tozalangan paxta tarkibidagi tola sifatini aniqlash uchun paxta laboratoriyadagi 10 arrali jinda jinlandi, so‘ngra laboratoriyadagi tola tozalagichda tozalandi. Tozalangan tolani sifatini aniqlash uchun namunalar 8 marta takroriy olinib, tahlil qilindi va o‘rtachasi olindi. Bunda tola tozalagichdan keyingi toladagi nuqsondor tola va iflos aralashmalarning massaviy ulushi o‘rtacha 1,95 % ni tashkil etib, sifat ko‘rsatkichi davlat standarti O‘zDst 632:2016 bo‘yicha I-nav “Oliy” sinfga mansubligi aniqlandi.

Paxta tarkibidagi chigitning sifatini aniqlash uchun jindan keyingi chigitdan namunalar olinib, laboratoriya sharoitida tahlil etildi. Bunda jindan keyingi chigitning tukdorligi o‘rtacha 10,9 % ga, shikastlanganligi o‘rtacha 3,44 % ga teng bo‘ldi. Bu ko‘rsatkich elastik qoziqchali-plankali barabanni uskunada qo‘llanilishida namligi 9,2 % ga, iflosligi o‘rtacha 6% ga teng bo‘lgan Ravnaq seleksiyali I- sanoat navli paxtani uskunada tozalashda uskunadan keyingi paxtaning iflosligi o‘rtacha 2,4 % ga teng bo‘lib, paxtani sifati mavjud barabanli uskunadan ishlab chiqarilgan paxta sifatiga qaraganda o‘rtacha 0,2 (abs) % ga yaxshilandi (3.7- rasm). Paxtani tozalashda uskunaning tozalash samaradorligi o‘rtacha 45 % ni tashkil etib, mavjud barabanli uskuna tozalash samaradorligiga qaraganda o‘rtacha 2,8 (abs) % ga yuqori ekanligi aniqlandi. Bunda uskunani ish unumdorligi o‘rtacha 7075 kg/soatga teng bo‘lib, tajriba uchun olingan mavjud to‘rli yuzaga qaraganda uskunaning tozalash samaradorligi o‘rtacha 3% ga yaxshilanganligi aniqlandi.

XULOSA VA TAKLIFLAR. Tozalangan paxtadagi tolaning sifatini aniqlash uchun avval paxta 20 arrali jinda jinlandi. Bunda jindan keyingi chigitning tukdorligi o‘rtacha 10,5 % ga teng bo‘lib, chigit tukdorlik darajasi 0,4 (abs)% ga kamaydi. Chigit shikastlanganligi o‘rtacha 3,15 % ga teng bo‘lib, mavjud tozalagichdan ishlab chiqarilgan paxtani jinlashdan olingan chigit shikastlanganligiga qaraganda o‘rtacha 0,29 (abs)% ga kamayib, chigit sifati yaxshilandi.

Paxtani jinlashdan ishlab chiqarilgan tola jin patrubogi orqali tola tozalagichga uzatilib, tozalandi. Tozalangan toladagi nuqsondor tola va iflos aralashmalarning massaviy ulushi o‘rtacha 1,96 % ni tashkil etib, sifatining 0,38

ISSN 3030-3907

(abs) % ga yaxshilanganligidan davlat standarti O‘zDst 632:2016 bo‘yicha II- nav “Oliy” sinfga mansubligi aniqlandi.

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SEPARATION OF SOUR COMPONENTS FROM FLARE GASES IN ABSORPTION PURIFICATION OF GASES

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Abstract. This article presents the selection of reagents for cleaning flare gases containing carbon dioxide and hydrogen sulfide, including the study of chemisorption processes in the absorption of sour components in the gas, which is one of the urgent tasks of the "Mubarok Gas Processing" plant. The composition of flare gases, their physicochemical properties, and the results of experimental work on obtaining ammonium carbonate and ammonium sulfide solutions from sour components are presented.

Keywords: sour component, flare gas, utilization, CO_2, H_2S, chemisorption, sodium carbonate, sodium sulfide, absorber, ammonium carbonate, ammonium sulfide, gas, absorbent.

Аннотация. В данной статье представлен подбор реагентов для очистки факельных газов, содержащих углекислый газ и сероводород, включая изучение процессов хемосорбции при поглощении кислых компонентов в газе, что является одной из актуальных задач газоперерабатывающего завода "Мубарок". Представлены состав факельных газов, их физико-химические свойства, а также результаты экспериментальных работ по получению растворов карбоната и сульфида аммония из кислых компонентов.

Ключевые слова: высокосернистый компонент, факельный газ, утилизация, CO2, H2S, хемосорбция, карбонат натрия, сульфид натрия, поглотитель, карбонат аммония, сульфид аммония, газ, абсорбент.

Annotatsiya. Ushbu maqolada karbonat angidrid va vodorod sulfidini o'z ichiga olgan alangali gazlarni tozalash uchun reagentlarni tanlash, shu jumladan "muborak gazni qayta ishlash" zavodining dolzarb vazifalaridan biri bo'lgan gazdagi nordon komponentlarning so'rilishidagi kimyosorbsiya jarayonlarini o'rganish keltirilgan. Olovli gazlarning tarkibi, ularning fizik-kimyoviy xususiyatlari va nordon tarkibiy qismlardan ammoniy karbonat va ammoniy sulfid eritmalarini olish bo'yicha eksperimental ishlarning natijalari keltirilgan.

Kalit so'zlar: nordon komponent, olovli gaz, utilizatsiya, CO2, H2S, xemisorbsiya, natriy karbonat, natriy sulfid, absorber, ammoniy karbonat, ammoniy sulfid, gaz, changni yutish.

ISSN 3030-3907

Introduction

In the world, certain scientific and practical results are being achieved in the modernization of the gas processing industry, the creation of new reserves of absorbents, the development of technologies for the production of import-substituting products based on them, in particular, the development of competitive products and the use of gas processing industry flare gases containing sour components in the purification processes. In this regard, the search for opportunities to obtain ammonium carbonate, ammonium and sulfide sodium carbonate, sodium sulfide solutions as a result of the absorption of sour components (CO_2 and H_2S) in flare gases by absorbents is of great importance.

The annual amount of toxic gases released into the atmosphere during the flaring of gas from the Muborak Gas Processing Plant has been determined. According to calculations, if the flare gas is not utilized, more than 30 million m^3 of toxic gases are released into the atmosphere per year.

When examining the quantity and composition of products formed during the separation of CO_2 and H_2S from flare gases, flare gas containing 93.85% mol of sour components was separated from the "Muborak Gas Processing" plant in the presence of alkaline absorbents, and the composition of the purified gas was determined using a Kristallux gas chromatograph.

Table 1

Composition of flare gases purified at Unit 7 of the Mubarak Gas Processing Plant

№	Components	Amount, mole %
1	Methane	91,61
2	Ethan	4,02
3	Propane	1,64
4	*i-Bhutan*	0,17
5	*n-Butane*	0,15
6	CO_2	0,60
7	Nitrogen	1,80
Total:		**100**

The object was selected by examining the composition of flare gases at the “Mubarak Gas Processing” plant (Table 1). The properties of the reagents used in the research, their purity and preparation of solutions, qualitative and quantitative methods for determining the composition of products, methods for calculating the concentrations of flare gases released into the environment, methods for determining the composition and properties of flare gases using the “Gas Chromatography” method are presented. Two types of flare gas samples from units

ISSN 3030-3907

7 and 10 of the “Mubarak Gas Processing” plant, which are discharged into the flare system, are presented.

Table 2

Properties of flare gases from the Mubarak Gas Processing Plant

№	Indicators		Component composition, % mol												Molar weight of gas	Gas density, *kg/m³*
	P, *kgf/sm²*	T, °C	C_1	C_2	C_3	*i*-C_4	*n*-C_4	*i*-C_5	*n*-C_5	C_{6+V}	$\sum C_{5+V}$	CO_2	H_2S	N_2		
Block 7 of the Mubarak Gas Processing Plant	3,9	40	1,04	0	0	0	0	0	0	0	0	96,5	2,21	0,25	43,41	1,937
Block 10 of the Mubarak Gas Processing Plant	3,1	42	0,85	0	0	0	0	0	0	0	0	95,6	3,10	0,21	43,42	1,938

According to the results of the analysis in Table 2, flare gases from units 7 and 10 of the Muborak Gas Processing Plant were selected as the object because they contain the highest levels of CO_2 and H_2S.

The effect of various factors on the chemisorption process with solutions of CO_2 and H_2S contained in flare gas was studied, and a laboratory device for the separation of CO_2 and H_2S from flare gases and its material balance were constructed.

ISSN 3030-3907

This laboratory device performs the two-stage chemisorption process of flare gas.

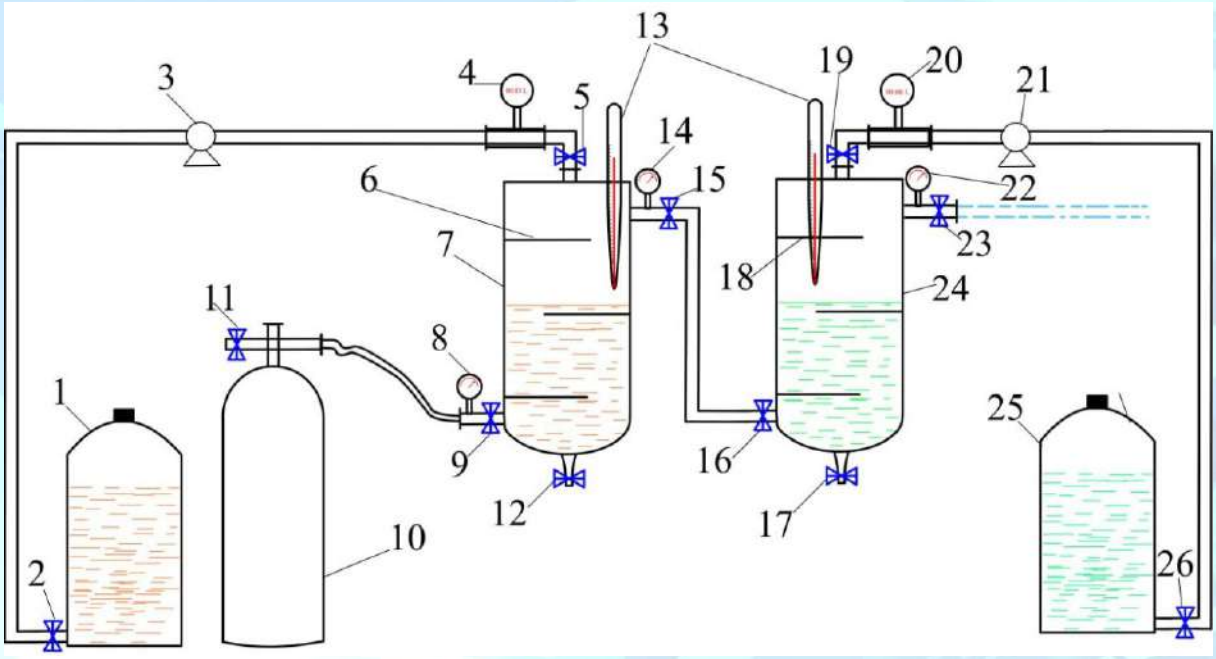


Figure 1. Laboratory device for separating acidic components from flare gases and obtaining sulfide and carbonate salt solutions

1-capacity for storing an aqueous solution of ammonium hydroxide; 3,21 - pump; 4,20 - flow meter; 2,5,9,11,12,15,16,17,19,23, 26 - crane; 6,18 - barrier; 7,24 - absorber; 8,14,22 - monometer; 10 - capacity for torch gas; 13 - thermometer; 25 - capacity for storing an aqueous solution of sodium hydroxide.

Research method. In this, the CO_2 and H_2S components in the flare gas were separated to obtain an ammonium carbonate and ammonium sulfide solution. According to the chromatographic analysis of the obtained solution, the CO_2 content was reduced from 68.60% to 32.4% and the H_2S content from 24.24% to 21.36% using a 20-25% NH_4OH solution, and its composition is presented in Table 3.

Table 3

Gas composition obtained from the cleaning of flare gases with NH4OH

№	Components	Torch gas		Gas purified with NH_4OH solution	
		% mol	% mass.	% mol	% mass
1	Methane	5,73	2,30	43,83	23,95
2	Ethan	0,19	0,14	1,45	1,48
3	Propane	0,10	0,11	0,76	1,14
4	*i*-buthan	0,01	0,015	0,08	0,16
5	*n*-butane	0,01	0,015	0,08	0,16
6	CO_2	68,60	76,7	32,4	47,48

ISSN 3030-3907

7	H_2S	21,25	20,64	21,36	24,8
8	Nitrogen	0,11	0,08	0,84	0,83
Molecular mass, *kg/kmol*		39,95		29,27	
Density, *kg/m*^{3}		1,783		1,307	

The maximum value of the absorption level of CO_2 and H_2S components contained in the flare gas into an aqueous solution of NH_4OH with a concentration of 20-30% was achieved.

Research was conducted based on the dependence of the pressure and temperature indicators in the absorber on the flare gas emitted from the Muborak Gas Processing Plant when taking each sample of ammonium carbonate and ammonium sulfide solution ($(NH_4)_2CO_2$ and $(NH_4)_2S$).

Table 4

The rate of absorption of CO_2 in flare gas by NH_4OH

The pressure in the absorber device, *kgf/sm*^{2}	Temperature in the absorber device, °C	CO_2 absorption rate by the absorbent, %				
		$(NH_4)_2CO_3$-1 (CO_2:NH_4OH) 1:1,5-1,7	$(NH_4)_2CO_3$-2 (CO_2:NH_4OH) 2,0:2,5	$(NH_4)_2CO_3$-3 (CO_2:NH_4OH) 1:2,5-2,8	$(NH_4)_2CO_3$-4 (CO_2:NH_4OH) 3:3,5	$(NH_4)_2CO_3$-5 (CO_2:NH_4OH) 1:3,5-3,8
4,7	28	24,6	28,7	32,7	31,8	30,3
5,2	30	25,8	29,6	33,6	32,8	31,1
5,7	33	27,5	30,4	35,2	33,5	32,3
6,2	36	30,2	33,5	37,9	35,7	34,1
6,5	39	29,3	30,1	36,2	33,8	32,5

The maximum value of the CO_2 absorption degree of the flare gas by the absorbent was 38.01% of CO_2 as a result of chemisorption of a sample with a molar ratio of $(NH_4)2CO3$-3 (CO2:NH4OH) 1:(2.4-2.45) at a pressure of 6.2 *kgf/cm*^{2} and a temperature of 36 °C. We can see in Table 4 that 37.9% of the CO2 in the flare gas was absorbed by a solution with a molar ratio of 2.5-2.8 NH_4OH as a result of chemisorption at a pressure of 6.2 *kgf/cm*^{2} and a temperature of 36 °C.

As a result of chemisorption of the sample of $(NH_4)_2CO_3$ and $(NH_4)_2S$-3(H_2S:NH_4OH) in a molar ratio of 1:2.3-2.6 in Table 5 at a pressure of 5.5 *kgf/cm*^{2} and a temperature of 35 °C, the maximum value of the absorption level of H_2S in the flare gas by the absorbent was 2.90 % H_2S.

ISSN 3030-3907

Table 5

The degree of absorption of H_2S in flare gas into NH_4OH

Working pressure in the absorber *kgf/sm²*	Working temperature in the absorber °C	The degree of absorption of H2S by the absorbent, %				
		$(NH_4)_2S$-1 (H_2S:NH_4OH) 1:1,5-1,7	$(NH_4)_2S$-2 (H_2S:NH_4OH) 1:2-2,3	$(NH_4)_2S$-3 (H_2S:NH_4OH) 1:2,3-2,6	$(NH_4)_2S$-4 (H_2S:NH_4OH) 1:2,7-2,9	$(NH_4)_2S$-5 (H_2S:NH_4OH) 1:3-3,5
5	27	1,58	1,66	1,67	1,64	1,63
5,5	30	2,44	2,38	2,71	2,72	2,55
5,0	33	2,65	2,56	2,83	2,76	2,75
5,5	35	2,75	2,76	2,90	2,84	2,81
6,0	38	2,84	2,85	2,84	2,81	2,70

Based on the absorption rates of CO_2 and H_2S components in the flare gas, it can be concluded that when the molar ratio of CO_2 and H_2S and NH_3 in the flare gas with a concentration of 20-25% is (CO_2 and H_2S:NH_3H_2O=1:2.5-2.6), and when the chemisorption process is carried out in the absorber under a pressure of 5.5 *kgf/cm²*, the absorption rate of CO_2 and H_2S in the flare gas with an absorbent was 37.90% CO_2 and 2.90% H_2S, which gave the highest rate.

Using the laboratory device shown in Figure 1, research was conducted to obtain a solution of sodium carbonate and sodium sulfide with the aim of maximum absorption of CO_2 and H_2S components in the flare gas, as a result. According to Table 6, the content of CO_2 in the initial purified flare gas in chromatographic analyses was reduced from 32.14% to 0.57%, and complete absorption of H_2S was achieved using a 10-12% solution of NaOH.

Table 6

Composition of the initial purified gas before and after purification with NaOH

№	Components	Initial purified gas		Gas purified with NaOH solution	
		% mol	% mass.	% mol	% mass.
1	Methane	42,81	24,95	91,63	84,18
2	Ethan	1,48	1,98	3,07	6,3
3	Propane	0,73	1,64	2,61	4,10
4	*i-butane*	0,07	0,14	0,14	0,54

ISSN 3030-3907

5	*n-butane*	0,07	0,14	0,14	0,54
6	CO_2	32,14	45,48	0,57	1,69
7	H_2S	21,30	24,8	0	0
8	Nitrogen	0,84	0,83	1,80	2,66
Molecular mass, *kg/kmol*		30,25		17,3	
Density, kg/m^3		1,277		0,781	

To determine the maximum value of the absorption rate of CO_2 and H_2S contained in flare gas into a 10-12% aqueous solution of NaOH, research was conducted on the dependence of the amount of absorbent selected, the operating pressure and temperature in the absorber.

As a result of chemisorption of Na_2CO_2 and Na_2S - 3 samples at a pressure of 5 kgf/cm^2 and a temperature of 35 °C in a molar ratio of 10-12% concentration of CO_2 and H_2S components of the flare gas at a temperature of 35 °C, it can be seen that the maximum value of the absorption level of CO_2 and H_2S in the initially purified flare gas by the absorbent was from 32.3% to 0.57% of CO_2 and the complete absorption level of H_2S.

Table 7

The rate of CO_2 absorption in the flare gas using NaOH

Working pressure in the absorber, kgf/sm^2	The working temperature in the absorber, °C	CO_2 absorption rate by the absorbent, %				
		Na_2CO_3 - 1 (CO_2:NaOH) 1:1,7-1,9	Na_2CO_3 - 2 (CO_2:NaOH) 1:2-2,5	Na_2CO_3 - 3 (CO_2:NaOH) 1:2,3-2,7	Na_2CO_3 - 4 (CO_2:NaOH) 1:2,6-2,9	Na_2CO_3 - 5 (CO_2:NaOH) 1:2,8-3
3,4	27	25,67	26,04	26,42	26,31	26,76
3,9	29	26,44	27,11	27,11	27,94	27,87
4,2	33	27,27	28,07	27,39	28,34	28,02
4,9	35	28,45	29,39	32,3	30,93	28,57
5,4	38	29,7	30,41	31,12	29,56	29,02

The dependence of the degree of absorption of H_2S in the flare gas on the absorbent on the working pressure in the absorber, temperature, and the amount of absorbent in the sodium carbonate and sodium sulfide solution samples is presented in Table 8.

ISSN 3030-3907

Table 8

The rate of H_2S absorption in flare gas using NaOH

Working pressure in the absorber *kgf/sm²*	Working temperature in the absorbert °C	The degree of absorption of H2S by the absorbent, %				
		Na_2S - 1 (H_2S:NaOH) 1:1.6-1.9	Na_2S - 2 (H_2S:NaOH) 1:1.7-1)	Na_2S - 3 (H_2S:NaOH) 1:2,2-2,5)	Na_2S - 4 (H_2S:NaOH 1:2.0-3.0)	Na_2S - 5 (H_2S:NaOH) 1:2.5-3.0
3,7	27	16,1	15,1	16,2	16,1	15,2
4,1	29	17,2	16,9	17,2	16,8	16,4
4,6	32	18,6	17,5	18,6	17,4	17,5
5,1	35	19,7	19,4	20,4	19,9	19,7
5,6	39	19,3	18,9	19,9	18,8	19,1

In this Table 8, the chemisorption of the Na_2S - 3 sample at a pressure of 5.1 *kgf/cm²* and a temperature of 35 °C resulted in complete absorption of the H_2S contained in the initial purified flare gas onto the absorbent.

Based on the indicators of the absorption rate of CO_2 and H_2S in the flare gas by the absorbent, it can be concluded that when the CO_2 and H_2S components in the flare gas are in a molar ratio of 10-12% concentrated aqueous solution of NaOH (Na_2CO_3 and Na_2S:NaOH=1:2.3-2.7), and when the chemisorption process is carried out in the absorber at a pressure of 5.1 *kgf/cm²* and a temperature of 35 °C, when taking a sample of Na_2CO_3 and Na_2S-3, the absorption rate of CO_2 and H_2S in the flare gas by the absorbent is 32.3% of CO_2 and H_2S are completely absorbed. According to the results of the study, it was determined that by separating CO_2 and H_2S from 30 million *m³* of flare gas per year, 10,202.7 *m³* of clean gas can be obtained per year.

Conclusion. It was found that flare gas from power units 7 and 10 of the Mubarek Gas Processing Plant emits more than 30 million m3 of toxic gases into the atmosphere per year. It was revealed that in flare gas containing 91% acid gases purified using alkaline solutions by chemisorption, their content in pure gas decreased to 0.57%.l

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7. “Muborak gazni qayta ishlash” zavodi reglamenti

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TEACHING FRENCH GRAMMAR CREATIVELY: STRATEGIES FOR FLE CLASSROOMS

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Abstract: This article is devoted to the study of creative and effective methods of teaching French grammar in FLE classes. Traditional grammatical approaches often lead to boredom and loss of motivation in students. The study presents practical examples of learning grammar through text and their application in oral speech. The article also provides practical recommendations for FLE teachers.

Keywords: Morphological, syntactic and phonetic rules, traditional methodology, deductive and analytical approach, logical analysis, linguistic aspects.

Аннотация: Данная статья посвящена изучению креативных и эффективных методов преподавания французской грамматики на уроках английского языка. Традиционные грамматические подходы часто приводят к скуке и потере мотивации у учащихся. В исследовании представлены практические примеры изучения грамматики с помощью текста и их применения в устной речи. В статье также приведены практические рекомендации для преподавателей английского языка.

Ключевые слова: морфологические, синтаксические и фонетические правила, традиционная методология, дедуктивно-аналитический подход, логический анализ, лингвистические аспекты.

Annotatsiya. ushbu maqola FLE darslarida frantsuz grammatikasini o'qitishning ijodiy va samarali usullarini o'rganishga bag'ishlangan. An'anaviy grammatik yondashuvlar ko'pincha o'quvchilarda zerikish va motivatsiyani yo'qotishga olib keladi. Tadqiqotda grammatikani matn orqali o'rganish va ularni og'zaki nutqda qo'llashning amaliy misollari keltirilgan. Maqolada FLE o'qituvchilari uchun amaliy tavsiyalar ham berilgan.

Kalit so'zlar: morfologik, sintaktik va fonetik qoidalar, an'anaviy metodologiya, deduktiv va analitik yondashuv, mantiqiy tahlil, lingvistik jihatlar.

Introduction

Grammar acquisition is an essential step toward mastering a foreign language. It is the starting point for language proficiency. French grammar is characterized by its difficulty. To achieve this, teachers must do their utmost to help their learners acquire grammatical competence. This task is not easy. Therefore, teachers must use specific teaching methods to ensure the acquisition of this skill. The acquisition of grammatical competence is crucial for any learner

ISSN 3030-3907

wishing to learn a given language. This competence allows the learner to access other skills. For many experts in language teaching, there is no language without grammar. For Kerrouzi and Fari, grammatical competence allows the learner to develop written expression. (2017: 35) In an article entitled "Grammar" and "Representations" in the Language Classroom: The Case of Algerian High School Students, the author states that according to a survey conducted with learners, they are fully aware of the need to correctly manipulate grammatical structures in order to master the French language. (Bouthiba, 2018: 35). According to Anatole, grammar constitutes: "Not only fundamental processes of thought, transferable from one subject to another, but also encompasses all social, cognitive, affective, cultural, and psychomotor interactions between the learner and the reality around them". (p. 2). According to Fougerouse, for teachers, grammar is the most important linguistic component in the language classroom, ahead of vocabulary, civilization, and even phonetics. (2: 2001).

Therefore, it is essential to understand the meaning of the word grammar. In the 2012 Petit Larousse Illustré dictionary, the word grammar is defined as: "Set of morphological, syntactic and phonetic rules, written and oral, of a language; study and description of these rules". (2012: 512). Anselmi defines grammar as a branch of linguistics that includes phonology, morphology, and syntax: "A set of rules to follow to speak and write a language correctly. This is the part of linguistics that includes phonology, morphology, and syntax (according to the definition found in a dictionary of common nouns)". (2014: 9).

According to Benlehlouh, Besse and Porquier the term grammar has three meanings: *1. A certain internal functioning characteristic of a given language, which is called internalized grammar. 2. The methodical explanation of this functioning. For the authors, this is a reflective knowledge of regularities that conform to the norms of a given language. 3. The "continued method of explanation". According to Besse and Porquier, these are theories that attempt, from a particular perspective, to highlight the functioning and internal organization of a given language (2013: 10).*

Benlehlouh (2013: 10) also mentions that R. Galisson and D. Coste identify six meanings of the term grammar:

1. Description of the general functioning of a mother tongue.
2. Description of the morphology and syntax of a natural language.
3. Discipline studying the rules of the functioning or evolution of any natural language.
4. Set of normative prescriptions playing a role in sociolinguistic discrimination.

ISSN 3030-3907

5. Formal system constructed by the linguist.

6. System internalized by the speaker-listener of a language. (Benlehlouh, 2013: 10).

According to Özçelik, the most commonly used methods for teaching grammar in language classrooms are:

- active/passive grammar.
- contextualized/decontextualized grammar.
- deductive/inductive grammar.
- implicit/explicit grammar. (2012: 5)

According to Özçelik, active grammar or production grammar includes: "The set of linguistic rules that the learner masters at a level of active competence, defined as the learner's ability to reuse linguistic or cultural elements for their own personal expression". (2012: 5). Regarding passive grammar, also called recognition grammar, Özçelik defines it as: "The set of linguistic rules mastered by the learner at a level of recognition". (2012: 5).

Contextualized grammar, for Özçelik, is grammar taught in a context that refers to a communicative situation. (2012: 5). Decontextualized grammar is one that is taught outside of any context or communicative situation, such as in artificial exercises composed of isolated sentences. (2012: 5).

For Özçelik, deductive grammar refers to grammar teaching that moves from rules to examples, unlike "Inductive grammar, which moves from examples to rules, such as when the teacher asks learners to discover a rule from a series of sentences. Application exercises correspond to a deductive phase of grammar learning". (2012: 5).

Finally, regarding implicit and explicit grammar, Özçelik makes the following observation: "Implicit grammar means grammar teaching that ignores any explanation of rules in class, which is the main method of explicit grammar". (2012: 6).

METHODS

So, first of all, it would be better to shed light on the place grammar occupies in the different methodological approaches. Methodologies are classified according to the order of their chronological appearance.

- ***Traditional Methodology***

The traditional methodology, the grammar-translation method, or the classical method, was based on translation. For grammar teaching in this methodology: "The foreign language was dissected and presented as a set of grammatical rules and exceptions, which could be compared to those of the mother tongue." (2005: 4) In the 18th century, grammar was taught deductively: "that is,

ISSN 3030-3907

by presenting the rule, then applying it to specific cases in the form of sentences and repetitive exercises." (2005: 4)

In the 19th century, a major change took place in the teaching of grammar. When studying a foreign language text, it is broken down into parts. This text is then translated word for word into the learner's mother tongue. This translation was: "the starting point for a theoretical study of grammar, which no longer occupied a prominent place in learning. Consequently, grammatical points were addressed in the order in which they appeared in the basic texts." (2005: 4)

According to Özçelik, traditional grammar textbooks, designed using a deductive and analytical approach, were based on grammatical analysis or logical analysis. (2012: 6)

- ***The Natural Method***

According to Capré, the natural method, inspired by the work of Steven Krashen, strongly asserted that to learn any foreign language, grammar is useless, even harmful. "To support this assertion, Krashen demonstrated the inhibiting effect of grammar rules his nebulous hypothesis of affective filters on the speaker who wants to express themselves in a foreign language" (2002: 1).

- ***Active Methodology***

Active methodology emerged in response to teachers' rejection of direct methodology. With this methodology, we can observe a relaxation of grammar teaching. Reasoned learning is favored. According to this learning, the learner needs to understand the reasons for phenomena. Empiricism in grammar teaching is avoided. An inductive approach is used, which prioritized morphology over syntax. (Introductory Course on Teaching French as a Foreign Language in a Syrian Context, University of Aleppo 2005: 9).

For Anselmi, grammar teaching has been softened with the active method. (2014: 14).

- ***The Audio-Oral Method***

For Özçelik, this method prioritizes oral expression and the grammatical structures of everyday language. He also adds that grammar no longer consists of a set of rules, but rather a list of structures: "Language structures are practiced through structural exercises focused on syntax, substitution, or transformation, followed by intensive repetition and memorization of model structures, that is, automation exercises" (2012: 7).

- ***The structural-global audiovisual methodology:***

This methodology is based on the use of images and sound. This method: "will be applied equally to the teaching of vocabulary (without resorting to translation into the native language) and to grammar teaching (without the

ISSN 3030-3907

intermediary of rules, the learner grasps the rules intuitively)". (Introductory Course on the Teaching of French as a Foreign Language in a Syrian Context, University of Aleppo, 2005: 12).

- ***The communicative approach:***

All four skills are targeted by this approach since: "everything depends on the learners' language needs. Language is conceived as an instrument of communication or social interaction. Linguistic aspects (sounds, structures, vocabulary, etc.) constitute grammatical competence, which is in reality only one component of a more comprehensive skill: communication competence". (Introductory Course on Teaching French as a Foreign Language in a Syrian Context, University of Aleppo, 2005: 12).

- ***The Action-Based Approach***

The action-based approach emerged in the mid-1990s. This approach focuses on: "Tasks to be completed within an overall project. Action must encourage interaction that stimulates the development of receptive and interactive skills." (Introductory Course in the Teaching of French as a Foreign Language in a Syrian Context, University of Aleppo, 2005: 14).

According to Özçelik: "Managing the learning process requires the selection, organization, progression, and practice of new material ranging from simple to complex. Furthermore, the communicative productivity of grammatical categories, contrastive data, authentic oral and written discourse, and the natural order of the child's acquisition of foreign language must be taken into consideration when organizing and planning grammatical progression". According to this perspective, learners can develop their grammatical competence:

"*a. inductively through exposure to new grammatical data as they appear in authentic documents,*

b. inductively by introducing new grammatical elements, categories, structures, rules, etc., into texts specifically produced to demonstrate their form, function, and meaning,

c. as in b. but also followed by formal explanations and exercises" (CEFR, 2001: 116). (2012: 10).

RESULTS AND DISCUSSION

So, in one of the schools in the Bukhara region, an experiment was conducted to teach French grammar to students who were learning the French language. In particular, they managed to make the complex process much easier by learning grammar through text and using it in oral speech. In particular, the French language has the main verbs être and avoir and they can learn a lot about their conjugation, difference, and usage from the following text:

ISSN 3030-3907

A la cafétéria universitaire

- *Claire : Salut Julien ! Tu es en forme aujourd'hui ?*
- *Julien : Salut Claire ! Oui, je suis très content. J'ai eu une bonne note à mon examen de français !*
- *Claire : Félicitations ! Tu as bien travaillé, alors. Moi, j'ai étudié, mais je pense que je n'ai pas réussi l'épreuve…*
- *Julien : Oh, ne dis pas ça ! Tu as fait beaucoup d'efforts. Tu verras, tu as sûrement réussi mieux que tu ne le crois.*
- *Claire : Merci ! Hier, je suis restée à la bibliothèque pendant trois heures. Et toi, qu'est-ce que tu as fait hier soir ?*
- *Julien : Je suis allé chez mes parents. On a dîné ensemble et ensuite, j'ai révisé un peu.*
- *Claire : Tu es très organisé, dis donc. Moi, je suis rentrée tard et j'étais trop fatiguée pour réviser.*
- *Julien : Ça arrive. L'important, c'est que tu n'as pas abandonné. D'ailleurs, tu as déjà beaucoup appris depuis le début du semestre.*
- *Claire : C'est vrai. Et toi, tu es toujours motivé. C'est inspirant!*
- *Julien : Merci Claire ! Allez, on va manger ? J'ai faim, et il est déjà midi.*
- *Claire : Bonne idée ! Et après, on se retrouve pour réviser ensemble ?*
- *Julien: Avec plaisir!*

Through this dialogue, students learned to construct sentences based on the verbs avoir and être in oral speech. Because in this text they studied the following cases of these verbs:

a) phrases used with the verb être (être en forme, être content, être motivé)

b) phrases used with avoir (avoir une bonne note, avoir faim)

c) past tense verb conjugation and negative form

- J'ai eu une bonne note

- Tu as bien travaillé

- Je n'ai pas réussi l'examen

- Tu as fait beaucoup d'efforts

- Je suis allé chez mes parents

- J'ai revisé un peu etc...

d) necessary and frequently used phrases in oral speech (salut, oui, félicitations, merci, ça arrive, l'important, d'ailleurs, c'est vrai, c'est inspirant, allez, bonne idée, avec plaisir).

In addition, students participated in a survey to express their opinions on how difficult it is to learn French grammar and whether or not it is important to learn it. Based on the results of the questionnaire, the following points can be noted:

ISSN 3030-3907

Students consider French grammar to be difficult, even very difficult. They find it difficult to master. They often confuse it with English grammar, often considering it as a source of difficulty in acquiring French grammar. They consider it as a tool for teaching/learning French. Grammar allows them to understand how the language works. Given the importance they attach to French grammar in connection with other subjects such as literature, students would like teachers to vary the exercises in order to better grasp the grammar rule in question. Regarding the method to be adopted in class to approach grammar, students prefer the teacher; they start by giving examples that allow them to deduce the grammar rule. Others then do practical exercises.

For example: ***Le pauvre enfant***

Toujours, je rentre à la maison à cinq heures. Mais aujourd'hui, il fait un jour hivernal. Un éclair aveuglant (éclatant, éblouissant) zigzague dans le ciel. Le vent souffle violemment et une pluie se met à tomber de cordes. Sur le chemin, je rencontre un pauvre petit garçon ruisselant d'eau qui tremble de froid. Il a des cheveux frisés (bouclés) et sales. Son visage est blafard (pâle). Il a très faim. Ses vêtements sont déchirés (usés) et il est nu aux pieds. J'ai pitié de lui et je décide de l'aider. Je le prends à la maison et je le présente à mes parents. Maman est fière. Mon père est content. Depuis ce jour-là, nous sommes inséparables (liés, associés), nous jouons ensemble, nous amusons ensemble. Toujours je l'aide et une vraie amitié naît entre nous.

Through this text, students can learn the present tense conjugation of various groups of verbs, first through the text, and then further enrich and strengthen their knowledge through theoretical grammar. Finally, students recognize the usefulness and necessity of grammar despite their lack of understanding.

CONCLUSION

Grammar acquisition is fundamental to mastering a foreign language. Many educationalists give grammar a very special place: "No method of teaching French can dispense with grammatical reflection, regardless of the explicit role given to grammar in the classroom. But we don't teach grammar for the sake of learning grammar, but to acquire a certain grammatical competence, to internalize a certain grammatical knowledge in order to use the language adequately". (Osmani, M. 2009: 88). This research focused on certain aspects related to the teaching and learning of grammar in FLE classrooms. Several concepts directly related to grammar were defined. Particular attention was then paid to the role of grammar in various methodological approaches. A questionnaire was then developed to gather students' opinions and perceptions regarding the teaching/learning of grammar in the classroom. Didactic proposals were formulated to facilitate learners' acquisition

ISSN 3030-3907

of French grammar. The main objective of this study is to contribute to the improvement not only of grammar teaching, but also of the teaching/learning of French in French language departments in Bukhara. Several means of improvement have been proposed, including the diversification of exercises and teaching materials, the integration of fun activities, the use of ICT, the need for specialized training for teachers to better transmit grammatical rules, the moderate use of metalanguage, as well as reading as a tool facilitating grammatical understanding.

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TECHNICAL THINKING AND ITS IMPACT ON SOCIETY

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Abstract: The article deals with the technical thinking and its impact on society. The development of technical thinking affects many aspects of our lives, from innovation in technology to our daily functioning. Technological thinking plays an important role in youth development as it fosters skills in analytical thinking, creativity, problem solving and innovation.

Key words: technical thinking, features, process, improvement, knowledge, ability, learning process, professional, life, future specialists, graduates, self-development and self-realization.

Аннотация: В статье рассматривается техническое мышление и его влияние на общество. Развитие технического мышления влияет на многие аспекты нашей жизни, от технологических инноваций до нашей повседневной деятельности. Технологическое мышление играет важную роль в развитии молодежи, поскольку оно развивает навыки аналитического мышления, креативности, решения проблем и инноваций.

Ключевые слова: техническое мышление, особенности, процесс, совершенствование, знания, способности, процесс обучения, профессионализм, жизнь, будущие специалисты, выпускники, саморазвитие и самореализация.

Annotatsiya. maqolada texnik fikrlash va uning jamiyatga ta'siri haqida so'z boradi. Texnik fikrlashning rivojlanishi hayotimizning ko'p jihatlariga, texnologiyadagi innovatsiyalardan tortib, kundalik faoliyatimizga ta'sir qiladi. Texnologik fikrlash yoshlarning rivojlanishida muhim rol o'ynaydi, chunki u analitik fikrlash, ijodkorlik, muammolarni hal qilish va innovatsiyalar ko'nikmalarini rivojlantiradi.

Kalit so'zlar: texnik fikrlash, xususiyatlar, jarayon, takomillashtirish, bilim, qobiliyat, o'quv jarayoni, kasbiy, hayot, kelajakdagi mutaxassislar, bitiruvchilar, o'z-o'zini rivojlantirish va o'zini anglash.

Introduction

Nowadays, technological progress has globally changed the lives, priorities and thinking of humankind. In the recent past, mankind dreamed of computer technologies, and today they are a necessary tool for almost every activity. And what is especially important is that the process of improvement and change of technical means, as well as of man as a person, continues.

ISSN 3030-3907

New developments not only give us new opportunities to manufacture and improve products, but also direct us to develop a new learning process. This is due to the fact that a graduate must be competent in his or her future field of activity. This means that the learning process must include the study of newly invented systems. But here the question arises, how can this be done? After all, technical progress is so fast moving forward that the knowledge acquired in the process of training becomes obsolete by the time the student enters the professional life.

The main task of modern education of a future engineer is not just the transfer of experience and knowledge in this field of activity, but the preparation of a competent specialist capable of self-development and self-realization, able to solve non-standard problems, predict the result of upcoming activities and focused on universal human values.

The thinking of a modern engineer and highly qualified workers of the 21st century is becoming significantly more complex and includes related types of thinking: logical, imaginative-intuitive, practical, scientific, aesthetic, economic, environmental, ergonomic, managerial and communicative.

Since the sphere of technical design includes environmental reflection, which considers the introduction of a technical system into the human environment, ergonomic reflection, which examines the correspondence of the technical system and human capabilities, and finally, existential reflection, which considers the technical system as a means of realizing human goals, as self-determination of human existence, then thus, the need for communication, coordination and adoption of a systemic decision is manifested.

MATERIALS AND METHODS

The possibility of multiple points of view, their free expression, the organization of understanding, reflection and criticism - these are the essential conditions of modern project culture. Thus, an engineer must have sufficiently high communication skills of communication, interaction, mutual understanding with other specialists, and developed communicative thinking. The formation of communicative thinking and skills is facilitated by knowledge of psychology. Thus, when teaching and training engineers of the 21st century, along with fundamental and technical disciplines, it is necessary to carry out a synthesis with economic, social and managerial, environmental, cultural, and psychological sciences.

Psychological branches of science can have a beneficial effect on various aspects of the formation of an engineer’s personality.

Thus, problems of effective interaction between man and technology are studied in engineering psychology and ergonomics; the patterns of constructive

ISSN 3030-3907

activity of an engineer are revealed in the psychology of thinking and creativity, heuristics and engineering psychology; patterns of technical and engineering-management decisions are analyzed in management psychology, social psychology and heuristics; problems of effective interaction between an engineer and people and specialists are revealed in social psychology, psychology of communication, psychodiagnostics, psychotherapy and conflictology; the specifics of an engineer's activity in a market economy are considered in economic psychology and management psychology; the need for continuous training and advanced training of a modern engineer is based on the principles of educational psychology; and, finally, a modern engineer must be able to manage his activities, behavior, mental state, as a result of which he needs knowledge of general psychology, personality psychology, psychology of experiences and stress, and the psychology of self-regulation. Psychological support for all training of modern engineering workers is becoming an actual necessity.

The meaning of technical thinking is a successful solution of technical problems, in the process of solving them necessary qualities of technical thinking are formed. In this regard, the basis of the educational resources for the development of technical thinking of students are traditionally tasks. In general, educational resources, determining the development of technical thinking, we refer to the means, technologies, techniques, methods and development environments of students' technical abilities and diagnostic tools for assessing their level of development. The development of technical thinking in English lessons is accompanied by the development of technical abilities, which are interrelated and manifest independently from each other personal qualities: ability to understand technology in English, understanding technical terms, handling equipment, making technical products and technical invention. Along with some general ability, which can be considered as a general technical talent or technical experience acquired by a person in working with equipment, there are independent factors: spatial representations and technical understanding. By spatial representations they mean the ability to operate with visual images, for example, when perceiving geometric shapes. When entering a higher educational institutions, the first stage is the in-depth study of technical disciplines that were previously studied in school. This stage is necessary for the development of students' thinking and identifying abilities in various directions. Technical thinking is one of the important means of polytechnic education and vocational guidance, contributes to the formation of students' sustained interest in technology, the development of rationalization and inventive aptitudes, technical thinking, contributes to improving the scientific level of education. Students are involved in creative work in connection with the study

ISSN 3030-3907

of the fundamentals of science, familiarity with industry, the achievements of science and technology. Most often, technical thinking manifests itself in the design of models, instruments, mechanisms, simple machines and other technical objects.

What influences the development and quality training of a technical university specialist? It is obvious that in order to form such a harmonious specialist with systemic and even globally civilizational engineering thinking, it is necessary that the teachers themselves of technical colleges and technical universities overcome their narrow professional view of the tasks of teaching and the role of their academic discipline, it is necessary that the teachers themselves have a comprehensive fundamental-technical, economic-ecological, humanitarian-psychological-pedagogical basis of scientific ideas, as a result of which, even when teaching narrow technical disciplines, the complex erudition and systematic thinking of the teacher will allow students to provide students with comprehensively synthesized scientific information, to form a comprehensively developed personality of a person of the 21st century.

The nature, features, and conditions of professional tasks set the direction in which the process of thinking itself unfolds as a solution to the problem. And although this process turns out to be mediated by internal conditions (initial knowledge, abilities, characteristics of the nervous system), the objective direction and content of the thought process is set by the task itself. Therefore, it is necessary to analyze technical and production tasks and highlight their specific features.

Technical thinking has a high degree of usefulness for society, since it helps strengthen the logical apparatus and prevents the “confusion” of the consciousness of a modern technical specialist.

RESULT AND DISCUSSION

In today"s world, technical thinking is very much required. Development in technical thinking is very influential in today's life which impacts everything-from technical innovations to the way we function daily. The effects of technical thinking on society:

1. Innovation and Technological Advancement: It is the backbone of all innovations and technological progress. With technical thinking, we would be able to develop an entirely new technology or improve our existing inventions and create completely new innovative products and services that further modern society towards enhancement.

2. Solving Complex Problems: Using technical thinking as an area that makes possible solutions for quite complex technical, engineering, and scientific problems, used for developing techniques for addresses that may include environmental, health, energy, and many more.

ISSN 3030-3907

3. Economic Growth: The development of technical thinking in itself causes economic growth through innovation and technological change that improve production while increasing efficiency or creating employment opportunities.

4. Global Challenges: By providing technological answers, tech thinking plays a major part in tackling different global challenges from the likes of climate change, poverty, health, and access to education.

Then, from the above aspects, take the methods of employing technical thinking in society as follows:

1. Education: Introducing learning that inculcates the development of technical thinking in schools of all levels.

2. Innovation Environment: Conditions governing research, development, and innovation such as encouragement for startups, research laboratories, technology parks.

3. Popularization of STEM Areas: Make science, technology, engineering, and mathematics cool so that young people will be turned on toward developing technical thinking.

4. Networking: Joint promotion of brain roles in industry, education, science, and state in fostering technical thinking and innovation.

CONCLUSION

However, the advances must also consider the social-cum-ethical issues involved with the use of technology concerning the very otherwise impacting societies and environments, and also involve the diverse societies in the evolution of technical-cum-ethical thinking. Thus, developing technical thinking would entail deep consideration of contemporary society, and its promotion strategies would also be quite essential in ensuring that benefits in technology usage are maximized and responsible for the greater good.

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ISSN 3030-3907

KONCHILIK SANOATIDA OG‘IR YUK TASHUVCHI AVTOSAMOSVALLARGA QO’SHIMCHA HAVO FILTRLARI O‘RNATISH ORQALI HOSIL BO‘LADIGAN BOSIMLAR TAHLILI

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Annotatsiya: Ushbu ilmiy maqolada konchilik sanoatida keng qo‘llaniladigan og‘ir yuk tashuvchi avtosamosvallarning havo filtrlari ishlash muddatiga ta’sir etuvchi omillar tahlil qilingan. Havo filtrlari samaradorligi va ularning xizmat muddati konchilik sanoatida tog` jinsi changining miyoriy omillar bilan bog‘liq ekani ko‘rsatib o‘tilgan. Havo filtrlarining eskirish jarayoniga havo bosimi, chang zarralarining ta’siri, tashqi muhitning harorati va namlikning o‘rni statistik modellar asosida baholangan. Tadqiqot natijalari havo filtrlari resursini oshirish va texnik xizmat ko‘rsatish muddatini uzaytirishga qaratilgan muhim tavsiyalarni o‘z ichiga oladi.

Kalit so‘zlar: Avtosamosval, havo filtri, eskirish jarayoni, chang zarralari, texnik xizmat, filtratsiya samaradorligi.

Аннотация: В данной научной статье анализируются факторы, влияющие на срок службы воздушных фильтров тяжелых автосамосвалов, широко используемых в горнодобывающей промышленности. Эффективность воздушных фильтров и срок их службы определяются тем, что горная пыль в горнодобывающей промышленности обусловлена миориальными факторами. Давление воздуха в процессе износа воздушных фильтров, воздействие пылевых частиц, температура и влажность внешней среды оценивались на основе статистических моделей. Результаты исследования включают в себя важные рекомендации по увеличению ресурса воздушных фильтров и продлению срока их технического обслуживания.

Ключевые слова: Автосамосвал, воздушный фильтр, процесс износа, пылевые частицы, техническое обслуживание, эффективность фильтрации.

Abstract: This scientific article analyzes the factors affecting the service life of heavy truck air filters, which are widely used in the mining industry. The efficiency

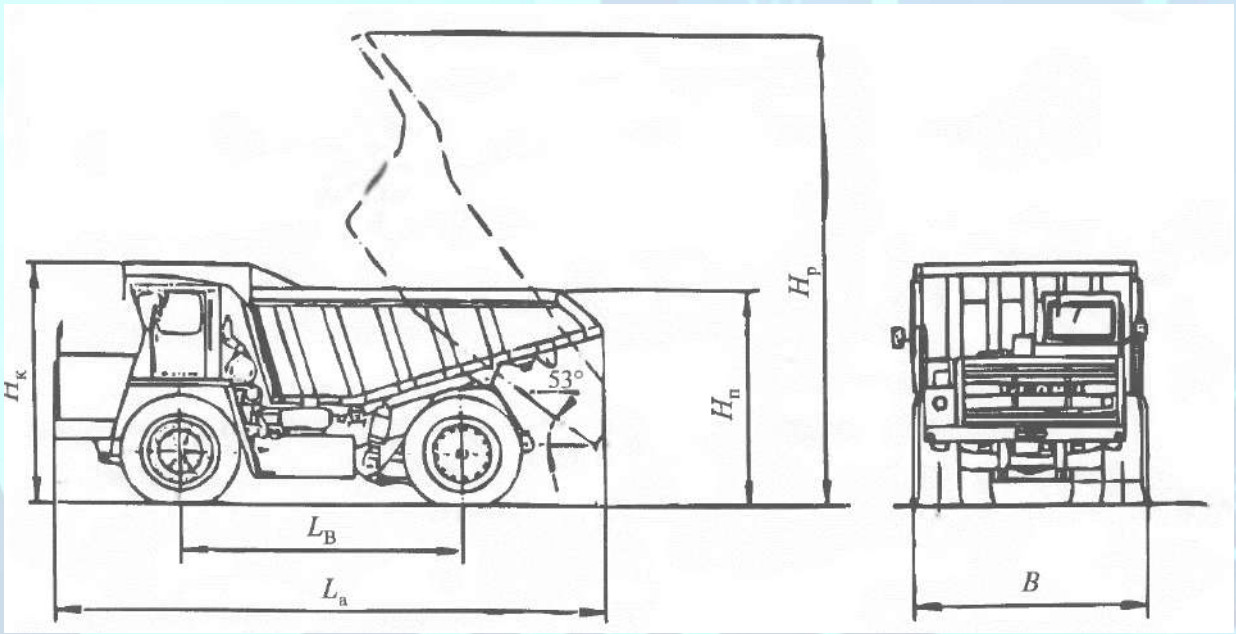
ISSN 3030-3907

of air filters and their service life are determined by the fact that mining dust in the mining industry is due to myorial factors. Air pressure during wear of air filters, exposure to dust particles, ambient temperature and humidity were estimated based on statistical models. The results of the study include important recommendations for increasing the life of air filters and extending their maintenance life.

Keywords: Dump truck, built-in filter, process characteristics, dust particles, maintenance, efficient filtration

ADABIYOTLAR TAHLILI. Avtomobil transporti dunyoda keng tarqalgan transport hisoblanib, kichik va o‘rta ishlab chiqarish kuchiga ega karyerlarda (yiliga yuk aylanmasi 15-20 mln. t.), tashish masofasi 1,3 – 3 km bo‘lgan katta karyerlarda (70-100 mln. t), tashish masofasi 5 km gacha bo‘lganda (ayrim hollarda undanda ko‘proq) ishlatiladi [111]. Avtomobil transporti karyerlarda foydali qazilmalarni, konchilik sanoati kimyoviy mahsulotlarni, qurilish materiallarini hamda yordamchi uskunalarni tashishda ishlatiladi.

Avtomobil gabaritlariga quyidagilar kiradi (1-rasm): to‘liq uzunligi L_a, kengligi V, balandligi kuzov qoshidan hisoblanadi H_k, ko‘tarilgan kuzovi bilan balandligi H_p, yuklanish balandligi H_{yu} va avtomobil bazasi L_v. Bu o‘lchamlar yo‘l parametrlarini aniqlaydi, remont qilish va texnik xizmat qilish, yuklovchi moslamalari bilan kelishuvchanligi, mashinaning ixchamligini ifodalaydi.



1-rasm. Avtomobillarning gabarit o`lchamlari

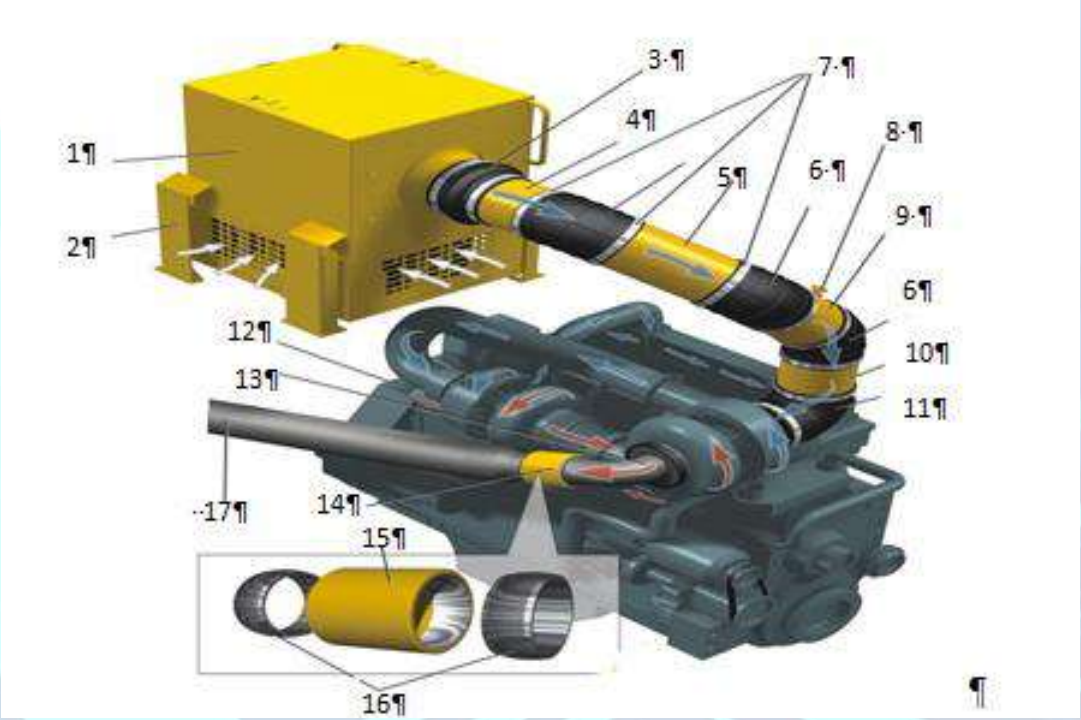
Avtosamosval transportining karyer chuqurligi ratsional qo‘llanishi 200–250 m. hisoblanadi, ammo karyer chuqurligi 300 - 400 m. dan oshgan konlarda ishlatilgan holatini ham e’tirof etish mumkin. Ushbu holatda avtomobil transportidan foydalanishning rotsionalligi kamayib boradi. Kar’er chuqurligining

ISSN 3030-3907

oshib borishi bilan transport vositalarida kombinatsiyalashgan holatini qo‘llash maqsadga muvofiq hisoblanadi. Yaqin 20-30 yilda eng istiqbolli transport vositalaridan biri sifatida avtomobil’-konveyer tranportining qo’llanishi e’tirof etilib kelinmoqda.

Konchilik sanoatida og‘ir yuk tashuvchi transport vositalarining ishonchliligi va samaradorligi muhim ahamiyat kasb etadi. Avtomobil transporti havo filtri avtosamosvallarning toza havo bilan ta’minlash tizimining asosiy ishchi qurilmasi hisoblanadi. Karyer avtosamosvallari dvigatellarining ishlash samaradorligi bevosita havo filtri ishchi holatiga bog‘liq (2-rasm).

Chang miqdorining ortishi filtr xizmat muddatini 30-40% ga qisqartiradi. Namlik darajasining 50% dan oshishi esa ushbu chang zarrazalarining filtrga tiqilib qolish ehtimolini oshiradi. Bundan tashqari harorat 80°C dan yuqori bo‘lsa, filtr materiali deformatsiyaga uchraydi. Havo filtrining ishdan chiqishi o’z navbatida dvigatel samaradorligini pasayishiga (ayrim hollarda dvigatellarning to’liq ishdan chiqishiga), yoqilg‘i sarfini va ekspluatatsiya xarajatlarining oshib ketishiga olib keladi.



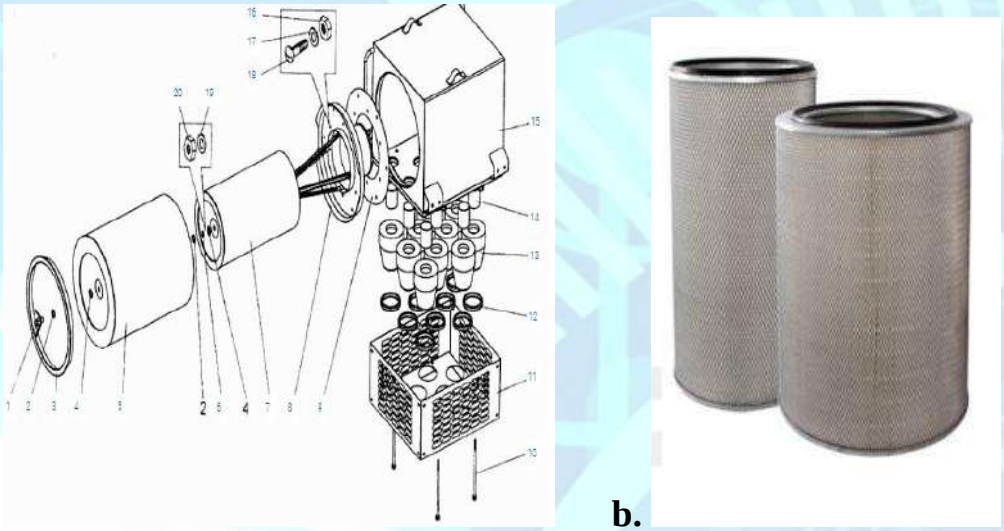
2-rasm Havo filtiri

1-havo filtri; 2-filtrni mahkamlash kronshteyni; 3-shlang; 4,6,9,10;17-turba; 5,11-burchakli shlang;7-xomut;8-havo filtrining bosim sensori; 12-dvigatel; 13-qabul qilish quvuri;14-ikki tomonlama sharnir; 15-korpus sharniri;

Avtosamosval havo filtri (2-rasm, 1-raqam va 3-rasm) tashqi muhitdagi havoni so’rib, notoza havo zarrachalarini o’zida ushlab qolib, dvigatelga toza havo

ISSN 3030-3907

bilan ta’minlash uchun qo’llaniladi. 3-rasmda BELAZ 7555B rusumidagi avtosamosval havo filtrining sxemasi keltirilgan.



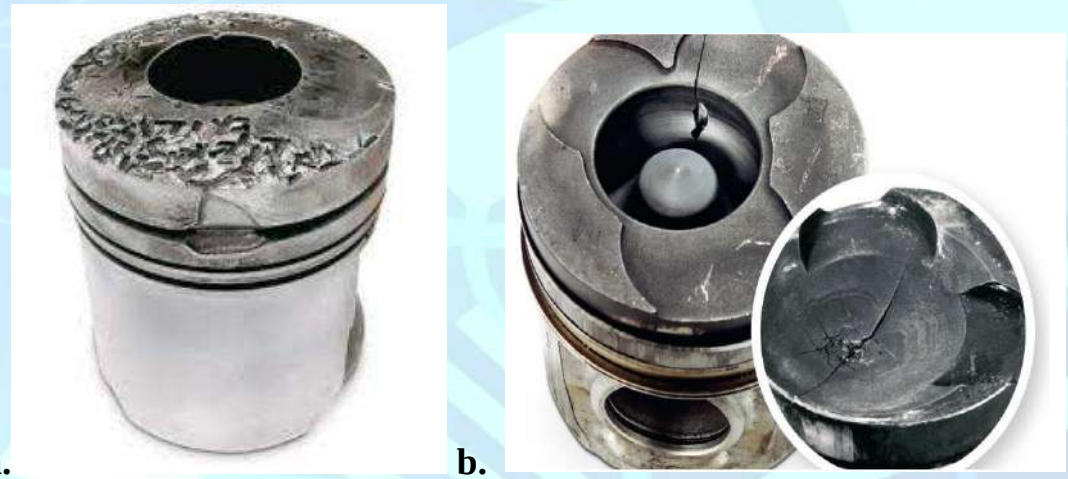
a. **b.**

3-rasm.1,10-ushlagich: 2-surish moslamasi; 3-qopqop; 4,9-shayba; 5,7-filtrlash elementi; 8-filtrlash elementini tutib turuvchi moslama; 11-qopqoq; 12-salnik; 13-himoya qopqog’I;14-suruvchi nay; 15-havo filtri qutisi;16,20-gayka;17,19-shayba;18-bolt

3-rasm. BELAZ 7555B rusumidagi avtosamosval havo filtrining a-sxemasi va b-tozalash elementi (tashqi filtr diametric 447/310/22.9 mm va ichki filtr diametri 302.8/259/22.9, balandligi 600/571.5 mm).

Ishdan chiqqan filtrdan havo kamroq o'tishi yoki chang zarrachalarining utib ketishi kuzatiladi, bu esa quyidagilarni vujudga keltiradi: Yoqilg'ining to'liq yonmasligi natijasida dvigatel quvvatining pasayishiga yoki zo’riqish bilan ishlab yoqilg'i sarfining oshishi hamda boshqa bir qator oqibatlarni keltirib chiqaradi, jumladan dvigatelni to’liq ishdan chiqishi ham sodir bo’ladi. 4-rasmda havo filtrining ishdan chiqishi natijasida yuzaga kelgan muommoli vaziyatdan olingan fotosuratlar keltirilgan.

ISSN 3030-3907

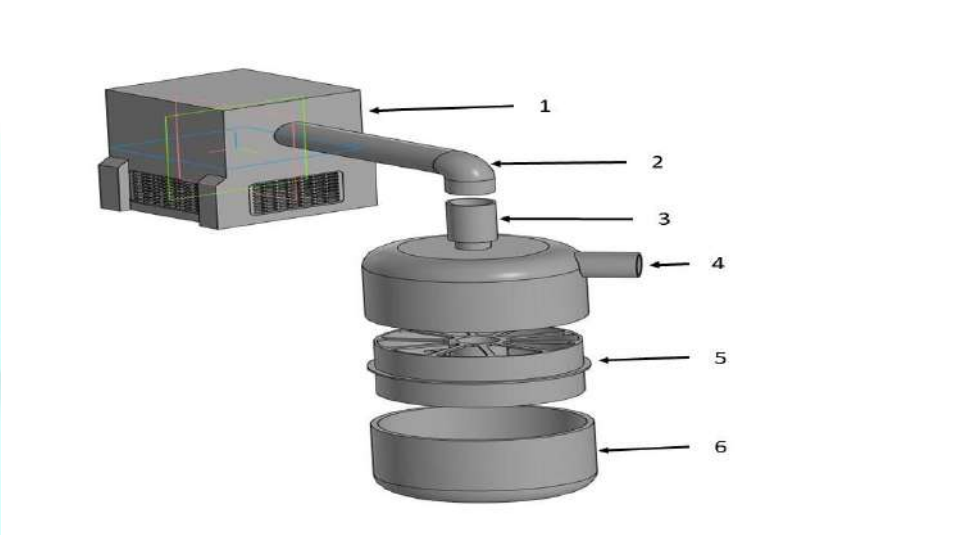


a. b.

4-rasm. Nuqsonli porshenlar a-yemirilishi va b-darz ketishi

Ushbu modelga ko‘ra, filtrning ishlash samaradorligi eksponensial tarzda kamayadi. Tadqiqot natijalari shuni ko‘rsatadiki, havo filtrlari samaradorligi 80% dan pastga tushganda ularning almashinuvi talab qilinadi.

5-rasm Mahalliy filtr



1-havo filtri; 2-yunaltiruvchi quvur; 3-qabul qiluvchi filtr quvuri;4-mahalliylashtirilgan filtr yunaltiruvchi quvuri; 5-filtrning ishchi deapozoni;6-filtrni suyuqlik idishi

Dvigatel ishlash samaradorligi va uzoq muddat xizmat qilishi uchun unga kirayotgan havo sifati muhim rol o‘ynaydi. Demak birinch navbatda ichki yonuv dvigetillarini ishlash muddatini oshirish uchun havo filtriga yordamchi yangi konustruksiyadagi havo filtirini quyish orqali havo filtirdan o‘tayotgan 2-5% chang miqdorini saqlab qolish mumkinligini ko‘rishimiz mumkin bo’ladi. 5-rasmda yangi tipdagi havo filtirini quyish orqali 1 litr dezil yoqilg‘isi yonishi uchun zarur bo‘ladigan 14,7 kg toza havo taminlab berishimiz kerak.

Avtosamosvalda o’rnatilgan havo filtrini ishlatgan vaqtimizda BELAZ 7555 rusumli avtosamosvallarda qo‘llaniladigan havo filtrlarining o‘rtacha qarshiligi

ISSN 3030-3907

(ΔP) fizik qonuniyatlar asosida aniqlanadi. Asosan bu hisob-kitoblar filtrdan o‘tuvchi havo oqimi, filtr materiali va uning tuzilishiga bog‘liq bo’lib filtrning o‘rtacha qarshiligi Darcy–Forchheimer qonuni yoki Hagen–Poiseuille qonuniyatiga asoslangan holda havo oqimining g‘ovak muhitdan o‘tishida qarshilik hisoblash uchun ko‘p hollarda Darcy qonuniga asoslanib havo filtri qarshiligi quydagi formulaga orqali topiladi:

$$\Delta P = \frac{\mu * l * v}{k} + \rho * \beta * l * v^2$$

μ −havoning dinamik qarishiligi

l −havo filtrining materiali qalinligi

v −havo tezligi(m/s)

k −g’ovaklik koeffisenti

ρ −havoning zichligi

β − Forchheimer koeffisenti

Yuqoridagi holatlarni hisobga olib umumiy jihatdan oladigan bo’lsak bitta havo filtri 180 Pa qarshilik ko’rsatishini ko‘rishimiz mumkin bo‘ladi.

Hozirgi kunda qo’llanilib kelayotgan Belaz7555 avtosamosvallarining havo filtrlariga qo’shimcha filtr o’rnatish orqali zararli chang zarralaridan ichki yonuv dvigatellarini aziyatsiz ishlashini ta’minlashimiz mumkin bo’ladi. Natijada ichki yonuv dvigatellariga havo miqdori talab darajasidan tushub ketish holatlarini ko’rishimiz mumkin bo’ladi. Yordamchi filtr quyilgandan so’ng qarshilik ortishini ko’rishimiz mumkin bo’ladi

$$\Delta P_{um.yan} = \Delta P_1 + \Delta P_2 + \Delta P_{quv}$$

bu yerda:

ΔP_1 − havo filtrining qarshiligi

ΔP_{quv} −quvurlarda hosil bo’ladigan qarshilik

ΔP_2 −yangi o’rnatilgan filtr qarshiligi

ΔP_{um} ni qiymatini o’zgarmasligini ta’minlash uchun Bernulli qonuni, gaz dinamikasi qonuniyatiga asosan havo tezligi va bosimini o’zgarishini kuzatishimiz mumkin bo’ladi.

Birinchi filtrga kelayotgan havodagi zararli chang zarrachalarni tozalash uchun quyidagi samaradorlik ko’rsatkich formulasi keltirib o’tilgan

$$\eta_1 = \frac{A_F}{A_4} * 100\% \Longrightarrow A_F = (C_k - C_{ch}); A_4 = C_k$$

ISSN 3030-3907

$$\eta_1 = \frac{C_k - C_{ch}}{C_k} * 100\% = (1 - \frac{C_{ch}}{C_k}) * 100\%$$

bu yerda: C_k –birinchi filtrga kiruvchi zarralar miqdori

C_{ch} – birinchi filtrdan chiquvchi zarralar miqdori

Birinchi filtrdan o'tib ikkinchi fitrga kelayotgan havoning tarkibidagi zararli chang zarrachalarini ushlab qolish uchun samaradorlik ko'rsatkichi quyidagi formula orqali hisoblanadi

$$\eta_2 = \frac{C_{k_2} - C_{ch_2}}{C_{k_2}} * 100\%$$

$$\eta_2 = f(\eta_1, C_{k_2}, C_k, C_{ch_2})$$

$$\eta_2 = f(\eta_1)$$

$$\frac{\eta_1 * C_{k_1}}{100\%} = C_{k_1} - C_{ch} \Rightarrow \qquad C_{ch} = C_{k_1} - \frac{\eta_1 * C_{k_1}}{100\%}$$

Agar quyidagi shart o'rinli bo'lsa $C_{ch_1} = C_{k_2}$

$$\eta_2 = \frac{C_{k_1} - \frac{\eta_1 * C_{k_1}}{100\%} - C_{ch_2}}{C_{k_1} - \frac{\eta_1 * C_{k_1}}{100\%}} * 100\%$$

bu yerda C_{k_2} –ikkinchi filtrga kiruvchi zarralar miqdori

C_{ch_2} – ikkinchi filtrdan chiquvchi zarralar miqdori

Ikkinchi o'rnatilgan filtr quyilganda filtrlash samaradorligini aniqlash uchun matematik model quydagicha bo'ladi

$$\eta_2 = f_3(C_{ch_2}, C_{k_1}, \eta_1)$$

$$\eta_2 = (1 - \frac{C_{ch_2}}{C_{k_1} - \frac{\eta_1 * C_{k_1}}{100\%}}) * 100\%$$

Filtrdan o'tgan chang zarrachalari foizi

$$P = \left(\frac{C_{ch}}{C_k}\right) * 100\%$$

$$\eta + P = 100\%$$

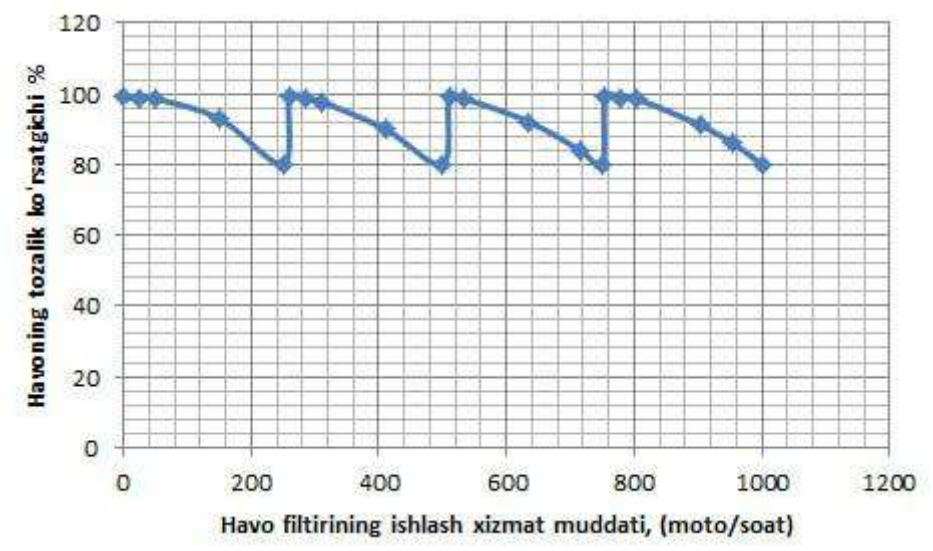
ISSN 3030-3907

Filtr samaradorligi oshgan sari bosim yuqotilishi bu quydgicha

$$\Delta P = P_k - P_{ch}$$

bu yerda P_k −filtrga kiruvchi bosim

P_{ch} − filtrga chiquvchi bosim

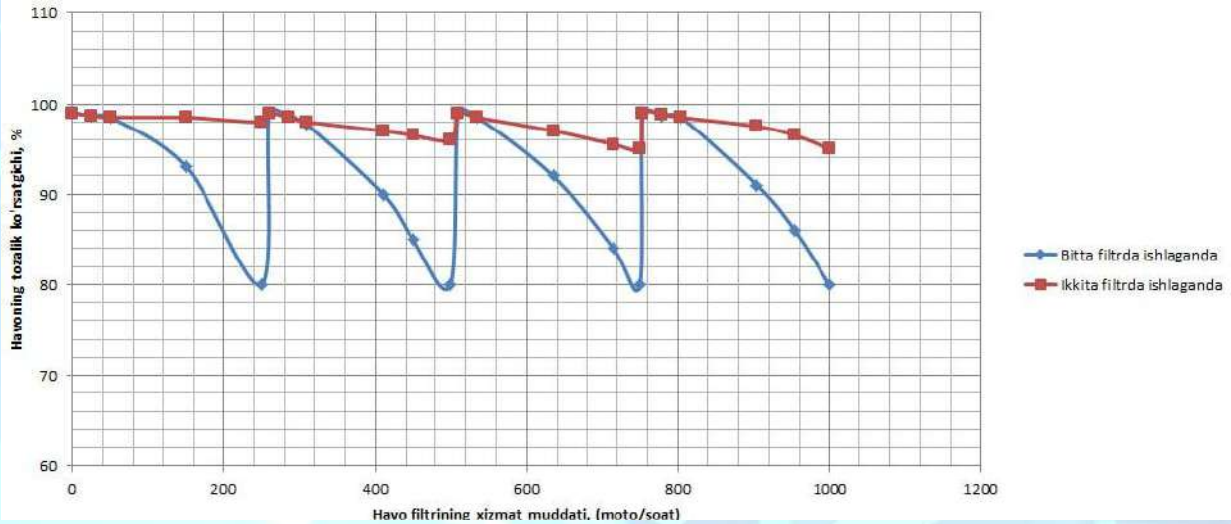


6-grafik. Og'ir yuk tashuvchi avtosamosvallar havo filtrlarining tozalik ko'rsatgichi va xizmat muddatiga bog'lik grafigi

Yuqorida og'ir yuk tashuvchi avtosamosvallar havo filtrlar ishchi grafigidan kelib chiqqan holatda har 250 moto/soatda tozalik ko'rsatkichi 100% dan 80% gacha kamayib ketishini kuzatishimiz mumkin bo'ladi.

Agar havo filtriga qo'shimcha filtr o'rnatish orqali ichki yonuv dvigateliga o'tadigan havoni tozalik ko'rsatkichini talab darajasida yetkazib berish mumkin bo'ladi.

ISSN 3030-3907



7-grafik. Og'ir yuk tashuvchi avtosamosvallar havo filtrlariga qo'shimcha o'rnatilga filtrning tozalik ko'rsatgichi va xizmat muddatiga bog'lik grafigi

Olib borilgan nazariy va amaliy tadqidodlar natijasida tahlili shu ko'rsatadiki o'rnatilgan havo filtri orqali o'tadigan havo tozalik ko'rsatkichini talab darajasida ichki yonuv dvigateliga yetkazib berish mumkin. Ikkinchi garafikda shuni ko'rish mumkinki(qizil chiziq) daslabki 250 moto/soatda tozalik ko'rsatkichi 100% dan 97% gacha kamayib ketishini kuzatishimiz mumkin bo'ladi.Bunday ko'rsatgich orqali ichki yonuv dvigatelning foydali ish koeffisenti quydagi nisbat orqali aniqlab olinadi.

$$k = \left(1 - \frac{\eta_1}{\eta_2}\right) * 100\% = \left(1 - \frac{80}{97}\right) * 100\% = 17\%$$

Ikkinchi filtrni qo'yish orqali ichki yonuv dvigateliga keladigan havoning tozalik ko'rsatgichini oshirish natijasida ichki yonuv dvigatelini foydali ish koeffisenti 17% oshirishga erishildi.

Ichki yonuv dvigatelining uzoq muddat ishlashini ta'minlash uchun havodagi zararli moddalarning samarali filtrlash tizimlari yordamida kamaytirilishi muhim ahamiyat kasb etadi. Zamonaviy havo filtrlash texnologiyalaridan foydalanish orqali dvigatelning ishlash samaradorligini oshirish va uning xizmat muddatini uzaytirish mumkin. Kelajakda nanofiltrlar va katalitik tozalash usullarining yanada rivojlanishi ushbu sohada yangi imkoniyatlar yaratishni talab qiladi.

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ISSN 3030-3907

KONCHILIK SANOATIDA OG‘IR YUK TASHUVCHI AVTOSAMOSVALLARNING HAVO FILTRLARINING ISHLASH MUDDATLARIGA TA’SIR ETUVCHI OMILLAR

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Annotatsiya: Ushbu maqolada tog‘-kon sanoatida, xususan ochiq usulda foydali qazilmalarni qazib olish jarayonida avtomobil transportining, ayniqsa BelAZ 7555 rusumli avtosamosvallarning roli yoritilgan. Karyer sharoitida 3–5 km gacha bo‘lgan masofalarda yuk tashishda ushbu transport vositalarining texnologik imkoniyatlari tahlil qilingan. Karyer chuqurligi 200–250 metr bo‘lganda avtosamosvallar samarali qo‘llanilishi ta’kidlangan, ammo 400–450 metr va undan chuqur konlarda kombinatsiyalashgan transport tizimlariga o‘tish zarurligi asoslab berilgan. Shuningdek, maqolada karyer avtotransportining ishlash samaradorligiga bevosita ta’sir etuvchi omillardan biri bo‘lgan havo filtrlari muammosi ko‘rib chiqilgan. Namlik va haroratning havo filtri ishlashiga salbiy ta’siri tahlil qilinadi hamda filtrning ishdan chiqishi dvigatel samaradorligiga, yoqilg‘i sarfiga va ekspluatatsiya xarajatlariga qanday ta’sir ko‘rsatishi bayon etilgan.

Kalit so‘zlar: Avtosamosval, havo filtri, eskirish jarayoni, chang zarralari, texnik xizmat, filtratsiya samaradorligi.

Аннотация: В данной статье освещается роль автомобильного транспорта, особенно автосамосвалов БелАЗ 7555, в горнодобывающей промышленности, в частности, в процессе добычи полезных ископаемых открытым способом. Проанализированы технологические возможности этих транспортных средств при перевозке грузов на расстоянии до 3-5 км в условиях карьера. Отмечено, что автосамосвалы эффективно используются при глубине карьера 200-250 метров, но обоснована необходимость перехода на комбинированные транспортные системы на глубинах 400-450 метров и более. Также в статье рассматривается проблема воздушных фильтров, которые являются одним из факторов, непосредственно влияющих на эффективность работы карьерного автотранспорта. Анализируется

ISSN 3030-3907

негативное влияние влажности и температуры на работу воздушного фильтра и описывается, как выход из строя фильтра влияет на эффективность двигателя, расход топлива и эксплуатационные расходы.

Ключевые слова: Автосамосвал, воздушный фильтр, процесс износа, пылевые частицы, техническое обслуживание, эффективность фильтрации.

Abstract: This article highlights the role of road transport, especially BelAZ 7555 dump trucks, in the mining industry, particularly in the open-pit mining process. The technological capabilities of these vehicles for cargo transportation at distances of 3-5 km under quarry conditions were analyzed. The effectiveness of the use of dump trucks at a quarry depth of 200-250 meters is emphasized, however, the need to switch to combined transport systems at a depth of 400-450 meters and deeper is substantiated. The article also examines the problem of air filters, which are one of the factors directly affecting the efficiency of quarry vehicles. The negative impact of humidity and temperature on the operation of the air filter is analyzed, and the impact of filter failure on engine efficiency, fuel consumption, and operating costs is described.

Keywords: Dump truck, built-in filter, process characteristics, dust particles, maintenance, efficient filtration

Kirish

Avtomobil transporti dunyoda keng tarqalgan transport hisoblanib tashish hajmi va ular karyerlarda ishlash bo‘yicha boshqa transportlarga nisbatan keng qo‘llaniladi. Avtomobil transporti karyerlarda rangli va temir rudasini tashishda qo‘llaniladi, konning kimyoviy mahsulotlari, qurilish materiallarini tashishda va yana faqat asosiy transport sifatida emas boshqa transportlar bilan birgalikda

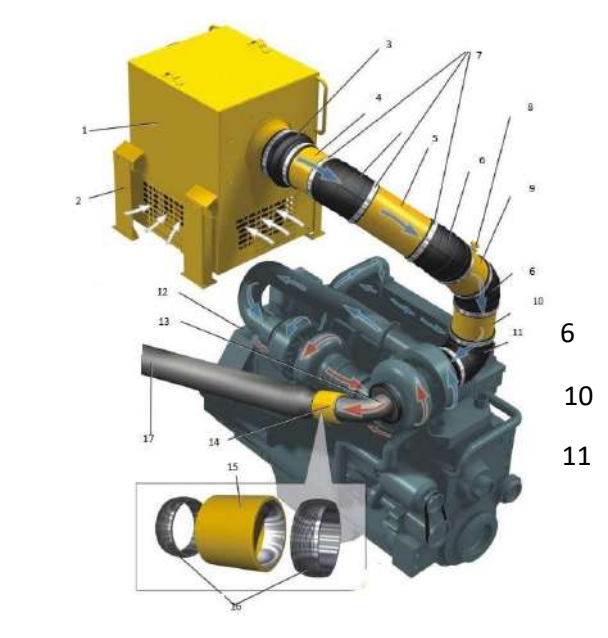


1-rasm Belaz7555 ning umumiy ko‘rinishi

ISSN 3030-3907

konveyer, temir yo‘l va skipli transport bilan birga kombinatsiyalashgan holatda ishlatiladi.

Asosiy tur sifatida – avtomobil transporti qo‘llaniladi:1-rasmda karyerlarda qo‘llanialdigan Belaz 7555 rudalarini tashishda, kon ochilish ishlarida, kichik va o‘rta quvvatli kon ishlarini olib borishda; ushbu karyer avtosamosvali asosan karyer hududida tashish masofasi 3-5 kmgacha bo‘lgan hollarda kon ishlarini olib borishda, magistral yo‘llarida va yuqori energetik resurslardan uzoq vaqt foydalanishda qo‘llanialdi. Avtosamosval transportining karyer chuqurligi ratsional qo‘llanishi 200 – 250 m. dan oshmaydi, ammo karyer chuqurligi 400- 450 m. dan oshgan konlarda transportning tashish unumdorligi yuqori avtosamosvallarni qo‘llash samarali ishlagan hollari ham bor, lekin undan chuqur konlarda kombinatsiyalashgan transportlarini qo‘llash samarali.Tog’-kon sanoatining muhim tarkibiy qismi, foydali qazilma konlarini tashishda intensiv jalb qilgan holda, karyer avtotransporti yaqin 20-30 yil ichida eng istiqbolli avtotransport vositalaridan biri bo’lib kelmoqda.



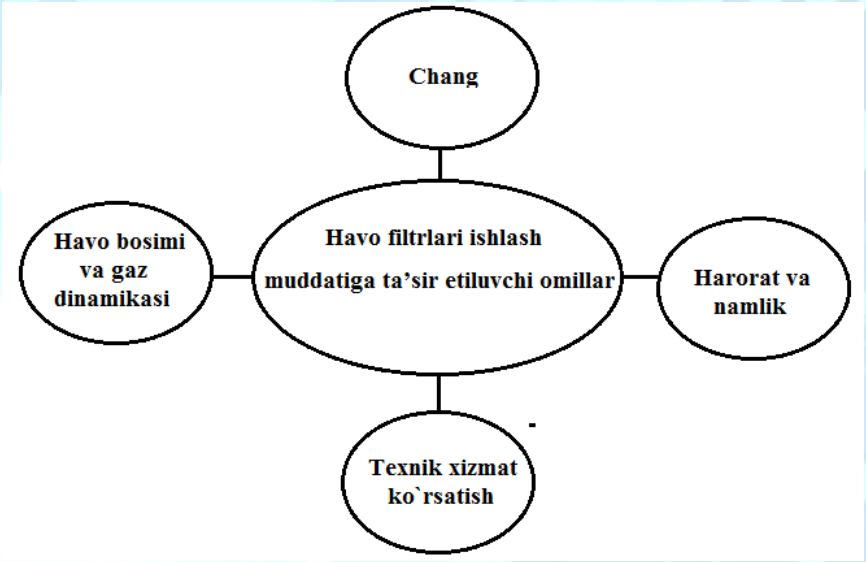
2-rasm Havo filtiri

1-havo filtri; 2-filtrni mahkamlash kronshteyni; 3-shlang; 4,6,9,10;17-turba; 5,11-burchakli shlang;7-xomut;8-havo filtrining bosim sensori; 12-dvigatel; 13-qabul qilish quvuri;14-ikki tomonlama sharnir; 15-korpus sharniri;

Konchilik sanoatida og‘ir yuk tashuvchi transport vositalarining ishonchliligi va samaradorligi muhim ahamiyat kasb etadi. 2-rasmdan ko‘rinib turibdiki karyer avtosamosvallari dvigatellarining ishlash samaradorligi bevosita havo filtri holatiga bog‘liq. Chang miqdorining ortishi filtr xizmat muddatini 30-

ISSN 3030-3907

40% ga qisqartiradi. Namlik darajasining 50% dan oshishi filtrning tiqilib qolish ehtimolini oshiradi. Harorat 80°C dan yuqori bo‘lsa, filtr materiali deformatsiyaga uchraydi. Havo filtrining ishdan chiqishi dvigatel samaradorligini pasaytirib, yoqilg‘i sarfini oshiradi va ekspluatatsiya xarajatlarini ko‘paytiradi. Shuning uchun havo filtrlari ishlash muddatiga ta’sir etuvchi omillarni o‘rganish dolzarb masala hisoblanadi.



3-rasm. Havo filtrlari ishlash muddatiga ta`sir etuvchi omillar

Yuqoridagi 3-rasmda havo filtrlari ishlash muddatiga ta`sir etuvchi omillar quyidagila bo‘lib **changning ta’siri** - konchilik sanoati muhitida katta hajmdagi chang havo filtrlari orqali o‘tib, ularning samaradorligini pasaytiradi. Chang zarralarining o‘lchamlari va ularning tarkibi filtrning xizmat muddatiga bevosita ta’sir ko‘rsatadi. Eksperimental tadqiqotlar shuni ko‘rsatadiki, chang miqdorining ortishi filtrning o‘tish qobiliyatini kamaytirib, uning muddatidan oldin ishdan chiqishiga sabab bo‘ladi.

Harorat va namlik - havo filtri materialining elastikligi va chang ushlash qobiliyati ish harorati va atrof-muhit namligiga bog‘liq. Yuqori harorat sharoitida filtr materiali tezroq eskiradi, past harorat esa changning zichlashishiga olib kelishi mumkin. Namlik esa chang zarralarining filtr yuzasiga yopishishini kuchaytirib, filtrning tiqilib qolishiga sabab bo‘ladi.

Havo bosimi va gaz dinamikasi - dvigatelning havo assimilyatsiyasi jarayonida bosim farqlari muhim rol o‘ynaydi. Agar havo filtri tiqilib qolsa, dvigatelga kiruvchi havo miqdori kamayadi, bu esa yoqilg‘i yonish jarayoniga salbiy ta’sir ko‘rsatadi va dvigatel quvvatini pasaytiradi.

Havo filtrlari ishlash muddatiga ta’sir etuvchi omillarni modellashtirish uchun differensial tenglamalar asosida quyidagi model ishlab chiqildi:

$$\frac{dC}{dt} = -kC$$

ISSN 3030-3907

bu yerda: C – filtrlovchi materialdagi chang miqdori; **mg/m³** yoki **g/m²**

Chang miqdorini aniqlash usullari

-gravimetrik usul

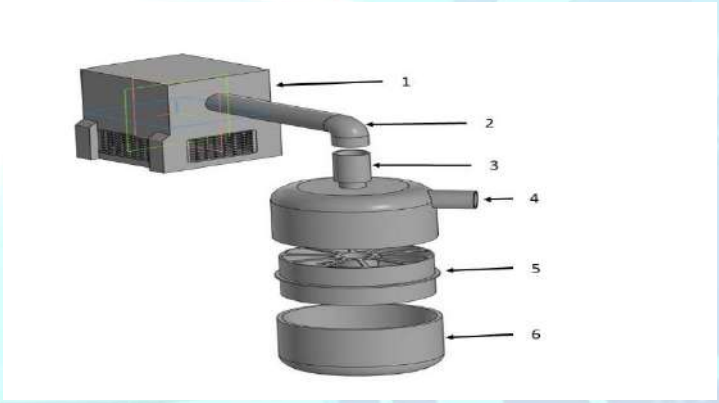
-optik usul

-elektrostatik usul

k – eskirish tezligini ifodalovchi koeffitsiyent;

t – vaqt;soat

Ushbu modelga ko‘ra, filtrning ishlash samaradorligi eksponensial tarzda kamayadi. Tadqiqot natijalari shuni ko‘rsatadiki, havo filtrlari samaradorligi 80% dan pastga tushganda ularning almashinuvi talab qilinadi.



4-rasm Mahalliy filtr

1-havo filtri; 2-yunaltiruvchi quvur; 3-qabul qiluvchi filtr quvuri;4-mahalliylashtirilgan filtr yunaltiruvchi quvuri; 5-filtrning ishchi deapozoni;6-filtrni suyuqlik idishi

Dvigatel ishlash samaradorligi va uzoq muddat xizmat qilishi uchun unga kirayotgan havo sifati muhim rol o‘ynaydi.Demak birinch navbatda ichki yonuv dvigetillarini ishlash muddatini oshirish uchun havo filtriga yordamchi yangi konustruksiyadagi havo filtirini quyish orqali havo filtirdan o‘tayotgan 2-5% chang miqdorini saqlab qolish mumkinligini ko‘rishimiz mumkin bo’ladi. 4-rasmda yangi tipdagi havo filtirini quyish orqali 1litr dezil yoqilg‘isi yonishi uchun zarur bo‘ladigan 14,7 kg toza havo taminlab berishimiz mumkin.

Ichki yonuv dvigatelining uzoq muddat ishlashini ta’minlash uchun havodagi zararli moddalarning samarali filtrlash tizimlari yordamida kamaytirilishi muhim ahamiyat kasb etadi. Zamonaviy havo filtrlash texnologiyalaridan foydalanish orqali dvigatelning ishlash samaradorligini oshirish va uning xizmat muddatini uzaytirish mumkin. Kelajakda nanofiltrlar va katalitik tozalash

ISSN 3030-3907

usullarining yanada rivojlanishi ushbu sohada yangi imkoniyatlar yaratishni talab qiladi.

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ISSN 3030-3907

ОПЫТНО-ЭКСПЕРИМЕНТАЛЬНОЕ ИССЛЕДОВАНИЕ ИЗМЕНЕНИЯ ТЕМПЕРАТУРЫ ПОГРУЖНОГО НАСОСА ПРИ УСТАНОВКЕ ОХЛАЖДАЮЩЕГО КОЖУХА

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Аннотация. В статье рассмотрены вопросы негативного влияние повышение температуры двигателя погружного насоса. Изучены распространенные причины выхода из строя электродвигателя погружных насосов. Разработано техническое решение для повышения эффективности охлаждение двигателя погружного насоса. Вычислено тепловой расчет погружного электродвигателя. Определено значение изменение температуры двигателя погружного насоса при изменении скорости потока жидкости. Смоделировано погружной насос в программным обеспечение KOMPAS. Произведён опытно-экспериментальные работы по исследование изменение скорости проточного охлаждение рекомендуемого охлаждающего кожуха в программе SolidWorks.

Ключевые слова: погружные центробежные насосы, скважина, повышения температуры, пластовой жидкость, перегрев, охлаждении насоса, эффективности работы, охлаждающие кожухи, скорость обтекания двигателя насоса, тепловой расчет, изменение температуры двигателя, моделирование в программных обеспечениях.

Annotation. The article deals with the issues of negative influence of submerged pump motor temperature increase. Common reasons of failure of electric motor of submersible pumps are studied. The technical solution to improve the efficiency of cooling of the submersible pump motor is developed. The thermal calculation of the submersible electric motor is calculated. The value of temperature change of the submersible pump motor at the change of liquid flow rate is determined. Modelled submersible pump in KOMPAS software. Experimental work on research of change of speed of flow cooling of recommended cooling casing in SolidWorks programme is made.

ISSN 3030-3907

Keywords: submersible centrifugal pumps, well, temperature rise, formation fluid, overheating, pump cooling, efficiency of work, cooling casings, flow velocity of pump motor, thermal calculation, motor temperature change, modelling in software.

Annotatsiya. Maqolada cho‘kma nasos dvigatelining harorati oshishining salbiy ta’siri ko'rib chiqiladi. Cho‘kma nasos elektrodvigatelini ishdan chiqishining eng ko‘p tarqalgan sabablari o‘rganildi. Cho‘kma nasos elektrodvigatelini sovutish samaradorligini oshirish uchun texnik yechim ishlab chiqildi. Cho‘kma nasos elektrdvigatelining termal hisobi hisoblab chiqilgan. Suyuqlik oqimi tezligi o'zgarganda, cho‘kma nasos dvigatelining harorat o‘zgarishi qiymati aniqlanadi. Cho‘kma nasos KOMPAS dasturi yordamida modellashtirildi. SolidWorks dasturida tavsiya etilgan sovutish g‘ilofini qo‘llaganda oqim sovutish tezligi o‘zgarishini o‘rganish uchun eksperimental ish olib borildi.

Kalit so‘zlar: cho‘kma markazdan qochma nasoslar, quduq, haroratning oshishi, qatlam suyuqligi, kuyish, nasosni sovutish, ish samaradorligi, sovutish g‘ilofi, nasos dvigateli oldidagi oqim tezligi, termal hisoblash, dvigatel harorati o'zgarishi, dasturiy ta'minotda modellashtirish.

Введение

Погружные центробежные насосы составляют группу, отличающуюся по конструкции от обычных насосов с горизонтальным расположением вала. Вертикальное расположение насоса в колодце или скважине предопределило такие конструктивные решения, как восприятия гидравлической нагрузки, расположение и смазку подшипников, конфигурацию и размеры деталей насоса, и их компоновку.

Электронасос представляет собой моноблок, объединяющий центробежный насос и погружной электродвигатель. Раствор из скважины на поверхность подается по колонне раствороподъемных труб.

Повышенная температура пластовой жидкости неблагоприятно влияет на работу погружного насоса. В частности, сам факт повышенной температуры пласта, свидетельствует о порции подведённой энергии к составным частям ПН, которая в свою очередь приводит к повышенной диссоциации скважной жидкости, то есть распаду сложных химических соединений на составляющие компоненты и элементы. Что способствует общему увеличению скорости реакции пластовой жидкости с элементами ПН, а, следовательно, и увеличению скорости коррозии металла.

АНАЛИЗ ЛИТЕРАТУРЫ. Распространенные причины выхода из строя электродвигателя погружных насосов связаны с его перегревом. Возникает при недостаточном охлаждении насоса проточной водой –

ISSN 3030-3907

например, при установке узкого насоса в скважину со слишком большого диаметра или, что еще хуже, в вырытый колодец. При диаметре скважины чуть больше, чем у насоса, вода охлаждает корпус устройства, предохраняя его от перегрева. Однако при отсутствии движения воды вокруг насоса двигатель во время работы нагревает окружающую жидкость, что приводит к перегреву двигателя и сокращению срока его службы. Предполагается, что разница между внутренним диаметром скважины и диаметром насоса должна быть не менее 4 мм и не более 100 мм.

Повышение эффективности работы насосных установок решается разработкой и применением технических решений по повышению работоспособности и коэффициента использования их. [1,2,3]

Задачей устройства является повышение эффективности работы электропогружных насосных установок на основе предворошение перегрева двигателя их.

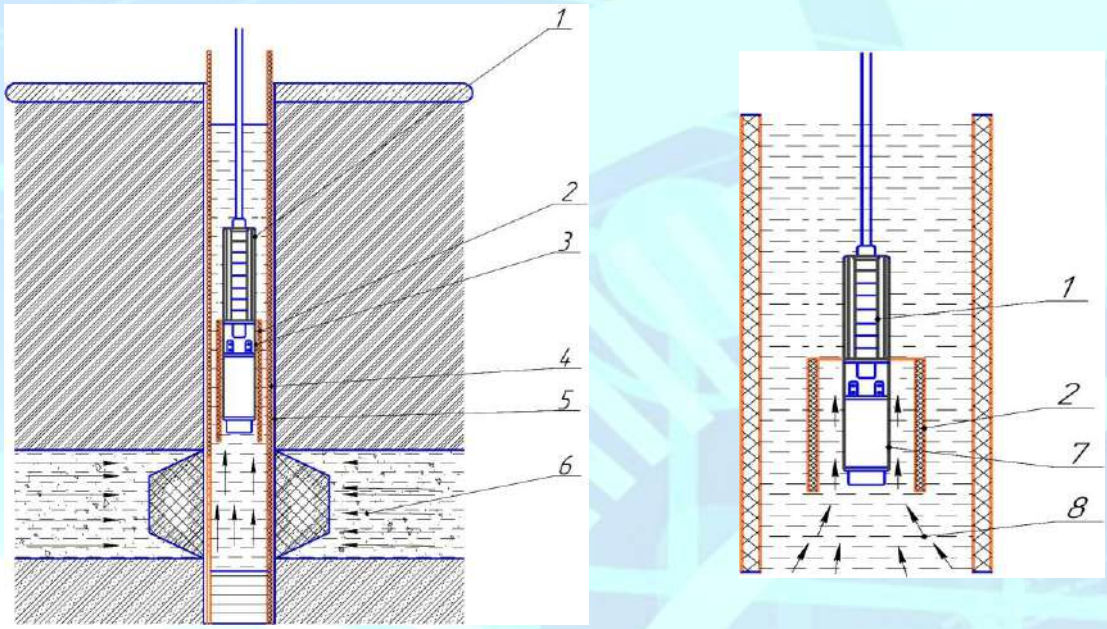
Поставленная задача достигается тем, что на верхней части патрубка всасывание жидкости погружного насоса устанавливается охлаждающий кожух. При поступлении в устройство жидкости проходит близко к двигательной части, с этим увеличивается скорость притока жидкости, поступающего на насос.

Охлаждающие кожухи рекомендуется устанавливать в тех случаев, когда степень охлаждения электродвигателя недостаточна. Это обеспечивает больший ресурс двигателя. Охлаждающие кожухи устанавливают в тех случаях, когда:

- скважинного насоса очень высокая тепловая нагрузка вследствие, например, асимметрии тока, работы «всухую», перегрузки, высокой температуры окружающей среды, плохого охлаждения.
- перекачивают агрессивные жидкости, поскольку при повышении температуры на 10°C скорость коррозии удваивается. [4]

МЕТОДОЛОГИЯ ИССЛЕДОВАНИЯ. Охлаждающий кожух поясняется чертежами, приведёнными на двух фигурах, где на рис.1а изображено общий вид скважине, который находится погружной насос с охлаждающим кожухом, на рис.1б показана схема принципа работы, предлагаемого устройство.

ISSN 3030-3907



а) б)

Рис. 1 Общий вид скважине и принцип работы охлаждающего кожуха в технологических скважинах, оборудованных погружным насосом. ***а) общий вид скважине б) схема принципа работы, предлагаемого устройство;*** *1 - погружной насос, 2 - охлаждающий кожух, 3- всасывающий патрубок погружного насоса, 4 - обсадная труба, 5 - технологическая скважина, 6 - пласт - который находится жидкость, 7 - двигательный часть погружного насоса, 8 – направление движение жидкости.*

Охлаждающий кожух прикреплён на верхней части всасывающего патрубка, при этом её длина превышает длину двигателя насосного агрегата на 20-50 см. Между насосным агрегатом и глухой трубы по диаметру оставляется зазор 20-30 мм.

Если скорость обтекания двигателя насоса меньше, чем указано в технических характеристиках на оборудования, то применение охлаждающих кожухов обязательно.

Для расчета скорости охлаждения используем формулу:

$$v \approx \frac{353 \cdot Q}{D^2 - d^2} \text{ [м/с]}$$

Q ($м^3/ч$) – расход (для расчета требуется минимальная производительность насоса);

D (мм) – условный диаметр скважины;

d (мм) – условный диаметр электродвигателя.

Тепловой расчет погружных электродвигателей (ПЭД), предназначенная для использования на стадии их концептуального

ISSN 3030-3907

проектирования. В основе модели лежит полная система уравнений гидродинамики, осредненных по поперечному сечению ПЭД и кольцевого канала, по которому прокачивается охлаждающая жидкость. Задаются все геометрические размеры и свойства вещества. Вычисляются распределение температуры по поперечному сечению и по длине электродвигателя. Использованы эмпирическую зависимость числа Нуссельта от чисел Рейнольдса и Прандтля.

Уравнение теплопроводности в твердой фазе внутри статора. Это уравнение имеет следующий вид

$$\rho\, c_p \frac{\partial T}{\partial t} = \lambda \nabla^2 T + q \qquad (1)$$

где ρ — плотность; c_p — теплоемкость; λ — коэффициент теплопроводности; q — эффективный объемный источник теплоты.

В установившемся режиме решение (6) для аксиально симметричной расчетной области и в отсутствие объемных источников теплоты

T = a ln r + b, (a, b) = const,

а при наличии объемного источника теплоты (q = const)

$T = -\frac{qr^2}{4\lambda} + a \ln r + b$, (a, b) = const.

Граничные условия:

на внутренней границе статора r = R1 задан поток теплоты от ротора в статор (q_{rot}):

$$-\lambda \frac{\partial T}{\partial r}\ 2\pi R1L = q_{rot} \qquad (2)$$

на внешней поверхности корпуса ПЭД, где r = Rk, которая охлаждается протекающей жидкостью, задавали условия теплоотвода:

$$-\lambda \frac{\partial T}{\partial r} = \alpha\,(T_k - T_{liq})$$

$$\alpha = \lambda_{liq} \frac{Nu}{d}\ ; d = 4\frac{S}{P} = 4\frac{\pi(R_k^2 - R_d^2)}{2\pi R_k + 2\pi R_d} = 2(R_k - R_d) \qquad (3)$$

где T_k — температура корпуса; T_{liq} — температура жидкости, λ_{liq} — коэффициент теплопроводности жидкости; Nu — число Нуссельта;

d — гидродинамический диаметр канала.

Число Нуссельта Nu вычисляли следующим образом [5, 6]:

. для ламинарного течения Re <2300

ISSN 3030-3907

$$Nu=1{,}4\ (Re_{liq}\frac{d}{L})0.33 \qquad Pr_k^{0.33}\ (\frac{Pr_{liq}}{Pr_k})0.25 \qquad (4)$$

$$Re_{liq}=\frac{\vartheta d}{v_{liq}};\ Prk=\frac{v_k}{X_k};\ P_{rliq}=\frac{v_{liq}}{X_{liq}} \qquad (5)$$

где Re_{liq} — число Рейнольдса для жидкости в канале ПЭД — обсадная колонна; Pr_k и Pr_{liq} — число Прандтля для внешней поверхности корпуса ПЭД и для жидкости соответственно;

. для турбулентного течения

$$Nu = 0.021\ Re_{liq}^{0.8}\ Pr_k^{0.43}\ (\frac{Pr_{liq}}{Pr_k})0.25 \qquad (6)$$

Или

$$Nu = 0.021\ Re_{жид}^{0.9}\ Pr^{0.43} \qquad (7)$$

$Re=\frac{wl}{v}=\frac{wl\rho}{\mu}$ - критерий Рейнольдса, который характеризует гидродинамический режим потока при вынужденном движении и является мерой соотношения сил инерции и вязкого трения;

$Pr=\frac{v}{a}=\frac{c\mu}{\lambda}$ - критерий Прандтля, который характеризует физико – химические свойства теплоносителя и является мерой подобия температурных и скоростных полей в потоке;

Выражении этих критериев:

$V=\mu/\rho$- кинематический коэффициент вязкости теплоносителя, м^2/с; w- скорость движения теплоносителя, м/с;

$a=\frac{\lambda}{c\rho}$ - коэффициент температуропроводности, м2/с;

ρ – плотность теплоносителя, кг/м3; $\Delta t=t_{ст}-t_ж$ – температурный напор между стенкой и теплоносителем, 0С;

λ – коэффициент теплопроводности теплоносителя, Вт/(м·К);

μ – динамический коэффициент вязкости, Па·с;

C_p – теплоемкость теплоносителя, Дж/(кг·К);

Подставив в формулу (7) критерий Рейнольдса и критерий Прандтля получим:

$$Nu= 0.021\ \frac{(\vartheta l\rho)^{0.9}}{v_{жид}^{0,47}\ a^{0.43}}$$

ISSN 3030-3907

ОБСУЖДЕНИЕ И РЕЗУЛЬТАТЫ. Получившуюся формулу подставляем в формулу (3), и находим изменение температуры ΔT:

$$\Delta T = \lambda_{жид} \frac{0{,}021 \times \frac{(\vartheta l \rho)^{0.9}}{V^{0.47}\ a^{0.43}}}{d}$$

Сделаем подсчеты.

Дано: $\lambda_{жид}$ =0,95 Вт/(мк);ρ =1100;

L= 200 м; v=1.01 м^2/сек; a= 0.19 м/с^2

$\vartheta_1 = 1{,}42$; $\vartheta_2 = 0.19$

d_1=159 мм; d_2=195 мм

Таблица.1

Значения плотности, динамической вязкости и кинематической вязкости для воды и воздуха при разных температурах.

Температура °C	Вода					Воздух (при давлении 760 мм рт.ст.)				
	Плотность ρ		Вязкость μ·10^6		Кинематическая вязкость v·10^6	Плотность ρ		Вязкость μ·10^6		Кинематическая вязкость v·10^6
	кг/м^3	кГсек^2/м^4	кг/м сек	кГсек^2/м^2	м^2/сек	кг/м^3	кГсек^2/м^4	кг/м сек	кГсек^2/м^2	м^2/сек
-20	-	-	-	-	-	1,39	0,142	15,6	1,59	11,3
-10	-	-	-	-	-	1,34	0,137	16,2	1,65	12,1
0	999,3	101,9	1795	183	1,80	1,29	0,132	16,8	1,71	13,0
10	999,3	101,9	1304	133	1,30	1,25	0,127	17,4	1,77	13,9
20	997,3	101,7	1010	103	1,01	1,21	0,123	17,9	1,83	14,9
40	991,5	101,1	655	66,8	0,661	1,12	0,114	19,1	1,95	17,0

ISSN 3030-3907

60	982,6	101,2	474	48,3	0,482	1,06	0,108	20,3	2,07	19,2
80	971,8	99,1	357	36,4	0,368	0,99	0,101	21,5	2,19	21,7
100	959,1	97,8	283	28,9	0,296	0,94	0,096	22,9	2,33	24,5

Решение:

При $\vartheta_1 = 1{,}42$

$$\Delta T = 0{,}95 \ \frac{0{,}021 \times \frac{(1{,}42 \times 200 \times 1100)^{0.9}}{1{,}01^{0.47} \times 0{,}19^{0.43} \times 10^3}}{0{,}159} = 0{,}95 \times \frac{3{,}77}{0{,}159} = 22{,}5^{\circ}C$$

При $\vartheta_2 = 0.19$

$$\Delta T1 = 0{,}95 \ \frac{0{,}021 \times \frac{(0{,}19 \times 200 \times 1100)^{0.9}}{1{,}01^{0.47} \times 0{,}19^{0.43} \times 10^3}}{0{,}195} = 0{,}95 \times \frac{1{,}35}{0{,}195} = 7^{\circ}C$$

Таблица 2

Значения изменение температуры двигателя от изменения скорости потока жидкости.

Расход Q, м³⁄ч	Диаметр скважина $D_{ск,мм}$	Диаметр двигателя насоса $D_{дв,мм}$	Температура двигателя T (^{0}C) до установки охлаждающего кожуха	Предлагаемая диаметр охлаждающего кожуха, мм	Скорость проточного охлаждения двигателя,м/с	Разность температуры ΔT (^{0}C)	Изменение температуры двигателя T (^{0}C) после установки охлаждающего кожуха
8	159	93	97 ^{0}C	113	0,6	11,12	85,88
				123	0,43	9,5	87,5
				133	0,31	9	88
				143	0,23	8	89
				145	0,19	7	90
25	195	145	97 ^{0}C	165	1,42	22,5	74,5
				170	1,12	17	80
				175	0,91	15	82
				180	0,77	11	86

ISSN 3030-3907

				185	0,66	9,8	87,2
				190	0,51	8	89

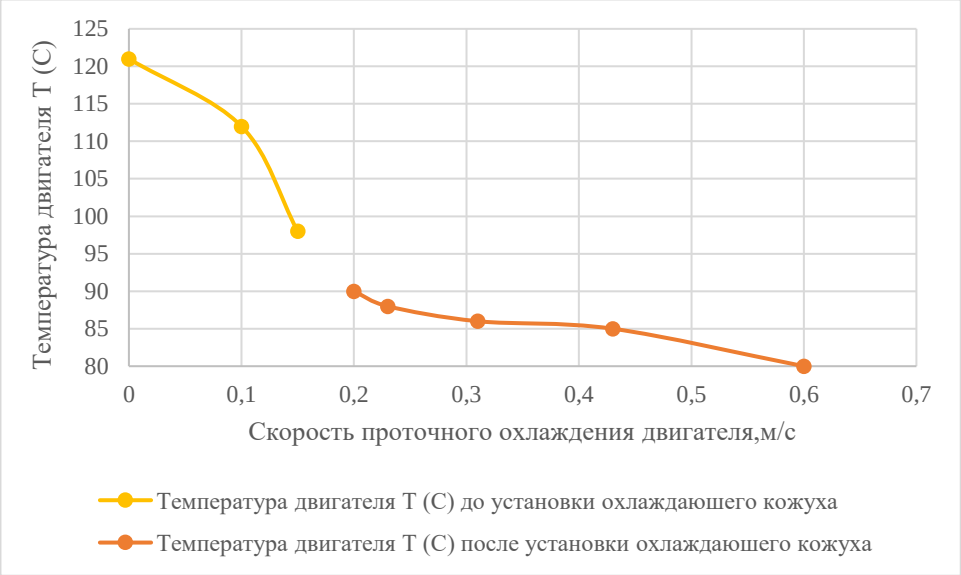


Рис. 2 Зависимость изменение температуры от скорости проточного охлаждение. (диаметр скважине $D_{ск}$ =159 мм, диаметр двигателя насоса $D_{дв}$ =93 мм.)

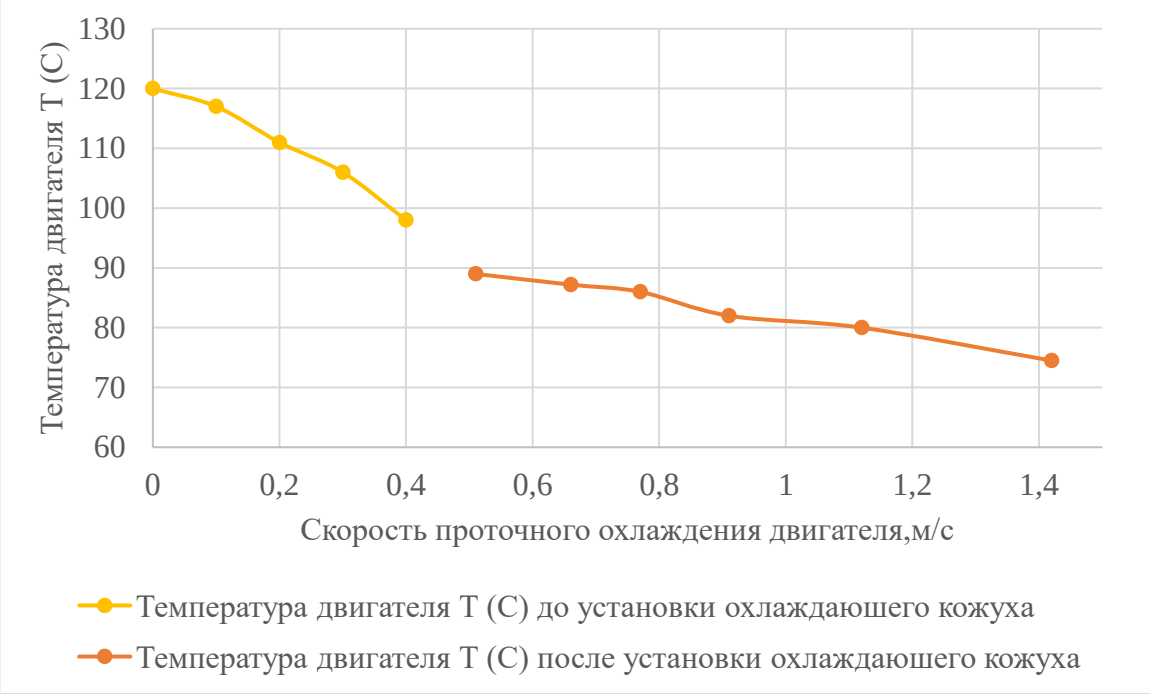
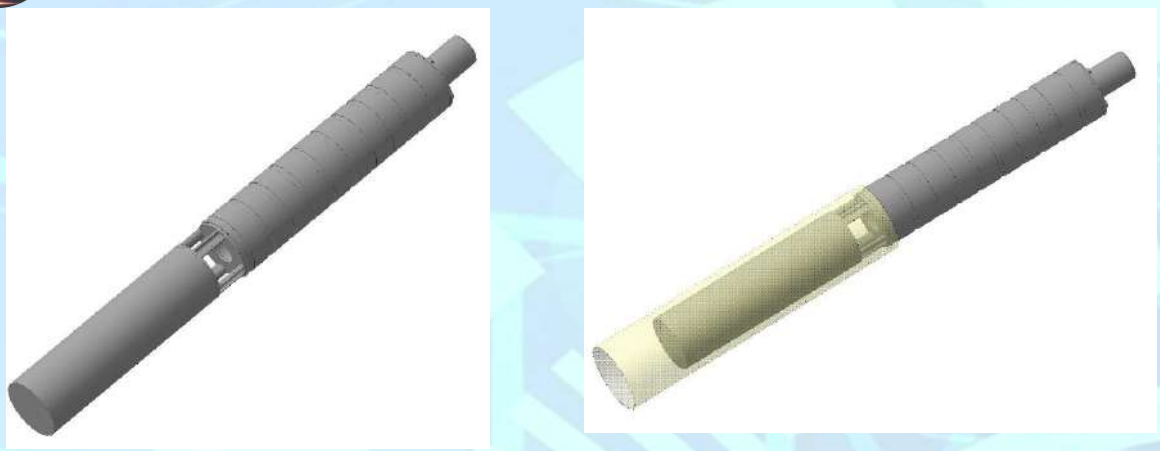


Рис.3 Зависимость изменение температуры от скорости проточного охлаждение. (диаметр скважине $D_{ск}$ =185 мм, диаметр двигателя насоса $D_{дв}$ =145 мм.)

На основе выше полученных данных нами смоделирован погружной насос и охлаждающий кожух на программным обеспечение KOMPAS.

ISSN 3030-3907



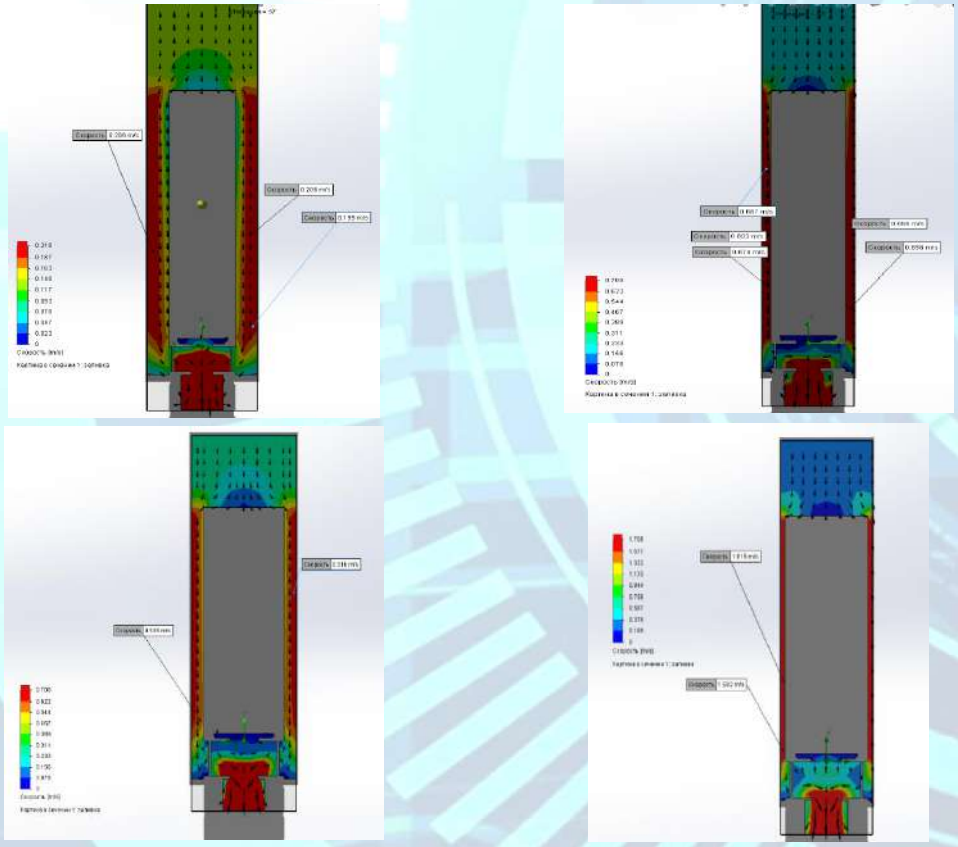
А) Б)

Рис. 4. Погружной электронасос

А) Общий вид погружного электронасоса

Б) Погружной электронасос с охлаждающим кожухом

После этого нами быль произведён опытно-экспериментальные работы по исследование изменение скорости проточного охлаждение рекомендуемого охлаждающего кожуха в программе SolidWorks и получены следующие результаты.



I

II

А) Б)

Рис. 5. Результаты расчетов опытно-экспериментальных работ в программном обеспечении SolidWorks.

ISSN 3030-3907

I-при диаметр скважине $D_{ск}$ =159 мм, диаметр двигателя насоса $D_{дв}$ =93 мм; II- при диаметр скважине $D_{ск}$ =195 мм, диаметр двигателя насоса $D_{дв}$ =145 мм;

А) Погружной электронасос без охлаждающего кожуха. Б) Погружной электронасос с охлаждающим кожухом.

Исходя из полученных результатов можно сделать вывод, что при установки охлаждающего кожуха на погружной электронасос увеличивается скорость протока жидкости около двигательного частя насоса, и это приводит к улучшению охлаждения двигателя. Минимальная скорость охлаждения для каждого производителя скважинных насосов может быть разное.

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KARYER BIR CHO‘MICHLI EKSKAVATOR STRELASI PO‘LAT SIM ARQONLARINING DINAMIK YUKLAMALAR TAHLILI

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Annotatsiya. Ushbu maqolada karyer ekskavatorlarining po‘lat sim arqonlari ekspluatatsion jarayonda uchraydigan statik va dinamik yuklanishlari chuqur tahlil qilinadi. Ekskavator strelasi bilan po‘lat sim arqonlari tizimi o‘rtasidagi kuch ta’sirlari mexanik muvozanat tenglamalari va chiziqli tebranishlar nazariyasi asosida aniqlanadi. SolidWorks modellashtirilgan tizimda yuklarning vaqt bo‘yicha o‘zgarishi, kuchlanishlarning maksimal holatlari, uzilish chegaralari va ehtimoli baholanadi. Taklif etilgan konstruktiv yechim sifatida sim arqonlarning taqsimotini o‘zgartirish orqali dinamik nomutanosiblikni kamaytiradi va xizmat muddati oshirilishini ta’minlaydi.

Kalit so‘zlar: ekskavator, po‘lat sim arqonlari, yuklanish, dinamik muvozanat, statik muvozanat.

Аннотация. В данной статье подробно анализируются статические и динамические нагрузки, возникающие в процессе эксплуатации стальных тросов карьерных экскаваторов. Силовые взаимодействия между стрелой экскаватора и системой стальных тросов определяются на основе уравнений механического равновесия и теории линейных колебаний. В моделируемой системе SolidWorks оценивается изменение нагрузок во времени, максимальные состояния напряжений, пределы разрыва и вероятность. Предлагаемое конструктивное решение уменьшает динамическую диспропорцию за счет изменения распределения проволочных тросов и обеспечивает увеличение срока службы.

Ключевые слова: экскаватор, стальные тросы, нагрузка, динамическое равновесие, статическое равновесие.

Abstract. This article provides an in-depth analysis of the static and dynamic loads encountered during the operation of steel cables of quarry excavators. The force interactions between the excavator boom and the steel cable system are determined based on the mechanical equilibrium equations and the theory of linear oscillations. In the SolidWorks simulated system, the change in loads over time, maximum stress states, breakdown limits, and probability are assessed. As a proposed

ISSN 3030-3907

structural solution, it reduces dynamic imbalance by changing the distribution of wire ropes and ensures an increase in service life.

Keywords: excavator, steel cables, load, dynamic equilibrium, static equilibrium.

Kirish

Karyer ekskavatorlari konstruksiyasida strelaning barqarorligini ta’minlovchi asosiy elementlardan biri bu - po‘lat sim arqonlari hisoblanadi. Bu po‘lat sim arqonlar yukni ko‘tarish, tutib turish va yuklamalarni taqsimlash vazifasini bajaradi. Ular ish jarayonida murakkab yuklanish - statik, zarbli (impuls), tebranuvchi va doimiy o‘zgaruvchan kuch ta’sirida ishlaydi. Ekskavatorlar, ayniqsa EKG-8I va EKG-10 modellari, katta massali yuk bilan ishlashi sababli, bu po‘lat sim arqonlaridagi yuklar ancha yuqori bo‘lib, ularni to‘g‘ri hisoblash - ishonchlilikni ta'minlashda muhim ahamiyat kasb etadi.

Dunyo bo‘ylab ekskavatorlar ishchi a’zolarining ishonchliligini oshirish bo‘yicha tadqiqotlar olib borilmoqda. Po‘lat sim arqonlari ekskavatorlarning yuk ko‘tarish samaradorligi va ishonchliligini mexanik nuqtayi nazaridan tahlil qilgan [2]. Ekskavatorlarda po‘lat sim arqonlari asosan, EKG-8I ekskavatorlarida ϕ45,5 mm diametrli po‘lat sim arqonlar, EKG-10 ekskavatorlarida ϕ52 mm diametrli po‘lat sim arqonlardan foydalaniladi. Ushbu po‘lat sim arqonlari ishlab chiqaruvchiga qarab GOST 2688-80 standartlariga muvofiq ishlab chiqariladi [3,4].

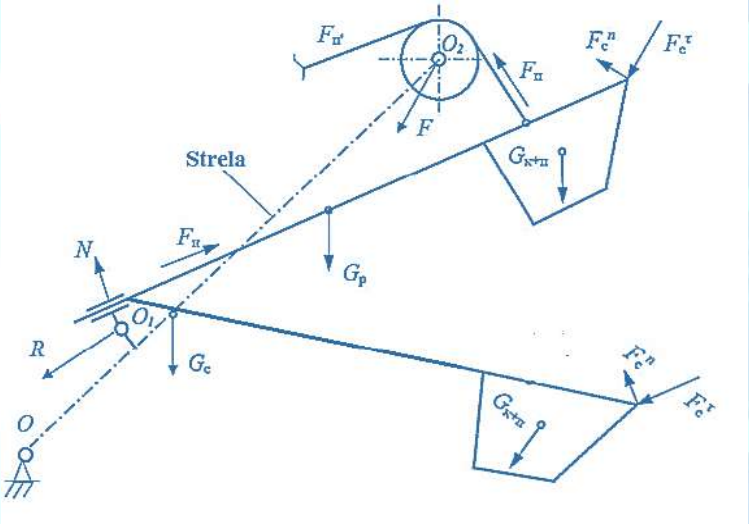
ADABIYOTLAR TAHLILI.

Adabiyotlar tahlili shuni ko‘rsatadiki, po‘lat sim arqonlar ekskavatorning muhim elementlaridan biri bo‘lib, ularning statik va dinamik yuklanishi chuqur ilmiy tahlilni talab qiladi. Aksariyat ishlar statik yondashuvga asoslangan bo‘lsa-da, so‘nggi yillarda sonli metodlar va raqamli simulyatsiya asosida dinamik kuchlanishlarni tahlil qilish dolzarb bo‘lib bormoqda. Bu esa, SolidWorks asosidagi konstruktiv takliflarning ilmiy asoslanganligini mustahkamlaydi. Karyer ekskavatorlarining mexanik ishonchliligi, ayniqsa strelaning barqaror ishlashida asosiy yukni qabul qiluvchi po‘lat sim arqonlar (vant troslari)ning holatini to‘g‘ri baholash, mashinaning xizmat muddati va xavfsizligi uchun hal qiluvchi ahamiyatga ega []. Ekskavator ishchi organlarining (strela, ruqoyat, tros) dinamik modeli asosida zarbli yuklanish holatlaridagi stress konsentratsiyalarni ko‘rsatgan. Ayniqsa, cho‘mich zarbasi paytida tushuvchi impuls kuchlar troslardagi kuch taqsimotining nomutanosib bo‘lishiga olib keladi []. Ekskavator troslari uchun texnik talablar va ularni hisoblash bo‘yicha me’yoriy hujjatlar GOST 3062-80 va GOST 3241-91 da aniq ko‘rsatilgan. Ushbu standartlar tros diametri, uzilish kuchi va xavfsizlik koeffitsientlariga doir talablarni belgilaydi [].

TADQIQOT METODOLOGIYASI.

ISSN 3030-3907

Hozirgi kunda EKG-8I va EKG-10 tipidagi ekskavatorlarning po‘lat sim arqonlari konstruksiyasi strelaga po‘lat sim arqonlarni o‘rnatganda arqonlarga yuklama to‘g‘ri taqsimlanmasligi ekskavator strelasining xizmat qilish vaqtini kamayishiga, po‘lat sim arqonlrga nuqsonlar va uzilib ketishiga olib kelidi. Ekskavatorning po‘lat sim arqonlari bir xil uzunlik yoki taranglikka ega bo‘lmasa, strela dinamik va statik yuklamalar ta’sirida notekis joylashadi. Quyidagi 1-rasmda ekskavator ishchi a’zosi va po‘lat sim arqonlarida hosil bo‘ladigan kuchlar ko‘rsatilgan.



1-rasm. Ekskavator ishchi a’zosi va po‘lat sim arqonlarida hosil bo‘ladigan kuchlar

Ekskavator cho‘michining harakat trayektoriyasi koordinatalar tizimi (1) va (2) ifodalar orqali ifodalanadi [1,2]:

$$X_k = X_{o1} + L_1 \cdot cos(\alpha_1) + L_2 \cdot cos(\alpha_2) \quad (1)$$

$$Y_k = Y_{o1} + L_1 \cdot sin(\alpha_1) + L_2 \cdot sin(\alpha_2) \quad (2)$$

Cho‘michining burilish burchagi (ɵ) va og‘irlik kuchi (G_k) hisobga olindi. Harakatni differensial tenglamalar (3) va (4) orqali aniq ifodasi quyidagicha bo‘ladi:

$$\frac{d^2X_k}{dt^2} = -\omega^2 X_k + 2\omega \frac{dY_k}{dt} \quad (3)$$

$$\frac{d^2Y_k}{dt^2} = -g + 2\omega \frac{dX_k}{dt} \quad (4)$$

Bu yerda: ω-burilish burchak tezligi, g-erkin tushish tezlanishi.

Cho‘michni harakatga keltiruvchi asosiy kuchlar quyidagicha ifodalanadi:

$$F_k = P_o + G_k + N_k \quad (5)$$

Bu yerda: P_o– qazib olish qarshilik kuchi, G_k– cho‘michning og‘irligi, N_k– normal reaksiya kuchi.

Ishqalanish va deformatsiyani hisobga olish uchun yangi parametrlar qo‘shiladi:

ISSN 3030-3907

$$F_k = P_o + G_k + N_k + \mu_k F_s \quad (6)$$

Bu erda μ_k– ishqalanish koeffitsienti, F_s– strukturaning elastik reaksiya kuchi.

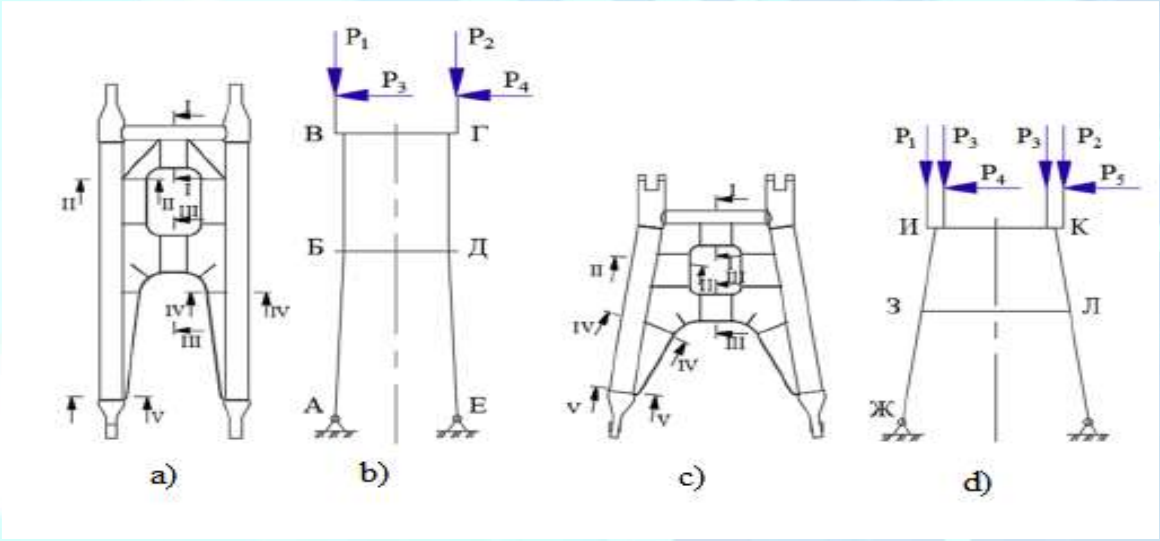
Ekskavatorning ishchi holatida vant troslariga ta’sir etuvchi kuchlar quyidagicha ifodalanadi.

Strelaning oxiriga ulanadigan vant troslari uchun statik muvozanat shartlari:

$$\sum F_y = 0 \text{ va } T_1 sin\alpha_1 + T_2 sin\alpha_2 = G_s + Q, \quad (7)$$

$$\sum F_x = 0 \text{ va } T_1 cos\alpha_1 = T_2 cos\alpha_2, \quad (8)$$

Bu yerda α_1, α_2 – mos ravishda chap va o‘ng troslarning vertikal bilan hosil qilgan burchaklari.



2-rasm. Yuqori (a, b) va balkalarning xarakterli kesimlari (a, c) va hisoblash sxemalari (b, d) strelaning pastki (c, d) seksiyalari:

I - V - kesimlar; AB, BV, VG, BD, DE, JZ, ZI, IK, ZL – balkalar strelalar; P1, P2, P3, P4, P5 - strelaning yuqori va pastki seksiyalarining kuchlari

Vibratsiyali yuklanish quyidagi tebranish differensial tenglamasi bilan ifodalanadi:

$$m\ddot{x} + c\dot{x} + kx = F(t) \quad (9)$$

Bu yerda: m - trosga tushuvchi ekvivalent massa, c – koeffitsient, k - ekvivalent qattiqlik, $F(t)$-vaqtga bog‘liq tashqi kuch (masalan, kovsh zarbasi)

Chiziqli tizim uchun umumiy yechim:

$$x(t) = e^{\tau\omega_n t}(Acos\omega_d t + Bsin\omega_d t) + x_{part}(t) \quad (10)$$

Bu yerda: ω_n- tabiiy tebranish chastotasi, τ- so‘nish darajasi.

MUHOKAMA VA NATIJALAR.

Vant troslarining dinamik yuklanishiga doir ilgari qilingan tadqiqotlar ularning statik tahliliga asoslangan bo‘lsada, bu maqola shuni ko‘rsatadiki, har bir zarba va vibratsiya trosning ish muddatiga bevosita ta’sir qiladi. Ekskavatorning ish sikli davomida zarba kuchlari ularning minimal xizmat muddati chegarasini buzadi. SolidWorks dasturi yordamida quyidagi natijalar olindi:

ISSN 3030-3907

- 3D modelda troslar to‘liq parametrik holatda chizildi;
- Nonmutanosib yuklanish rejimlari (g‘ayri-elastik cho‘zilish) kiritildi;
- Troslar uchun ASTM A586 po‘lat materiali tanlanib, quyidagi xossalar kiritildi: E=2.1 10^5 MPa, v=0.3 m/s va δ=1200 MPa

Yuklanish holatlari quyidagicha sinovdan o‘tkazildi:

- To‘satdan kuch berilishi (impuls zarba);
- To‘xtatish va qayta ishga tushirish holati;
- Maksimal ish holatida 15 soniyali dinamik tebranish.

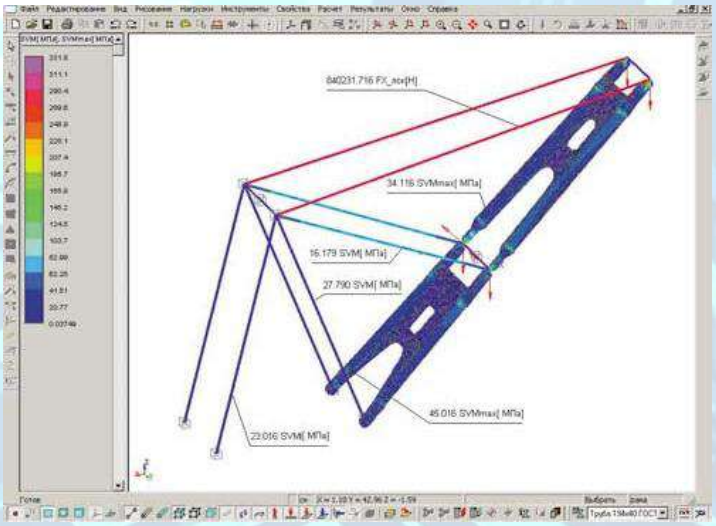
Troslarda maksimal kuchlanishlar quyidagi 1- jadvalda qayd etildi:

1- jadval

Troslarda maksimal kuchlanishlar

Ekskavator tipi	Maksimal kuchlanish δ_{max} MPa	Toliqish xavfi
EKG-8I	860	Yuqori
EKG-10	940	O‘ta yuqori

SolidWorks dasturi yordamida esa aniq zonalar, kuchlanish gradientlari va resurs chegaralari aniqlanishi mumkin. Taklif etilgan geometriya o‘zgarishi troslarga taqsimlanadigan kuchni tenglashtiradi, shunday qilib resurs tejamkorligini oshiradi.



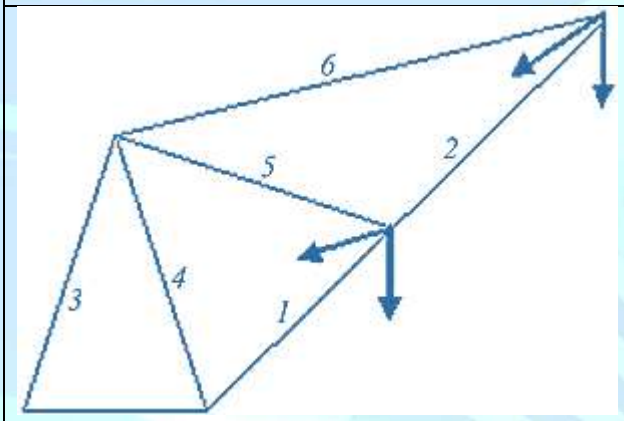
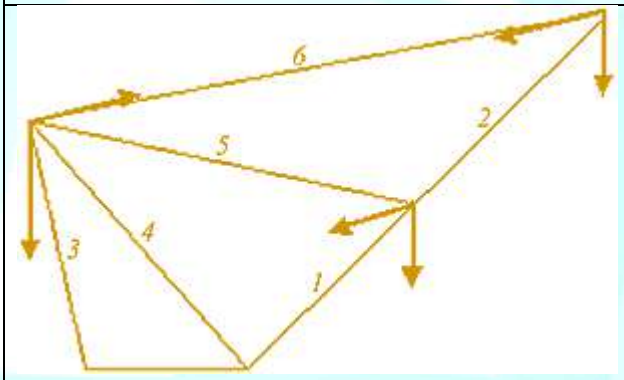
3-rasm. SolidWorks dasturi yordamida ekskavator ishchi uskunalarining 3D modeli

Ishchi organ elementlaridagi kuchlanishlar va strela osma troslaridagi kuchlarning hisoblash natijalari ekskavator ishchi organi elementlarining ikkita joylashuv sxemasi uchun quyida keltirilgan. Har bir sxemada variantlar ikki oyoqli tayanch konfiguratsiyasini o‘zgartirish orqali olingan. Quyidagi 2-jadvalda olingan natijalar va ikki sxemadagi turli variantlar sxemasi va qiymatlari ko‘rsatilgan.

2-jadval

Ishchi organ elementlaridagi kuchlanishlar sxeamsi va qiymatlari

ISSN 3030-3907

1-sxema uchun kuchlanish qiymatlari	
	1-Pastki strela seksiyasi - 47,0 MPa; 2-Yuqori strela seksiyasi - 38,1 MPa; 3-Ikki oyoqli tayanchning orqa bog‘lamasi - 21,0 MPa; 4-Ikki oyoqli tayanchning old bog‘lamasi - 23,8 MPa; 5-Strela bog‘lamasi - 14,2 MPa; 6-Strela osma trosidagi kuch - 830 kN.
2-sxema uchun ishchi a’zo elementlarining kuchlanish qiymatlari	
	1-Pastki strela seksiyasi - 24,1 MPa; 2-Yuqori strela seksiyasi - 36,3 MPa; 3-Ikki oyoqli tayanchning orqa bog‘lamasi - 6,0 MPa; 4-Ikki oyoqli tayanchning old bog‘lamasi - 14,6 MPa; 5-Strela bog‘lamasi – 98,8 MPa; 6-Strela osma trosidagi kuch - 570kN.

XULOSA VA TAKLIFLAR.

Ushbu ilmiy tadqiqot ishida EKG-8I va EKG-10 tipidagi karyer ekskavatorlarining vant troslariga ta’sir etuvchi statik va ayniqsa dinamik yuklanishlar murakkab modellashtirish orqali o‘rganildi. SolidWorks muhitida o‘tkazilgan sonli tahlillar shuni ko‘rsatdiki, zarbli va o‘zgaruvchan yuklanishlar natijasida troslarda yuqklamalar nomutanosib taqsimlanishi yuzaga keladi. Bu esa, ayrim troslarning erta ishdan chiqishiga, shuningdek, strelani xizmat muddatini kamayishiga olib keladi.

Tadqiqot davomida ilgari surilgan konstruktiv yechim – vant troslari burchaklarini optimallashtirish va kuchlarni muvozanatlashtiruvchi elementlar kiritish orqali yuklarning teng taqsimlanishiga erishildi. Buning natijasida maksimal kuchlanish darajasi 10–15% gacha kamaydi, troslarning xizmat muddati 70% gacha uzaytirildi, umumiy ekspluatatsion ishonchlilik oshirildi.

Shuningdek, ekskavatorlarning texnik xizmat ko‘rsatish strategiyasini individual ravishda shakllantirish, hamda favqulodda nosozliklarning oldini olish imkonini beradi. Tadqiqot natijalari ochiq konchilik korxonalarida

ISSN 3030-3907

amaliyotga tadbiq etish uchun muhim nazariy va amaliy asos bo‘lib xizmat qiladi.

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ISSN 3030-3907

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SHLAMLI REJIMNI HOSIL BO'LISHINI BARTARAF ETISH MAQSADIDA TOG' JINSINI PARCHALOVCHI ASBOBNING KONSTRUKSIYASINI TAKOMILLASHTIRISH

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Аннотация. Ушбу мақолада. Суюқлик билан скважинани тубини тозалаб бурғилашда турли қовушқоқликдаги тог ъ жинсларини бурғилашда скважина тубида тог ъ жинсини парчаловчи асбобнинг самарадорлигига салбий таъсир кўрсатувчи омиллар шламли режим ҳосил бўлиши натижасида тоғ жинсини парчаловчи асбобнинг самарадорлигини камайиши муаммолари юзага келади. Скважиналарни суюқлик ёрдамида тозалаб бурғилаш жараёнида, уч шарошкали долотада ва каронкада ҳосил қилинган винтли чизиқ бурғилашда сламли режим ҳосил бўлишини олдини олиш учун тог ъ жинсини парчаловчи асбобнинг такомиллашган конструкцияси ишлаб чиқилди.

Калит сўзлар. Скважина, уч шарошкали долота, винтли чизиқ, каронка, жинс парчаловчи асбоб, шлам.

Аннотация. В данной статье. Факторы, отрицательно влияющие на эффективность инструмента для разрушающих горных пород на дне скважины при бурении скважины с очисткой дна жидкостью при бурении горных пород различной вязкости возникают проблемы снижения эффективности инструмента для разрушения горных пород в результате образования шламового режима. В процессе бурения скважин с жидкостной очисткой была разработана усовершенствованная конструкция инструмента для разрушения горных пород, чтобы предотвратить образование неровностей при бурении винтовой линии, образованной в трехшарнирной долоте и каронке.

Ключевые слова: Скважина, долота трёхшарощечный , винтовая линия, инструмент разрушающий породы, каронка, шлам.

Annotation. In this article. When drilling the surface of the surface of the surface

ISSN 3030-3907

with liquid, when drilling rocks of different viscosity, factors that negatively affect the effectiveness of a rock-shattering tool on the bottom of the surface of the surface of the surface cause problems of reducing the effectiveness of a rock-shattering tool as a result of the formation of a slurry regime. In the process of cleaning and drilling the skewers using liquid, an improved construction of a rock flicker tool was developed to prevent the formation of a slurry mode when drilling a screw line formed in a three-ball dolota and a caronka.

Keywords: Skvajina, three-ball dolota, screw line, karonka, gender flicker tool, sludge.

Кириш

Геотехнологик, технологик ва геологик қидирув скважиналарини тўлиқ забой билан бурғилашда уч шарошкали долоталар кенг қўлланилади, аксарият ҳолатларда ушбу долоталарнинг иш ресурси белгиланганга нисбатан анча паст кўрсаткичга эга.

Бурғиланаётган скважина забойини шлам заррачаларидан самарали тозалаш ва шламли режимнинг салбий оқибатларини бартараф этиш мақсадида тоғ жинсини парчаловчи асбобнинг конструкцияси такомиллаштирилди. Бунда, уч шарошкали долотанинг панжа қисми винтли чизиқ бўйлаб уюрмали эгилтирилди ва куракчалар ўрнатилди, долотанинг ҳаракати давомида ушбу куракчалар ёрдамида шламли суюқликни уюрмали кўтарувчи куч ҳосил қилади, ва шунингдек, шлам заррачаларини долота остки қисмидан скважина деворлари томонга максимал йўналтириб, шлам оқимини таъминлайди.

Уч шарошкали долотанинг панжа қисмининг винтли чизиқ бўйлаб уюрмали эгилтириш бурчаги қуйидаги ифода орқали аниқланди [1;]:

$$\beta = arctg\frac{x}{2\pi d}, \qquad (1)$$

бу ерда, *x* -винтли чизиқнинг йўли,

d–долотанинг ўртача диаметри.

$$x = \frac{Q}{0.1\cdot\frac{\pi}{4}\cdot d\cdot n}, \qquad (2)$$

бу ерда, Q – ювувчи суюқликнинг сарфи, л/с;

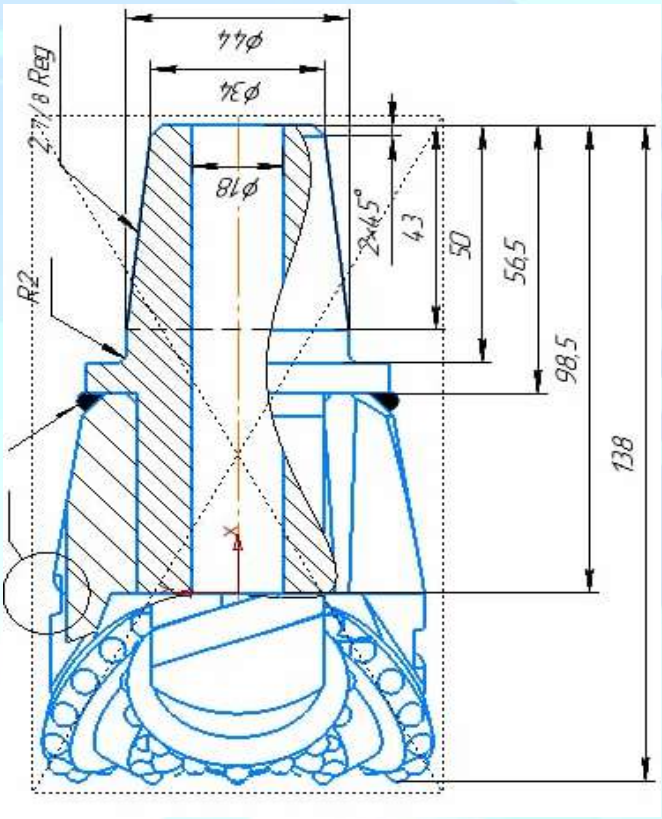
n–долотанинг айланишлар сони, мин$^{-1}$.

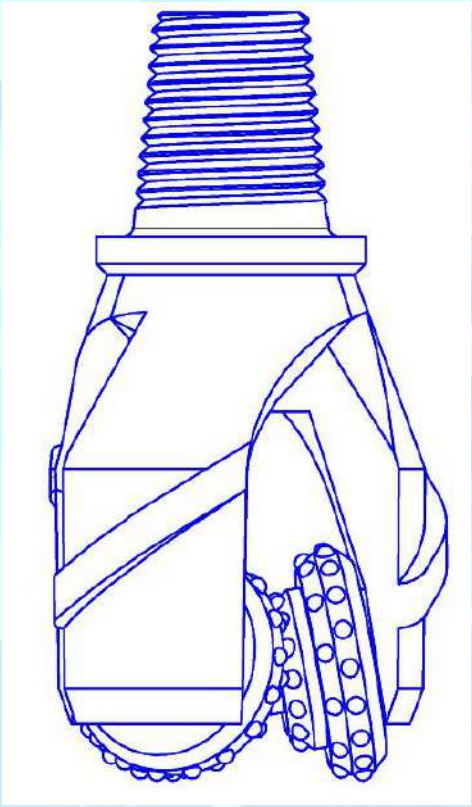
Ҳисоблар натижасида $\beta = 50 - 55°$ катталигида олинди.

Такомиллаштирилган диаметри 76 мм бўлган уч шарошкали

ISSN 3030-3907

долотанинг чизмаси 1-расмда келтирилган.





1-расм. Такомиллаштирилган уч шарошкали долотанинг чизмаси

Уч шарошкали долотанинг панжа қисмини радиал йўналиш бўйича 50°га эгилтирилди, панжа қисмининг устидан эса β=40° бурчак остида қалинлиги 4 мм, баландлиги 2 мм бўлган қаттиқ қотишмали куракча ўрнатилди.

Уч шарошкали долотанинг базавий ва такомиллаштирилгандан кейинги ҳолатларининг кўриниши 1.2 – расмда келтирилган.

ISSN 3030-3907



А Б

2-расм. Базавий (а) ва такомиллаштирилган (б) уч шарошкали долота (∅76 мм)

Уч шарошкали долотанинг панжа қисми конструкциясини такомиллаштиришда, унинг панжасини шаклини ўзгаришининг эвазига ювувчи суюқлик чиқувчи панжалар орасидаги бўшлиқнинг ҳажми ошди, бу 2-расмдан ҳам яққол кўриниб турибди, бунинг эвазига эса, суюқликнинг тескари оқими ҳосил бўлмайди ва шу орқали шламнинг қайта майдаланиши камаяди.

Шунингдек, уч шарошкали долоталарнинг панжа қисмининг ва уюрмали куракчаларни винтли чизиқ бўйлаб турли хил бурчаклар остида эгилтирилган ҳолатлари ишлаб чиқилди (3-расм).

ISSN 3030-3907



А б

а - (β= 60°); б - (β= 65°)

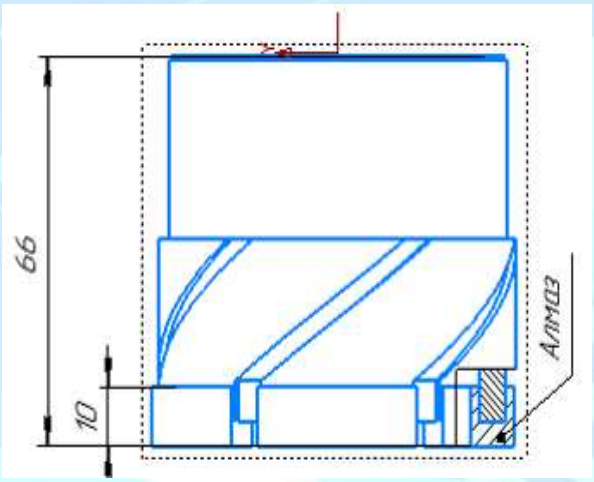
3-расм. Уч шарошкали долоталарнинг панжа қисмининг ва уюрмали куракчаларини винтли чизиқ бўйлаб турли хил бурчаклар остида эгилтирилганлиги

Геологик-қидирув бурғилаш ишларида геологик маълумотларни сифатли олиш мақсадида скважинадан керн шаклидаги намуна олиб бурғиланади, ушбу ҳолатда эса ҳалқасимон коронкалар қўлланилади. Колонкавий бурғилашда ҳам, коронкаларнинг чидамлилигига ва бурғилашнинг механик тезлигига шламли режим салбий таъсир кўрсатади. Бурғилаш коронкаларининг самарадорлигини шламли режим ҳосил бўлишини бартараф этиш асосида ошириш мақсадида уларнинг ҳам конструкциясига ўзгартириш киритилди.

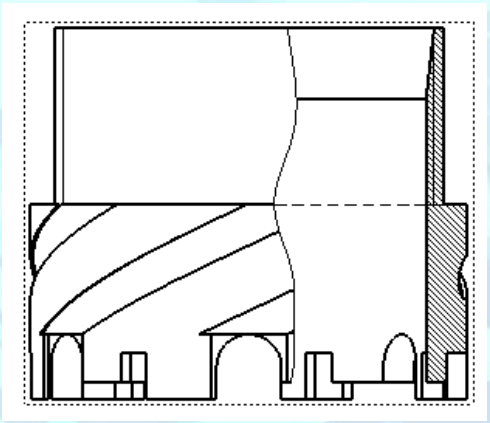
Бурғилаш коронкаларининг конструкциясини такомиллаштиришда, шламли режимни бартараф этувчи куракчаларнинг винтли чизиқ бўйлаб уюрмали эгилтириш бурчаги юқорида келтирилган (7) ифода орқали танлаб олинди.

Қуйида 4-6-расмларда қаттиқ қотишмали тишли ва олмос тишли коронкаларнинг такомиллаштирилган конструкциялари чизмаси ва ҳақиқий кўринишлари келтирилган.

ISSN 3030-3907



А



б

1.4-расм. Олмос тишли (а) ва қаттиқ қотишмали тишли (б) коронканинг такомиллаштирилган конструкциялари (∅76 мм)



А **б** **в**

5-расм. Қаттиқ қотишмали коронканинг такомиллаштирилган конструкциялари

Юқорида 5-расмда келтирилган қаттиқ қотишмали коронкаларлар винтли чизиқ бўйлаб уюрмали эгилтирилган куракчаларининг параметрлари билан фарқланади.

5 а-расмда кўрсатилган коронкада уюрмали эгилтирилган қаттиқ қотишмали куракчаларининг сони 12 та, ҳар бирининг узунлиги 50 мм, коронка танасига 40° бурчак остида ўрнатилган, куракчанинг эни 3,5 мм, баландлиги 2 мм ни ташкил этади.

5 б-расмда келтирилган коронкада эса куракчаларнинг узунлиги ҳудди юқоридаги каби 50 мм ни, сони 6 тани, коронка танасига ўрнатилиш бурчаги эса 35° ни ташкил этади.

5 в-расмда келтирилган коронкада эса куракчалар сони 6 тани, узунлиги 35 мм, ни коронка танасига ўрнатилиш бурчаги эса 30° ни ташкил этади.

ISSN 3030-3907



А б

6-расм. Олмос тишли коронканинг такомиллаштирилган конструкциялари

Диаметри 76 мм бўлган олмос тишли коронка 2 турда такомиллаштирилди 6 а-расмда келтирилган олмос тишли коронкада куракчалар сони 8 та, узунлиги эса 50 мм, коронка танасига жойлашиш бурчаги 40° ни ташкил этади, 6 б-расмда келтирилган коронкада куракчаларини сони юқоридаги каби 8 тани, узунлиги эса 30 мм ни, куракчаларни коронка танасига жойлашиш бурчаги 35° ни ташкил этади.

Такомиллаштирилган тоғ жинсини парчаловчи асбобларнинг экспериментал тадқиқотлари

Скважина тубида шламли режимни ҳосил бўлишини камайтириш ва бартараф этиш мақсадида конструкцияси такомиллаштирилган тоғ жинсини парчаловчи асбобларнинг самарадорлигини аниқлаш учун саноат тажриба-синов ишлари ўтказилди.

Дала шароитида ўтказилган тажриба-синов ишларининг мақсадини тоғ жинсини парчаловчи асбобларнинг чидамлилигини ва бурғилашнинг механик тезлигига таъсирини аниқлаш, ҳамда такомиллаштирилган долоталарнинг юқори эксплуатация кўрсаткичларини таъминловчи рационал иш режимларини аниқлаш ташкил этди.

Тажриба-синов ишлари Навоий кон-металлургия комбинати Давлат корхонаси Геологик қидирув экспедициясининг Марказий геологик қидирув партиясида ҳамда Регионал геология ДУК нинг Марказий-Ўзбекистон партиясида олиб борилди.

Дала шароитида ўтказилган тажриба-синов ишлари қуйидаги тартибда

ISSN 3030-3907

бажарилди, оддий ва такомиллаштирилган уч шарошкали долоталар бир турдаги геологик шароитларда, бурғилашнинг турли хил режимларида долотанинг тўлиқ ишдан чиққунига қадар эксплуатация қилинди. Экспериментал бурғилаш ишлари қаттиқлиги f=7÷8 тоифага тенг бўлган тоғ жинсларида, техник сув ва гил асосида тайёрланган (ППБ маркали гил порошоги (8%), кальцийли сода (0,5%), техник сув (91,5%) бурғилаш суюқлигини қўллаган ҳолатда амалга оширилди. Ҳар бир бурғилаш режими учун тажриба-синовлари 3 мартадан такрорланди.

Тажриба-синов ишлари долотага бериладиган ўқий босим кучи ($P_{ос}$) 7,5 кН, 10 кН, 12,5 кН ва 15 кН катталиклари, ва худди шундай долотанинг айланишлар сони (n) хар бир ўқий босим кучи катталиги учун 80, 100, 120 ва 140 мин$^{-1}$ катталикларида бажарилди.

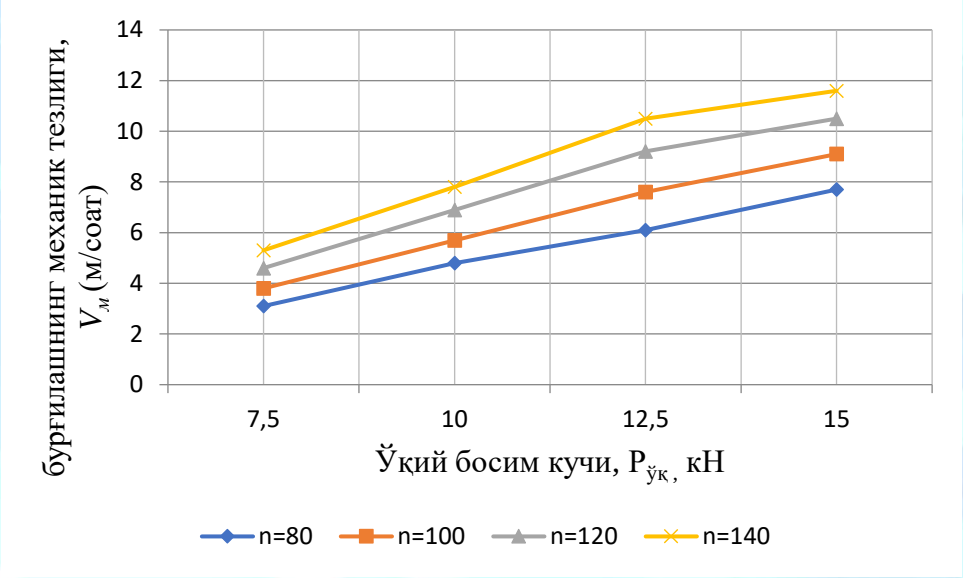
Бажарилган тажриба-синов ишларининг умумлаштирилган ўртача натижалари И. 1-жадвалда келтирилган. [2, 3]

Ўтказилган тажриба-синов ишларининг натижалари уч шарошкали долотанинг скважина ўтиш қобилиятини ҳамда бурғилашдаги механик тезлигини бурғилаш режимининг кўрсаткичларига ва долотанинг конструктив тузилишига, яъни уч шарошкали долотанинг панжа қисмининг ва куракчаларини винтли чизиқ бўйлаб уюрмали эгилганлик бурчагига боғлиқлигини аниқлаш имконини берди.

Тажриба-синов ишлари давомида такомиллаштирилган уч шарошкали долоталарнинг панжа қисмининг ва куракчаларини винтли чизиқ бўйлаб β= 60° ва β= 65° уюрмали эгилганлик бурчакларида оддий долотага нисбатан бурғилашнинг механик тезлиги ($V_м$) ўртача 2 % га, долотанинг чидамлилиги эса 3 % гача ошгани кузатилди.

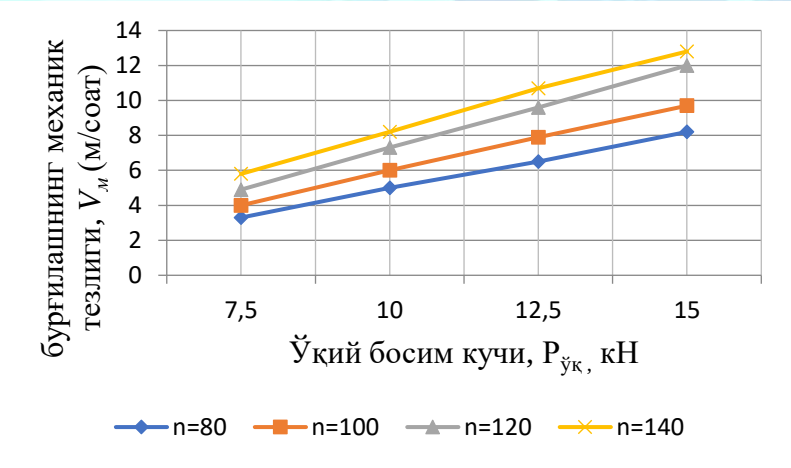
Уч шарошкали долотанинг панжа қисминини радиал йўналиш бўйича 50° га эгилтирилган, панжа қисмининг устидан эса β=40° бурчак остида куракча ўрнатилган конструкцияси эса тажриба-синовлари давомида яхши натижа кўрсатди. Қуйида 4.8- ва 4.9-расмларда оддий ва такомиллаштирилган долотанинг (β= 40°) бурғилаш механик тезлигини ўқий босим кучи ва айланишлар сонига боғлиқлик графиги келтирилган.

ISSN 3030-3907



7-расм. Оддий долотанинг бурғилаш механик тезлигини ўқий босим кучи ва айланишлар сонига боғлиқлиги графиги

Оддий долота билан тажриба-синов ишларини амалга оширганда ўқий босим кучи 7,5 кН ни, долотанинг айланишлар сони 80 мин$^{-1}$ ни ташкил этганда бурғилашнинг механик тезлиги ($V_м$) 3,1 м/соат ни ташкил этди. Ўқий босим кучини ва айланишлар сонини ошириш билан бирга бурғилашнинг механик тезлигини ошиб бориши кузатилди, бунда ўқий босим кучи максимал 15 кН, айланишлар сони 140 мин$^{-1}$ ни ташкил этганда бурғилашнинг механик тезлиги ($V_м$) 11,6 м/соатга етди (4.8-расм).



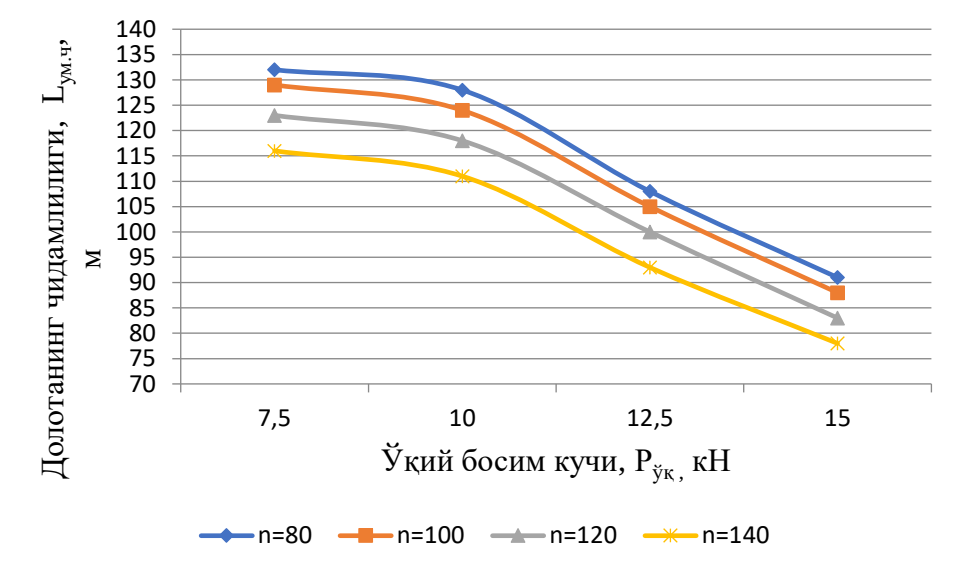
8-расм.Такомиллаштирилган долотанинг (β= 40°) бурғилаш механик тезлигини ўқий босим кучи ва айланишлар сонига боғлиқлиги графиги

Уч шарошкали долотанинг такомиллаштирилган конструкциясини қўллаганда эса ўқий босим кучи 7,5 кН ни, долотанинг айланишлар сони 80 мин$^{-1}$ ни ташкил этганда бурғилашнинг механик тезлиги ($V_м$) 3,3 м/соат ни ташкил этди. Ўқий босим кучини 15 кН ва айланишлар сонини 140 мин$^{-1}$

ISSN 3030-3907

катталигида таъминланганда эса бурғилашнинг механик тезлиги ($V_м$) 12,8 м/соатни ташкил этди. Бунда такомиллаштирилган долотани қўллаш бурғилашнинг механик тезлигини ўртача 6 % гача ошириши кузатилди (4.9-расмга қаранг). Бурғилаш режимининг қолган кўрсаткичларида ҳам бурғилашнинг механик тезлигининг ($V_м$) ҳудди шундай ўсиши кузатилди. [3, 4]

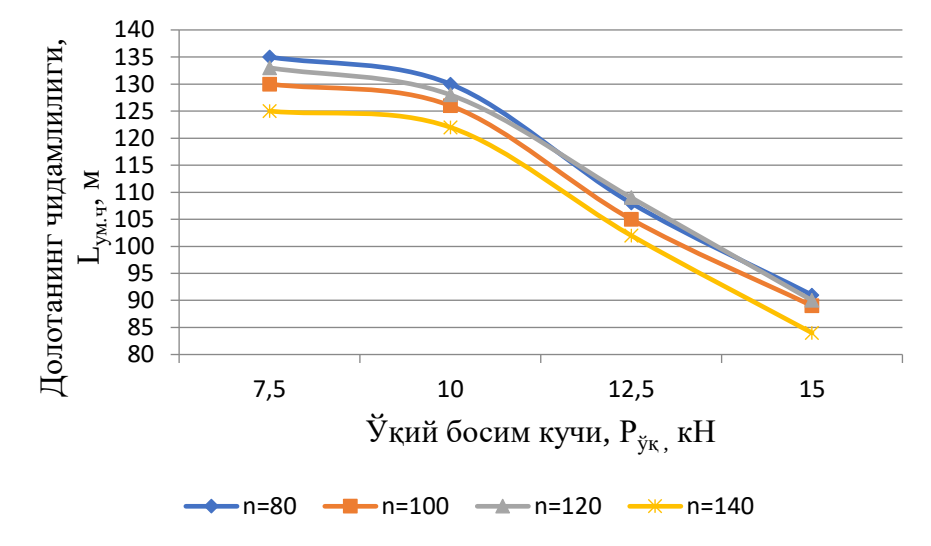
Тажриба-синов ишлари давомида оддий ва такомиллаштирилган уч шарошкали долоталарнинг чидамлилигини бурғилаш режимларига боғлиқлиги тадқиқ қилинди. Қуйида 1.9- ва 4.10-расмларда оддий ва такомиллаштирилган долоталарнинг чидамлилигини ўқий босим кучи ва айланишлар сонига боғлиқлик графиклари келтирилган.



9-расм. Оддий долотанинг чидамлилигини ўқий босим кучи ва айланишлар сонига боғлиқлиги графиги

Скважинани оддий долота билан бурғилаш давомида бурғилаш режимининг қуйидаги катталикларида $P_{ўқ}$=7,5 кН, n=80 мин$^{-1}$, G=6,8 л/с, долотанинг чидамлилиги (ўтиш ресурси) 132 метрни ташкил этди. Айланишлар сонини ҳар 20 мин$^{-1}$ га оширганда долотанинг чидамлилиги 3-4 метрга камайиб борди. Ўқий босим кучини 10 кН га оширганда долотанинг чидамлилиги 128 метрни, ўқий босим кучини 12,5 кН ва 15 кН га оширганда эса 108 ва 91 метрни ташкил этди (4.10-расм). Ўқий босим кучининг ҳудди шундай катталикларида долотанинг айланишлар сонини ошириш долотанинг чидамлилигини камайишига олиб келди. Бурғилаш режими кўрсаткичларининг ошиб бориши натижасида долотанинг чидамлилиги (ўтиш ресурси) камайиб бориши кузатилди.

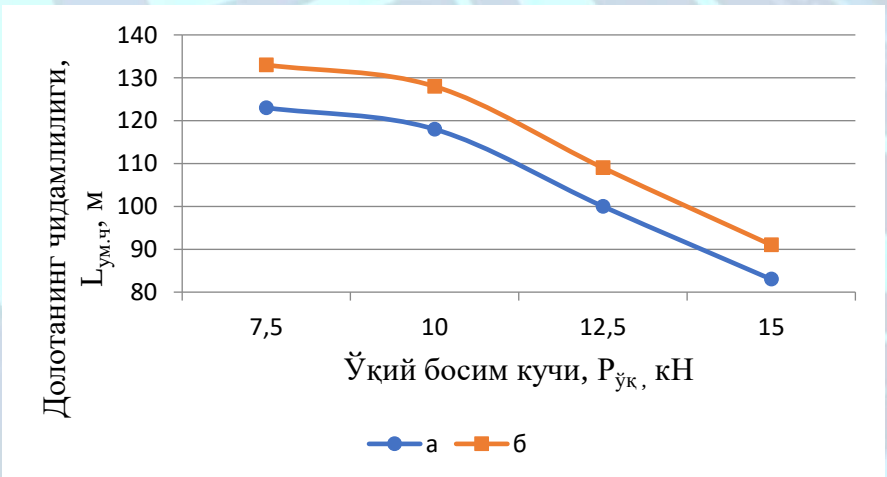
ISSN 3030-3907



10-расм. Такомиллаштирилган долотанинг (β= 40°) чидамлилигини ўқий босим кучи ва айланишлар сонига боғлиқлиги графиги

Такомиллаштирилган долотани қўллаганда эса (10-расм) бурғилаш режимининг $P_{ўк}$=7,5 кН, n=80 мин$^{-1}$, G=6,8 л/с катталикларида долотанинг чидамлилиги 135 метрни, айланишлар сонини 100мин$^{-1}$ га оширганда 130 метрни ташкил этди. Долотанинг айланишлар сонининг 80 ва 100мин$^{-1}$кўрсаткичларида оддий долотани қўллаганга нисбатан такомиллаштирилган долотада деярли чидамлилик ошмади. Долотанинг айланишлар сонининг 120 ва 140 мин$^{-1}$га етказилганда чидамлилик ўртача 8-10 метргача ошгани аниқланди. Бундан келиб чиқиб шуни хулоса қилиш мумкинки такомиллаштирилган долотанинг самарадорлигига долотанинг айланишлар сони 120 мин$^{-1}$ дан ошганда эришилади.

Оддий ва такомиллаштирилган долоталарнинг чидамлилигини долотанинг айланишлар сонининг (n) 120 ва 140 мин$^{-1}$ катталикларида қиёсий графиклари 11- ва 12-расмларда келтирилган. [5,6]

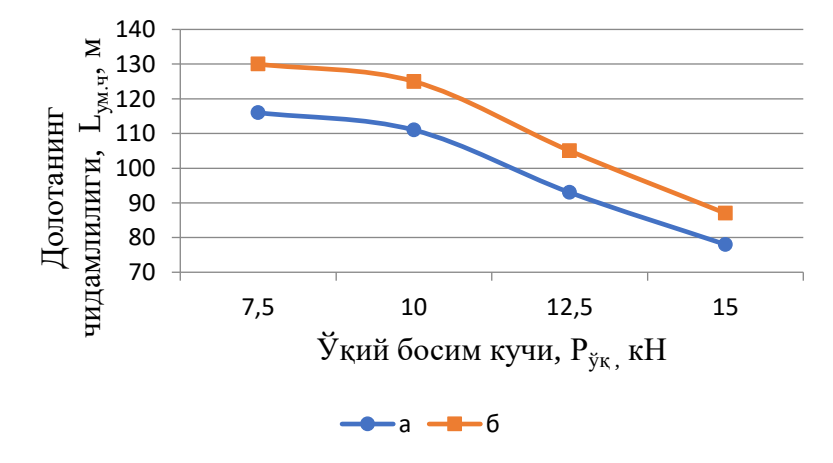


а-оддий долота; б-такомиллаштирилган долота

ISSN 3030-3907

11-расм. Оддий ва такомиллаштирилган долотанинг айланишлар сони (*n* = 120)бўлганда чидамлилигини ўқий босим кучи ва айланишлар сонига боғлиқлиги графиги

Долотага бериладиган ўқий босим кучининг 7,5 кН катталигида айланишлар сони 120 мин$^{-1}$ бўлганда (11-расм), оддий долотанинг чидамлилиги 123 метрни, такомиллаштирилган долотанинг чидамлилиги эса 133 метрни ташкил этди. Ўқий босим кучини ошиб бориши натижасида ҳар иккала долотада ҳам чидамлилик камайиб борди, бироқ такомиллаштирилган долотанинг чидамлилиги ўртача 7-8 % га юқорилиги сақланиб қолди.



а-оддий долота; б-такомиллаштирилган долота

12-расм. Оддий ва такомиллаштирилган долотанинг айланишлар сони (*n* = 140) бўлганда чидамлилигини ўқий босим кучи ва айланишлар сонига боғлиқлиги графиги

Долотанинг айланишлар сони (n) 140 мин$^{-1}$ га етказилганда (12-расм), ўқий босим кучининг ($P_{ос}$) 7,5 кН катталигида оддий долотанинг чидамлилиги 116 метрни, такомиллаштирилган долотанинг чидамлилиги эса 130 метрни ташкил этди, бунда долотанинг чидамлилиги 14 метрга ошди. Ўқий босим кучининг бошқа кўрсаткичларида ҳам ҳудди шундай ўсиш кузатилди.

Юқорида келтирилган тажриба-синов ишларини натижаларини таҳлил қилиш асосида шуни таъкидлаш мумкинки, такомиллаштирилган уч шарошкали долота скважина забойида шламли режим ҳосил бўлишини камайтириш асосида бурғилашнинг механик тезлигини ($V_м$) ва долотанинг чидамлилигини оширади. Шунингдек, ўтказилган тажриба-синовлари натижасида шу аниқландики, таклиф этилаётган долотанинг юқори самарадорлилиги унинг айланишлар сони (n) 120-140 мин$^{-1}$, ўқий босим кучи 10-12,5 кН катталикларида таъминланади.

Шундай қилиб, уч шарошкали долотанинг панжа қисмини радиал йўналиш бўйича 50° га эгилтирилиб, панжа қисмининг устидан эса β=40°

ISSN 3030-3907

бурчак остида қаттиқ қотишмали куракча ўрнатилиб такомиллаштирилган конструкциясини қўллаш, бурғилашнинг муъайян режимларида оддий долоталарга нисбатан бурғилашнинг механик тезлигини 6 % гача, долотанинг чидамлилигини 8 % гача ошириши аниқланди.

Хулоса

Шундай қилиб, уч шарошкали долотанинг панжа қисмини радиал йўналиш бўйича 50° га эгилтирилиб, панжа қисмининг устидан эса β=40° бурчак остида қаттиқ қотишмали куракча ўрнатилиб такомиллаштирилган конструкциясини қўллаш, бурғилашнинг муъайян режимларида оддий долоталарга нисбатан бурғилашнинг механик тезлигини 6 % гача, долотанинг чидамлилигини 8 % гача ошириши аниқланди.

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ISSN 3030-3907

YUQORI KUCH UZATMA JAMLANMASINING TEXNIK KO`RSATKICHLARI VA AFZALLIKLARINI TAVSIFLASH

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Annotatsiya. Maqolada neft va gaz quduqlarini burg‘ilash sanoatida qo‘llaniladigan zamonaviy, eng yangi texnologik jihozlar kompleksi bo‘lgan yuqori kuch uzatmasi jamlanmasining qo‘llanilishi, burg‘ilash jarayonini soddalashtirib, ish unumdorligini oshirish, ortiqcha sarf xarajat, texnika va texnologiyasi, vaqt va ishchi kuchini sarfini kamaytirish imkonini beradi. Burg‘ilash qurilmasining yuqori kuch uzatma jamlanmasi bir qator murakkab texnologik operatsiyalarni ta’minlashi mumkin bo‘lgan burg‘ilash qurilmalari uchun printsipial yangi turdagi mexanizmlar shaklida taqdim etilgan.

Kalit so‘zlar: quduq, quduqlarini burg‘ilash, texnologik jihozlar kompleksi, burg‘ilash sanoati, dizel agregati, quvurlar tizmasi, burg‘ilash uskunasi.

Аннотация Применение в статье современных, новейших комплексов технологического оборудования, применяемых в буровой промышленности нефтяных и газовых скважин, позволит упростить процесс бурения, повысить производительность работ, сократить затраты на перерасходы, технику и технологии, время и рабочую силу. Верхний силовой привод буровой установки представлена в виде принципиально нового типа механизмов для буровых установок, которые могут обеспечить ряд сложных технологических операций.

Ключевые слова: бурение скважин, скважина, комплекс технологического оборудования, буровая промышленность, дизельный агрегат, трубопровод, буровое оборудование.

Annotation: The use in the article of modern, state-of-the-art technological equipment used in the oil and gas well drilling industry will make it possible to simplify the drilling process, increase the productivity of work, reduce the cost of overspending, equipment and technologies, time and labor. The upper power drive of the drilling rig is presented in the form of a fundamentally new type of mechanism for drilling rigs, which can provide a number of complex technological operations.

ISSN 3030-3907

Keywords: well drilling, well, complex of process equipment, drilling industry, diesel unit, pipeline, drilling equipment.

Kirish

Yuqori kuch uzatma jamlanmali burg‘ilash qurilmalari – bu, asosan, aylantirgichning harakatli turi bo‘lib, salnik-vertlyug bilan ta’minlangan. Bugungi kunda yuqori kuch uzatma jamlanmalari jahonda burg`ilash ishlari amaliyotida keng qo‘llanilmoqda.



1 – rasm. Burg‘ilash qurilmasining yuqori kuch uzatma jamlanmasi.

Yuqori kuch uzatma jamlanmasining ishlash prinsipi.

Yuqori kuch uzatma jamlanmali o‘zining mukammalligi, keng ko‘lamli imkoniyatlari, birinchi navbatdagi funktsiyalar va texnologik operatsiyalarni bajarishga qobiliyati tufayli burg‘ilash sohasida jahon amaliyotida keng qo‘llanilmoqda. Uskunalar birinchi navbatda quduqlarni burg‘ilash jarayonida burg‘ilash tizmasining uzluksiz aylanishini ta’minlab beradi. Bundan tashqari, ushbu tizim quduq devoriga ishlov berish va quduq diametrini kengaytirishda qo‘llanilishi mumkin. Yuqori kuch uzatma jamlanmali burg‘ilash qurilmalari quduqni burg‘ilash vaqtida qo‘llaniladigan burg`ilash quvurlarini qo‘shish va quduqlarni mustahkamlash uchun jalb qilinishi mumkin. Elektr yoki dizel agregatli

ISSN 3030-3907

yuqori kuch uzatma jamlanmasi quvurlar tizmasini biriktirish orqali burg‘ilash quvurlar tizmasini hosil qilishda katta yordam ko‘rsatishi mumkin.

Ta’kidlash joizki, elektr yoki dizel agregatli yuqori kuch uzatma jamlanmasi mustahkamlash tizmalarini tushirishga qaratilgan operatsiyalarni sezilarli darajada soddalashtirishi mumkin. Bundan tashqari, tizim quduq tubi dvigateli qo`llanilganida burg'ilash quvurlar tizmasini aylantirishga yordam beradi. Ushbu tizim quduqni tezroq yuvish va quvurlarni quduqqa tushirishni osonlashtirishi mumkin.

Burg‘ilash qurilmasining yuqori kuch uzatma jamlanmasi ko‘rinishida taqdim etilgan tizim, ya’ni uning harakatli qismi vertlyug va burg‘ilash reduktoridan iborat bo‘lib, ular sirg`a yordamida tal blokining traversiga o‘rnatiladi. Bu tizim barcha turdagi jinslarni burg‘ilashni yanada yaxshilaydi. Shuningdek, bu usulda burg'ilash ayniqsa, uzoq shimolning ekstremal sharoitida amalga oshirilishi mumkin. Vertlyug-reduktor tizimi joylashgan qopqoq ikki gidromotor bilan jihozlangan. Burg‘ilash shu tarzda yuz beradi, gidroval konstruksiyasiga kiruvchi gidroval reduktor valining korpusi bilan bevosita ulanadi. Tizim shunday yaratilganki, gidravlik tormoz burg'ilash tizmasini tormozlash uchun maxsus mo'ljallangan gidravlik dvigatellardan biriga o'rnatiladi. Yon tomonidan vertlyug korpusiga rama o‘rnatiladi. Rama orqali tizim yo‘naltiruvchi uskunaga aylanish momentini uzatadi. Quvur manipulyatori elevatorni zarur yo‘nalishda aylantiradi. Bu qabul qiluvchi ko‘priklar, quvurlarni uzaytirish uchun mo‘ljallangan shurf yoki boshqa tomon bo‘lishi mumkin.

Burg'ilash moslamasining yuqori kuch uzatma jamlanmasi quvur qisqichi bilan jihozlangan bo'lib, bu vertlyug yechilganda quvurning yuqori muftasini ushlab turish va aylanishini oldini olish uchun kerak. Agregat shunday jihozlanganki, vertlyug tanasi va nippel orasiga qo‘lda sozlanuvchi sharli kran o`rnatilgan. U tizimga vertlyug o‘rtasidagi ichki teshikni operatish berkitish uchun kiritilgan. UnI ichki preventor o`rnida ishlatish mumkin. Uning yordamida burg'ilash tizmasini aylantirgandan keyin to'plangan yuvish suyuqligining qoldiqlari saqlanib qoladi.

Sirg`alar tizimi elevatorni quduq o‘rtasiga olib kelish va yaqinlashishni amalga oshiradi. U traverslarning yon shoxlariga biriktiriladigan sirg`alar shaklida namoyish etiladi.

Sirg`alarning qarama-qarshi tomonida gidravlik tsilindrlar biriktirilgan bo'lib, ularning u yoki bu yo'nalishda og'ishini ta'minlaydi.

Burg'ilash moslamasining yuqori kuch uzatma jamlanmasining asosiy xususiyati - burg'ilash jarayonini parallel ravishda to'xtatmasdan, quduqni

ISSN 3030-3907

burg'ilashning davom etayotgan har qanday bosqichlarida qurilmani o'rnatish mumkin.

Burg'ilash moslamasining yuqori kuch uzatma jamlanmasining turlari.

Burg'ilash uskunasining yuqori kuch uzatma jamlanmasining elektr ta'minoti iste`moli usullariga qarab tasniflanadi, ular quyidagilar bo'lishi mumkin:

1. Doimiy tok tarmog‘i orqali;
2. O‘zgaruvchi tok tarmog‘i orqali;
3. Gidravlik;
4. Elektr.

Bundan tashqari, ushbu agregatlarni qo‘llash usullariga qarab bir necha sinflarga ajratiladi. Ular quyidagicha:

1. Dengizda;
2. Quruqlikda;
3. Statsionar;
4. Mobil.

Zamonaviy tizimlar umumiy o'lchamlarni sezilarli darajada qisqardi. Bu, birinchi navbatda, jihozni loyihalashda ikkita ixcham elektrodvigateldan foydalanish bilan bog'liq. Bundan tashqari, ushbu elektrodvigatellar endi o'zgaruvchan tokdan foydalangan holda ko'pgina qurilmalarda ishlaydi.

Bu tezlik va aylanish momenti kabi xususiyatlarning sifat jihatidan yaxshilanishiga olib keladi. Burg‘ilash uskunasining yuqori kuch uzatma jamlanmasining zamonaviy tizimlarida qo‘llaniladigan o‘zgaruvchi tok dvigateli kommunikatsiya tizimlari va himoya vositalariga ehtiyoj bo‘lmaydi. Bu murakkab va xavfli sovitish tizimini bekor qilish imkonini beradi. O‘zgaruvchi tok dvigatellari orqali aylantirish momenti 350 ot kuchi hosil qilinmoqda. Ularning har biri 1200 ot kuchiga teng quvvatga ega bitta elektr dvigatel tomonidan yaratilgan momentga teng. Taqdim etilgan dvigatellar to'xtash joyidan to'liq tezlashishga maksimal nominal o'tish bilan aylanish moment hosil qilishga qodir. Bunga asoslanib, 220 aylanish tezligiga qadar daqiqada 110 momentga teng tezlikda moment 47,300 kg/m ni tashkil qiladi. Konstruksiya shunday loyihalanganki, ikkita oddiy o'zgaruvchan tok dvigateli butun burg'ilash tizimining eng muhim qismiga aylandi. Oddiy rejimdagi dvigatellar burg'ilash qurilmasi tomonidan ishlab chiqarilishi mumkin bo'lgan 600 va 480 voltli o'zgaruvchan kuchlanishli tarmoqdan ishlashga qodir. Bundan tashqari, kerakli kuchlanish 50 voltga teng doimiy tokni o‘zgartirish natijasida mumkin va yuqori kuchlanishli elektr uzatish tizimlariga uzatilishi mumkin. Bu xususiyatlar uskunani har qanday elektr tizimida ishlatishga imkon beradi. Zamonaviy agregatlarda yo‘naltiruvchi balkaning

ISSN 3030-3907

og`irligi kamaydi. Endi tizim 44 metr balandlikdagi machtalarga o'rnatilishi mumkin, bunda bo'shliq 3,6 metrdan oshmaydi.

Yangi modifikatsiyalarda aylanish momenti machta korpusiga emas, balki yo‘naltiruvchi balka bo‘ylab, to'g'ridan-to'g'ri tashuvchi ramaga va pastki poydevorga uzatiladi. Zamonaviy tizimlarning o'rtacha yuk ko'tarish quvvati 400 tonnaga yetishi mumkin va uning ishlashi kichik va o'rta turdagi burg'ilash qurilmalarida amalga oshiriladi. Butun konstruktsiyani sezilarli darajada soddalashtirish natijasida agregatni ta’mirlash va xizmat ko‘rsatish bilan bog‘liq xarajatlar darajasi sezilarli darajada kamaytirildi. Ikkinchi darajali integratsiyalangan gidravlika tizimini qo‘shish natijasida montaj ishlarining barcha bosqichlari sezilarli darajada soddalashtirildi. Jihozning eng yaxshi xususiyatlaridan biri - bu dvigatelning yuqori samaradorlik bilan xavfsiz ishlashini ta'minlaydigan intervalgacha momentning mavjudligi. Bu, ayniqsa, qo'shimcha burg'ilash elementlarini biriktirish va yechishda muhim ahamiyatga ega. Ushbu konstruktorlik yechimi quvur qisqichi yoki quvur manipulyatoriga bo'lgan ehtiyojni yo'q qiladi. Bularning barchasi agregatning konstruksiyasini sezilarli darajada soddalashtiradi, uning og'irligi va narxini sezilarli darajada kamaytiradi. Qisqichning oddiy konstruksiyasi shunday ishlab chiqilganki, yuqori va o'rta qulfni ushlaganda, burg'ilovchi quvurlar tizmasini to`liq aylantiradi. Qurilma ikkita o'rnatilgan xavfsizlik klapanlari bilan jihozlangan. Yuqori qismi masofadan boshqarilishi mumkin va burg`ilash eritmasi ruxsatsiz chiqarilganda yuqori darajadagi xavfsizlikni kafolatlaydi. Klapan aylanuvchi kuch uzatmasi boshiga ulanadi, buning yordamida shamlar va qiyalanuvchi sirg`a mexanizmlari bilan ishlash mumkin.

Qiyalanuvchan sirg`alar ikki tomonlama gidravlik mexanizm tarkibiga kiradi, u qiyalanuvchan sirg`alarlarni qo`llash tufayli harakatlanuvchi elementlarning 60 santimetrdan ortiq masofaga chekinishini ta’minlaydi. Gidravlik kompensator tizimining mavjudligi svecha bog`lovchi bilan ulangan vaqtda kompensator amortizatsiya paydo bo'lishiga imkon beradi. Bunday holda, quvurlar ohista polga qo`yiladi va vintni ochish paytida shpal muftadan ajratiladi.

Oddiy va ixtisoslashgan muzlatish tizimi xizmat ko‘rsatuvchi kontur, nasos va oraliq sovutgichning qo'shmaslik qo‘ymaslik uchun qo‘llaniladi. Agregatni o'rnatish jarayoni o'rtacha sakkiz soatdan oshmaydi. Bunday holda, ulanish ishlarining bir qismi butun o'rnatish keyingi ish joyiga kelgunga qadar amalga oshirilishi mumkin. Shlang kabeli o'ttiz metr balandlikda, machtaga biriktirilgan.

Xizmat ko‘rsatuvchi konturga ulanishni ta'minlash uchun tez ajraladigan ulash elementlaridan iborat bo`lgan uzel oldindan hosil bo'ladi. Ushbu maqsadlar

ISSN 3030-3907

uchun maxsus taqsimlash qutisi ham ishlatilishi mumkin. Boshqaruv amalga oshirilayotgan asosiy konsol burg'ilash panelida joylashgan.

Boshqaruv paneliga o'rnatilgan harfli – raqamli monoxrom displeyning mavjudligi nazorat va o'lchash guruhi asboblarining barcha ko`rsatkichlarini kuzatishni ancha osonlashtiradi. U joriy xizmat ko'rsatish rejimi, bajarilgan ish vaqti, soniyada aylanishlar soni va boshqalarga oid ma'lumotlarni ko'rsatadi.

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ISSN 3030-3907

KARYER GIDRAVLIK EKSKAVTORLARNING TO‘XTALISH SABABLARINING TAHLILI

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Annotatsiya. Ushbu maqolada mamlakatimizning foydali qazilma konlarida qo‘llaniladigan gidravlik ekskavatorlarning asosiy nosozliklari tahlili o‘tkazilgan bo‘lib, gidravlik qismlarining nosozliklari tufayli to‘xtalishlar ulishlari keltirilgan. Ishlab chiqish jarayonida gidravlik tizimlarning ish holati va yuzaga kelgan salbiy omillarning tadqiqoti olib borilgan va ularning natijalari tahlil qilingan.

Tayanch so‘zlar: Gidravlik tizimlar, ishchi suyuqlik, bosim, harorat, yuqori bosim rukav, zichlagichlar,gidrodvigatel, nasos.

Аннотация. В данной статье проведен анализ основных неисправностей гидравлических экскаваторов, применяемых на месторождениях полезных ископаемых нашей страны, приведены доли остановок из-за неисправностей гидравлических деталей. В процессе разработки проводилось исследование рабочего состояния гидросистем и возникших неблагоприятных факторов, анализировались их результаты.

Ключевые слова: гидравлические системы, рабочая жидкость, давление, температура, рукав высокого давления, уплотнитель, гидродвигатель, насос.

Abstract. This paper analyses the main faults of hydraulic excavators used in the mineral deposits of our country, the shares of stoppages due to faults of hydraulic parts are given. In the process of development the research of the working condition of hydraulic systems and the adverse factors occurred was carried out, their results were analyses.

Key words: hydraulic systems, working fluid, pressure, temperature, high-pressure hose, seal, hydraulic motor, pump.

Kirish

Gidravlik ekskavatorlarning to‘xtalishlari berilgan reja asosida, ekspluatasion, texnologik va texnik normativlaridan belgilanmagan holatidir. Gidravlik ekskavatorning to‘xtalishlarini keltirib chiqaruvchi sabablari rejalashtirilgan va rejalashtirilmagan bo‘ladi [1,2,3].

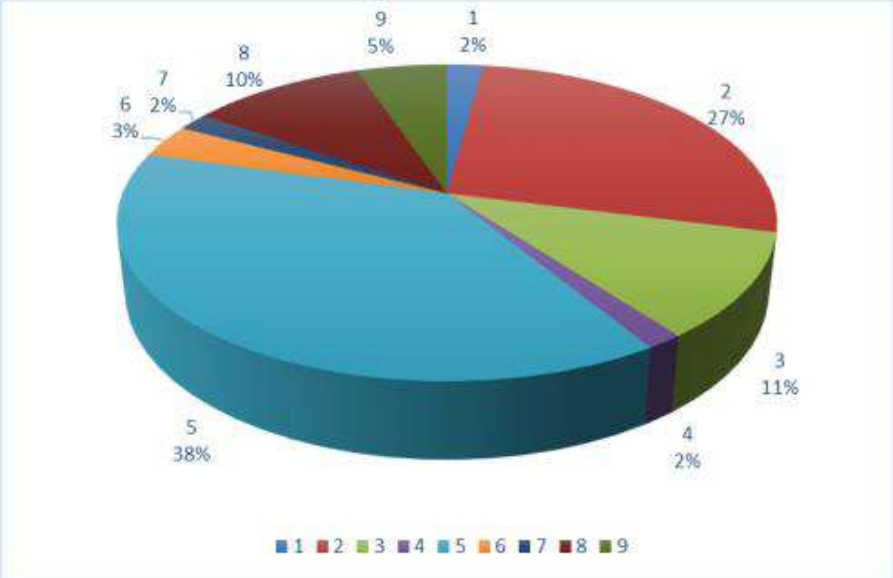
Rejalashtirilgan holatida to‘xtalishlar gidravlik ekskavatorning ekspluatasiyasi normativ hujjatlari asosida berilgan reglamentga asosan amalga oshiriladi. Bularga kabel liniyalarining montaji, rejali profilaktika ta'mirlash, yoqilg‘i quyish, burg‘ilash portlatish ishlarining olib borilishi, texnik xizmat ko‘rsatish va zaboyni tayyorlash ishlari kiradi [4,5].

ISSN 3030-3907

Rejalashtirilmagan holatida texnik va tashkiliy to‘xtalishlarga ajraladi. Texnik holatiga turli xil ta'mirlash ishlari kiradi. Tashkiliyga esa avtosamosvalni yuklashda kutish, yoqilg‘ining tugab qolishi, elektr energiyaning oshishi, burg‘ilab portlatish ishlarini berilgan normadan oshib ketishi, negabaritlarning xalaqit berishi, yo‘l sharoiti, ta'mirlash ishlarining muddati oshib ketishlari kiradi [6,7].

ADABIYOTLAR TAHLILI. Mamlakatimizning foydali qazilma konlarida qo‘llaniladigan gidravlik ekskavatorlarning ishini tahlili shuni ko‘rsatadiki, to‘xtalishlarning 2 % akkumulyatorning, 27 % ichki yonuv dvigatelining, 11 % nasosning, 2% avtomatik moylash tizimi, 38% gidravlik tizim butlovchi detallarining yo‘qligi natijasida to‘xtalish, 3% gidravlik qismlarining, 2% cho‘michning, 10% yuqori bosim rukavlari, 5% gidrotizim gidroyuritmasining nosozliklariga to‘g‘ri keladi[8].

1- rasmda gidravlik ekskavatorlarning to‘xtalishlari sabablarining hissalari ko‘rsatilgan.



1 – akkumulyatorning nosozligi; 2 – ichki yonuv dvigatelning nosozligi; 3 – nasosning nosozligi; 4 – avtomatik moylash tizimi nosozligi; 5 – gidravlik tizimning detallarini tiklash uchun zahira yo‘qligi uchun to‘xtalishi; 6 – gidravlik qismlarning nosozliklari; 7 – cho‘michning nosozligi; 8 – yuqori bosim rukavlari nosozligi; 9 – gidrotizim gidroyuritmasining nosozligi

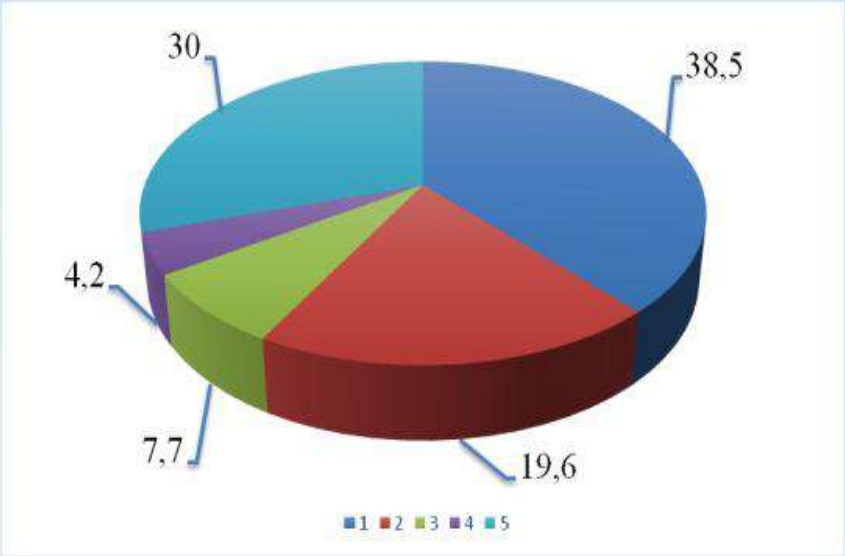
1-rasm. Gidravlik ekskavatorlarning to‘xtalishlari sabablari

Gidravlik tizim tomonidan umumiy yuzaga keladigan to‘xtalishlar o‘rtacha 70 % ga to‘g‘ri keladi. Gidravlik tizimning ishdan chiqish turlarining to‘xtalish hissasiga nisbatan ko‘radigan bo‘lsak, shulardan 38,5% ni gidrosilinrdan, yuqori bosimli rukavdan, aylanish gidrodvigatelidan va zichlagichlarning emirilishi natijasida ishchi suyuqlikning sirg‘ib ketishi sababli yuzaga keladigan to‘xtalishlar egallaydi. Quvurlarning yorilishi va rukavlarning ishqalanishi natijasida emirilishi

ISSN 3030-3907

sababli to‘xtalishlar 19,6% ni tashkil etadi, gidrosilindrning ishdan chiqishi 4,2 % va yuqori bosimli rukavlarning yorilishi va fiting qismidan ajralishi natijasidagi to‘xtalishlar 7,7 % ni tashkil etadi[8].

2-rasmda karer gidravlik ekskavatorlarining gidravlik tizimida yuzaga keladigan nosozliklar keltirilgan.



1 – ishchi suyuqlikni sirg‘ib ketishi; 2 – quvurlarni yorilishi va rukavalarning ishqalanishida emirilishi va egilishi; 3 – yuqori bosim rukavalarni yorilishi va fiting qismining uzilishi; 4 – gidrosilindirning ishdan chiqishi; 5 – boshqa nosozliklar

2-rasm. Karer gidravlik ekskavatorlarining gidravlik tizimida yuzaga keladigan nosozliklar

Yuqoridagi keltirilgan ma'lumotlarning tahlili shuni ko‘rsatadiki, murakkab kon-geologik sharoitli foydali qazilma konlarida qo‘llaniladigan gidravlik ekskavatorlarning ekspluatasion ko‘rsatkichlariga uning gidravlik tizimining ishi sezilarli darajada ta'sir ko‘rsatadi.

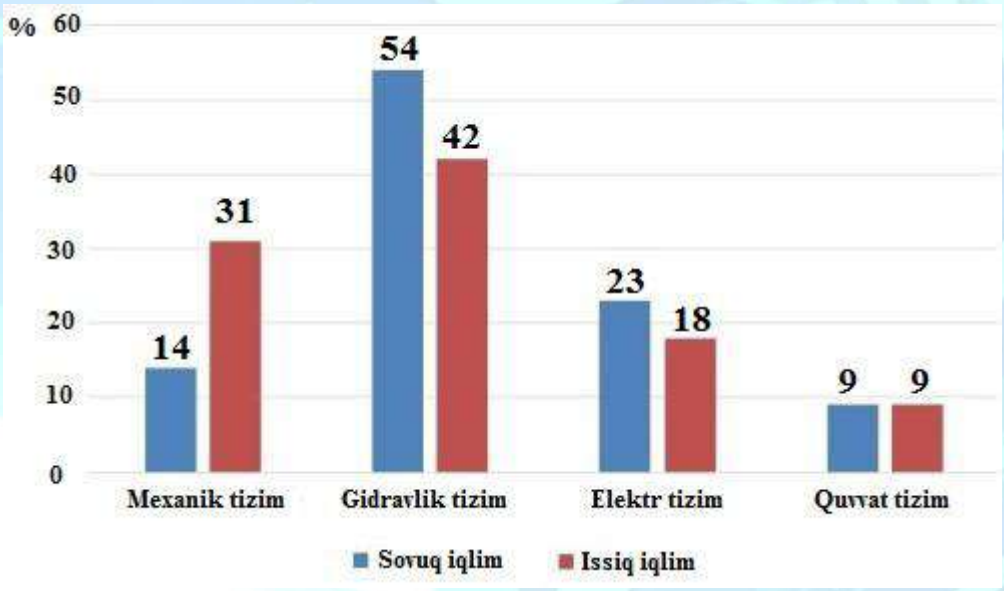
Yuqorida keltirilgan gidravlik tizimning to‘xtalishlarini keltirib chiqaruvchi asosiy nosozliklarni bartaraf etish va ularning yuzaga kelishini oldini olish evaziga karer gidravlik ekskavatorlarining umumiy ishini yaxshilash va ekspluatasion tannarxini kamaytirishga erishiladi.

TADQIQOT METODOLOGIYASI. Karer gidravlik ekskavatorlarining ekspluatasion unumdorligining pasayishi iqlim va ishlatilish sharoitlariga bog‘liq bo‘ladi. Noqulay iqlim va murakkab ish sharoitlari gidravlik tizim qismlari ish resursining kamayishiga olib keladi, natijada tizimning umumiy ish ko‘rsatkichlari yomonlashadi.

Dunyoda qo‘llanilayotgan karer gidravlik ekskavatorlarining ishi tahlili shuni ko‘rsatadiki, sovuq iqlimli hududlarda ishlayotgan ekskavatorlarning umumiy ishdan chiqish holatining 54% gidravlik tizimning nosozliklari bilan

ISSN 3030-3907

bog‘liq. Iliq iqlimli o‘lkalarda esa bu ko‘rsatkich 42% ni tashkil etadi. 3-rasmda dunyoda foydali qazilma konlarida qo‘llanilayotgan gidravlik ekskavatorlarning tizimlaridagi nosozliklar ko‘rsatkichlari keltirilgan.



3-rasm. Gidravlik ekskavatorlar tizimlarining nosozliklari ko‘rsatkichlari

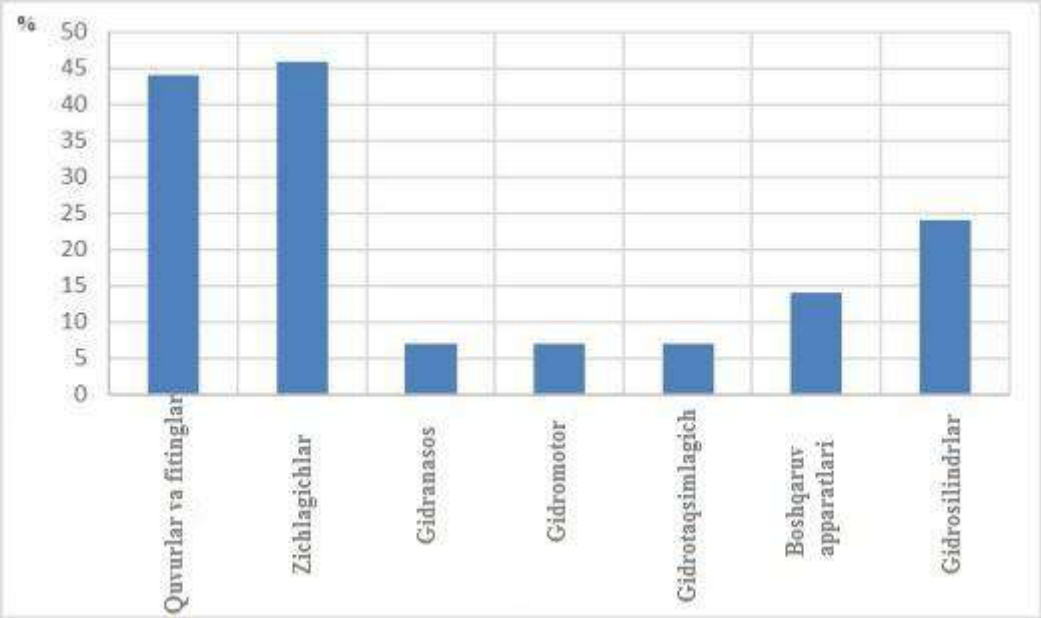
Karer ekskavatorlarining gidravlik tizimi nosozliklari bir qancha omillarga bog‘liq bo‘lib, ularni asosan, ekspluatasiya jarayonida xizmat ko‘rsatish qoidalariga amal qilmaslik, ish rejimlarining yuqori zo‘riqish bilan ishlashi, gidravlik suyuqliklarda gazlar yig‘ilib qolishi va ularning ifloslanishi, noqulay iqlim sharoitlari, ya'ni havo haroratining keskin o‘zgarishi va texnik faktorlar tashkil etadi.

4-rasmda gidravlik ekskavatorlarning gidravlik tizimi qismlari nosozliklarining hissalari keltirilgan.

Mamlakatimizdagi foydali qazilma konlarining ma'lumotlariga ko‘ra, karer gidravlik ekskavatorlarining nosozliklari tizimlari bo‘yicha qilingan tahlil shuni ko‘rsatadiki, gidravlik tizimdagi nosozliklar 59 % ni, kuch yuritmalaridagi nosozliklar 24 % ni va mexanik qismlardagi nosozliklar 13% ni tashkil qiladi.

Ochiq konlarda changlanganlik holati yuqori bo‘lganligi sababli, gidravlik tizimlarning ulanish qismlarida ishchi suyuqliklarning sirqishi natijasida ulanish yuzalarida moylanish hosil bo‘ladi va ko‘p miqdorda chang zarrachalari yig‘ilib qoladi. Bu esa, o‘z navbatida, tizimda harorat almashinuvini yomonlashtiradi va gidravlik tizimning nosozliklariga sabab bo‘ladi.

ISSN 3030-3907



4-rasm. Gidravlik tizimdagi nosozliklar

Navoiy kon-metallurgiya kombinati ochiq konlarida kuchli changlanganlik tufayli 5-rasm ko‘rinishidagi kabi gidravlik ekskavatorning harakatlanish qismlarida, gusenisalarida o‘rnatilgan gidromotorlarning ishchi suyuqligi yuqori magistral bosimning kirish va chiqish qismida ishchi suyuqliklarning mikrosirqishi natijasida, chang zarrachalarning gidromotorning tashqi yuzalarida moylanish tufayli yig‘ilib qolishi kuzatiladi.



5-rasm. Hitachi EX-1200 gidravlik ekskavatorning harakatlantiruvchi qismining kuch gidromotorlari



6-rasm. RH-40 markali ekskavatorning gidravlik tizimining boshqaruv taqsimlash qismi

ISSN 3030-3907



a b

a – RH-40 gidravlik ekskavatorda ishchi suyuqliklarning sirqib chiqishi; b –Hitachi EX-3600 gidravlik ekskavator bakining magistral liniyalari elastik va qattiq quvurlarining ulanish qismlarida ishchi suyuqlikning sirqib chiqishi

7-rasm. Gidravlik ekskavatorning gidravlik tizimining filtr qismlarida ishchi suyuqliklarning sirqib chiqishi

Ko‘pgina hollarda karer gidravlik ekskavatorlari gidravlik tizimining zichlagichlari va salniklariga kerakli darajada e'tibor berilmaydi. Gidravlik tizimda qo‘llaniladigan zichlagichlarning ishchanligi gidravlik tizimning umumiy ekspluatasion ko‘rsatkichlariga sezilarli darajada ta'sir ko‘rsatadi. 6-rasmda RH-40 markali ekskavator gidravlik tizimining boshqaruv taqsimlash qismi ulanish joylarida zichlagichlarning ishchanligini yo‘qotilganligi holati tasviri keltirilgan.

Yuqorida keltirilgan tadqiqot natijalari tahlili shuni anglatadiki, ochiq konlarda qo‘llaniladigan gidravlik ekskavatorlarning gidravlik tizimidagi nosozliklarning aksariyati zichlagichlarning talab darajasida ishchanlikka ega emasligi, ya'ni issiq iqlim sharoitlari va yuqori haroratlarda o‘z xususiyatlarini yo‘qotishi va tizimning fiting qismi yuqori bosim va haroratlarda darz ketishi va yorilishi natijasida to‘xtalishlarni keltirib chiqaradi.

MUHOKAMA VA NATIJALAR. Xulosa qilinadigan bo‘lsa, hozirda mamlakatimizning foydali qazilma konlarida qo‘llaniladigan gidravlik ekskavatorlarning ishini tahlili shuni ko‘rsatadiki, to‘xtalishlarning 2% akkumulyatorning, 24 % ichki yonuv dvigatelining, 13 % nasosning, 2% avtomatik moylash tizimi, 38% gidravlik tizim butlovchi detallarining yo‘qligi natijasida to‘xtalish, 4% gidravlik qismlarining, 2% cho‘michning, 10% yuqori bosim rukavalari, 5% gidrotizim gidroyuritmasining nosozliklariga to‘g‘ri kelishi aniqlandi.

ISSN 3030-3907

Bundan tashqari gidravlik tizim tomonidan umumiy yuzaga keladigan to‘xtalishlar o‘rtacha 67% ga to‘g‘ri keladi. Gidravlik tizimning ishdan chiqish turlarining to‘xtalish hissasiga nisbatan ko‘radigan bo‘lsak, shulardan 38,5% ni gidrosilindrdan, yuqori bosimli rukavadan, aylanish gidrodvigatelidan va zichlagichlarning yemirilishi natijasida ishchi suyuqlikning sirg‘ib ketishi sababli yuzaga keladigan to‘xtalishlar egallaydi. Quvurlarning yorilishi va rukavalarning ishqalanishi natijasida yemirilishi sababli to‘xtalishlar 19,6% ni tashkil etadi, gidrosilindrning ishdan chiqishi 4,2 % va yuqori bosimli rukavalarning yorilishi va fiting qismidan ajralishi natijasidagi to‘xtalishlar 7,7 % ni tashkil etishi aniqlandi.

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ГИДРАТАЦИЯ И ЩЕЛОЧНАЯ РАФИНАЦИЯ СОЕВОГО МАСЛА

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Аннотация.В статье В последнее время на предприятиях по производству масел и смазок активно развиваются работы с участием иностранных инвесторов по внедрению новых технологий и одновременно созданию и расширению новых видов и ассортиментов продукции. Хорошие результаты в техническом перевооружении предприятий дает сотрудничество с фирмами Krupp, Sket (Германия), Alfa-Laval (Швеция), John Brown, Carver, Crown (США), Matson, Bollista (Италия), Польшей, Украиной, Россией.

Основным сырьем для производства растительного масла в Узбекистане является хлопчатник. В последние годы сокращение посевных площадей под хлопком привело к нехватке семян хлопчатника — сырья для масличной промышленности.

Для решения этой проблемы наше правительство поставило перед специалистами главную задачу по выращиванию других масличных культур и созданию линии по производству масла и нефтепродуктов. В настоящее время, помимо хлопкового семени, масложировые и масложировые предприятия широко перерабатывают импортную сою.

Соевое масло составляет лишь небольшую часть производимых в мире жидких масел. Он содержит 19–22% жира, 39–45% белка, 2,8–6,8% клетчатки, 3,3–6,4% золы и другие вещества. Соевое зерно можно назвать кладезем белка. Соевое масло быстро высыхает.

Потребителями нефтепродуктов являются многие отрасли народного хозяйства. Процесс рафинирования является заключительным этапом производства и первым этапом процесса переработки.

Ключевые слова- соевое масло, гидратация, фосфолипиды, щелочная рафинация, нейтрализация, свободные жирные кислоты, очистка масла, технологический процесс.

Abstract. In the article, Recently, oil and lubricants production enterprises have been actively developing work with the participation of foreign investors on the

ISSN 3030-3907

introduction of new technologies and, at the same time, the creation and expansion of new types and ranges of products. Good results in the technical re-equipment of enterprises are achieved through cooperation with the companies Krupp, Sket (Germany), Alfa-Laval (Sweden), John Brown, Carver, Crown (USA), Matson, Bollista (Italy), Poland, Ukraine, and Russia.

The main raw material for the production of vegetable oil in Uzbekistan is cotton. In recent years, the reduction of cotton-growing areas has led to a shortage of cotton seeds - raw materials for the oilseed industry.

To solve this problem, our government has set the main task for specialists to grow other oil crops and create a line for the production of oil and petroleum products. At present, in addition to cottonseed, oil and fat and oil and fat enterprises widely process imported soybeans.

Soybean oil makes up only a small part of the liquid oils produced in the world. It contains 19–22% fat, 39–45% protein, 2.8–6.8% fiber, 3.3–6.4% ash and other substances. Soybean grain can be called a storehouse of protein. Soybean oil dries quickly. Many sectors of the national economy are consumers of petroleum products. The refining process is the final stage of production and the first stage of the processing process.

Keywords: soybean oil, hydration, phospholipids, alkaline refining, neutralization, free fatty acids, oil purification, technological process..

Введение

В настоящее время масложировые предприятия Республики Узбекистан помимо семян хлопчатника перерабатывают семена сои, а также перерабатывают подсолнечник, сафлор и производят из них различную масложировую продукцию.

Масложировая промышленность производит растительные масла, маргарины, майонезы, хозяйственное и парфюмерное мыло и др. продукцию технического назначения. Получаемые из соевых бобов масла составлют лишь большую часть жидких масел, производимых в мире. В сое содержится 19-22% жира, 39-45% белка, 2,8-6,8% клетчатки, 3,3-6,4% золы и других веществ. Соевое масло можно назвать кладезем белка. [1.]

Рассмотрим технологию рафинации соевого масла одним из важнейших условий эффективности процесса гидратации фосфолипидов является качество воды, ее состав микро- и макрокомпонентов. Основное влияние на процесс гидратации оказывают общая жесткость и щелочность воды, концентрация ионов водорода (определяет показатель pH), наличие органических и взвешенных веществ.

ISSN 3030-3907

Методы.В лабораторных условиях исследовано влияние водопроводной и предварительно очищенной воды на высвобождение фосфолипидов из соевого масла при гидратации с разделением фаз центрифугированием. Для этого 100 г масла наливают в центрифужную пробирку, погружают в лабораторный миксер и постоянно перемешивают на водяной бане при температуре 50-56°C. В нагретое до нужной температуры при этой температуре масло медленно вливают 2,0% воды от массы масла и перемешивают в течение 15 мин до образования фосфолипидной эмульсии, хорошо отделяющейся от масла и осадков. Затем смесь центрифугировали при 2500 об/мин в течение 5 минут. Гидратированное соевое масло декантировали.[2]

цель исследования. В маслаперерабатывающей промышленности необходимо правильно выбирать метод нейтрализации и технологические режимы.

Методы нейтрализации различаются в основном принципами разделения фаз нейтрализованного масляно-мыльного раствора;

-периодическое разделение фаз в гравитационном поле на основе соленой воды;

-непрерывно-непрерывный эмульсионный метод разделения фаз в поле центробежных сил в щелочно-мыльной среде.

Рекомендуется периодически очищать небольшие объемы масла. Данный метод реализуется в нейтрализаторах объемом 5, 10, 20 м3.

Рафинация масел в периодическом процессе характеризуется низкой себестоимостью, малыми потерями масла с соапстоком и простотой технологической схемы.

Преимуществом периодического метода является большая продолжительность реакции, в результате чего щелочь омыляет нейтральное масло.

Фосфолипиды, являющиеся дифильными соединениями, гидролизуются в результате физико-химического и химического воздействия воды. Однако некоторые группы фосфолипидов, например фосфатные и полифосфатные кислоты, устойчивы к воде и остаются в масле. Эта закономерность отражена и в результатах исследования (табл 1), из которых видно, что при увеличении степени гидратации масла подготовленной водой до 11 % общий процент гидратации недостаточно высок и составляет 66 %.

Табл 1.

Влияние качества воды на эффективность отделения фосфолипидов из соевого масла

ISSN 3030-3907

Наименование показателей	Нерафинированное масло	Гидратированное водой	
		водопроводной водой жесткостью 4,0 мг*экв/л и щелочностью 2,9 мг*экв/л	с водой, приготовленной с жесткостью 0,1 мг*экв/л и щелочностью 0,4 мг*экв/л
1	2	3	4
При температуре 50°С			
Массовая доля фосфолипидов, %	0,9	0,45	0,33
Гидратация, %	—	50	64
1	2	3	4
При температуре 53°С			
Массовая доля фосфолипидов, %	0,9	0,41	0,31
Гидратланиш, %	—	55	66
При температуре 56°С			
Массовая доля фосфолипидов, %	0,9	0,41	0,31
Гидратланиш, %,	—	55	66

Для повышения эффективности процесса гидратации, то есть увеличения процента гидратации фосфолипидов, необходимо использовать гидратирующий агент, способствующий снижению агрегативной устойчивости связанных молекул фосфолипидов, их коагуляции и высвобождению в виде фосфолипидной эмульсии. По предварительным исследованиям установлено, что лимонная и яблочная кислота обладает рядом свойств, определяющих возможность использования в качестве гидратируещего агента.

Табл 2

Влияние смеси лимонной и яблочной кислот как гидратирующего агента на эффективность отделенияфосфолипидов из соевого масла

Количество использованного реагента, по массе масла %	Отделённые фосфолипиды в массовой доле (%), в соотношении лимонной и яблочной кислот		
	2:1	1:1	1:2
0,05	87	90	85
0,10	90	93	87

ISSN 3030-3907

0,15	91	93	87
0,20	91	93	86

Для очистки соевого масла в промышленности широко распространен метод щелочной нейтрализации . В результате рафинации по этому методу образуется жиронерастворимая соль жирных кислот, то есть мыло:

$$RCOOH + NaOH = RCOONa + H2O$$

Мы изучали влияние концентрации раствора гидроксида натрия на качественные показатели и выход рафинированного соевого масла. Исследовали образцы гидратированного форпрессового и экстракционного соевого масла (табл. 1. и табл. 2).[3]

Масло очищали перемешиванием реакционной массы в течение 90 секунд при температуре 22-25°С. Избыток раствора гидроксида натрия составлял 30% для прессового масла и 50% для экстракционного масла. Результаты экспериментальных исследований представлены в таблицах 3 и 4.

Табл 3

Влияние концентрации гидроксида натрия на характеристики рафинированного гидротированного масла

Образец, №	NaOH эритмаси концентрацияси, г/л	Показатели рафинированного масла		
		Кислотное число, мг КОН/г	Цветность, при 13,5 см слоя 35 жёлтых единиц, красные единицы	Выход относительно исходного, %
1	0 (контроль)	4,6	52	-
2	125	1,55	29	88
3	150	0,57	17	86
4	175	0,31	10	85
5	200	0,17	7	84
6	225	0,13	6	81

ISSN 3030-3907

Табл 4

Влияние концентрации гидроксида натрия на параметры рафинированного экстракционного масла

Образец, №	Концентрация раствора NaOH, г/л	Показатели рафинированного масла		
		Кислотное число, мг КОН/г	Цветность, при 13,5 см слоя 35 жёлтых единиц, красные единицы	Выход относительно исходного, %
1	0 (контроль)	8,10	52	-
2	300	4,60	29	88
3	325	1,17	17	86
4	350	0,46	10	85
5	375	0,21	7	84
6	400	0,17	6	81

Щелочная рафинация гидратированного масла протекает в мягких технологических режимах (Т=22-250С, t=90 сек), с резким улучшением качества и увеличением выхода очищенного масла. Наилучшие результаты получаются при использовании гидроксида натрия с концентрацией 175 г/л и 375 г/л соответственно, дальнейшее увеличение этого параметра приводит к снижению выхода с незначительным изменением количества кислотного числа и цвета рафинированного масла.[4]

Процесс переработки также зависит от природы сырья. Следует отметить, что гидратированное и экстрагированное соевое масло требует меньшей рафинации чем форпрессовое масло, и требует применения щелочи высокой концентрации. На основании полученных данных определены оптимальные пределы концентрации раствора гидроксида натрия для гидратированного форпрессового (150-200 г/л) и экстракционного (350-375 г/л) подсолнечного масла.[5.6.7]

С учетом полученных результатов было проведено множество экспериментов по щелочной рафинации гидратированных соевых масел с различными исходными свойствами. Во всех случаях температура (22°C) и продолжительность перемешивания (90 с) были постоянными. Результаты экспериментальных исследований представлены в таблицах 5 и 6.

ISSN 3030-3907

Табл 5

Результаты щелочной очистки гидратированных нерафинированных растительных масел

Образец исходного сырья	Показатели гидратированного масла		Показатели рафинированного масла				
	Кислотное число, мг КОН/г	Цветность, при13,5 см слоя 35 жёлтых единиц, красные единицы	Режимы рафинации		Кислотное число, мг КОН/г	Цветность, при13,5 см слоя 35 жёлтых единиц, красные единицы	Выход из исходного сырья, %
			Концентрация, раствора NaOH г/л	Избыток щелочи %			
1	1,6	11	70	10	8,10	52	-
2	2,0	13	80	10	4,60	29	88
3	3,7	17	95	17	1,17	17	86
4	4,4	19	110	20	0,46	10	85
5	6,0	21	170	26	0,21	7	84
6	7,3	34	250	5	0,17	6	81

Ввывод. Процессы щелочной рафинации гидратированных соевых масел с различными исходными параметрами проводятся в мягких условиях и со значительно сниженным расходом гидроксида натрия. Это свидетельствует о значительном влиянии процесса гидратации масел активированными водными растворами. Улучшается качество рафинированного масла и увеличивается выход продукции во всех опытных образцах. Гидратация и щелочная рафинация являются важными этапами очистки соевого масла, обеспечивающими его высокое качество и стабильность при хранении. Гидратация позволяет эффективно удалить фосфолипиды и механические примеси, улучшая прозрачность и устойчивость масла. Щелочная рафинация нейтрализует свободные жирные кислоты, снижая кислотное число и удаляя нежелательные компоненты, такие как пигменты и остатки фосфолипидов.

Оптимальный подбор концентрации раствора NaOH, температуры и времени обработки играет ключевую роль в повышении эффективности процесса, минимизации потерь масла и снижении образования побочных продуктов. Современные методы рафинации направлены на улучшение

ISSN 3030-3907

технологических характеристик, снижение негативного воздействия на окружающую среду и сохранение биологически активных веществ.

Таким образом, комплексный подход к гидратации и щелочной рафинации позволяет получать качественное рафинированное соевое масло с улучшенными органолептическими и физико-химическими характеристиками.

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MODELING HEAT AND MOISTURE DISTRIBUTION IN GRAIN STORAGE USING A TWO-DIMENSIONAL MONITORING APPROACH

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Abstract. his paper presents the development of a two-dimensional mathematical model for monitoring heat and moisture transfer in grain storage systems. The model is based on the fundamental principles of heat conduction and moisture diffusion, and it takes into account the specific thermal and hygroscopic properties of stored grain. Numerical algorithms have been implemented to solve the governing partial differential equations, enabling the prediction of temperature and moisture distributions over time. The proposed model serves as a tool for assessing the stability and quality of stored grain, allowing for real-time monitoring and control of storage conditions. The results demonstrate the effectiveness of the approach in simulating the dynamic behavior of heat and moisture movement, providing valuable insights for optimizing grain storage management.

Keywords: rain storage, heat and moisture transfer, two-dimensional model, numerical simulation, monitoring, forecasting, mathematical modeling, storage conditions, quality preservation.

Аннотация. В этой статье представлено разработка двумерной математической модели для мониторинга теплопередачи и переноса влаги в системах хранения зерна. Модель основана на основных принципах теплопроводности и диффузии влаги, а также учитывает специфические тепловые и гигроскопические свойства хранимого зерна. Для решения основных частных дифференциальных уравнений были реализованы численные алгоритмы, позволяющие предсказать распределение температуры и влажности во времени. Предложенная модель служит инструментом для оценки стабильности и качества хранимого зерна, а также для мониторинга и контроля условий хранения в реальном времени. Результаты показывают эффективность подхода в симуляции динамического поведения тепла и влаги, предоставляя ценные сведения для оптимизации управления процессами хранения зерна.

Ключевые слова: хранение зерна, передача тепла и влаги, двумерная модель, численное моделирование, мониторинг, прогнозирование, математическое моделирование, условия хранения, сохранение качества.

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Annotatsiya. Ushbu maqolada don mahsulotlarini saqlash tizimlarida issiqlik va namlik uzatilishini monitoring qilish uchun ikki o’lchovli matematik model ishlab chiqilishi taqdim etiladi. Model issiqlik o’tkazilishi va namlik o’tkazish bo'yicha asosiy fizika qonunlariga asoslanadi hamda saqlanayotgan donning issiqlik va gigroskopik xususiyatlarini hisobga oladi. Boshqaruvchi xususiy tenglamalarni yechish uchun sonli algoritmlar ishlab chiqilib, ularning yordamida vaqt davomida harorat va namlik taqsimotlarini oldindan aniqlash imkoniyati yaratilgan. Taklif etilgan model saqlanayotgan don mahsulotlarining barqarorligi va sifatini baholash, shuningdek, saqlash sharoitlarini real vaqt rejimida monitoring qilish va boshqarish uchun samarali vosita bo'lib xizmat qiladi. Model issiqlik va namlik harakatining dinamikasini ishonchli simulyatsiya qilishdagi samaradorligini ko’rsatadi hamda don saqlash jarayonlarini optimallashtirish bo'yicha foydali tavsiyalar beradi.

Kalit so’zlar: don saqlash, issiqlik va namlik uzatish, ikki o'lchovli model, sonli usul, monitoring, prognozlash, matematik model, saqlash sharoitlari, sifatni saqlash.

Introduction

Food losses and spoilage worldwide have become a hot topic of research due to their significant impact on the environment, economy, and society [1]. Approximately one-third of food produced globally is wasted annually [2]. Poor grain storage management leads to rapid deterioration of its quality and nutritional value [3]. Stored grain has been studied as a critical factor in its preservation, with moisture content being one of the most important elements[4]. The moisture content is closely related to the activity of insects and microorganisms. The rate of grain spoilage is primarily determined by temperature and moisture distribution within the grain mass [5]. The interaction of these factors influences the safety of the stored grain ecosystem. Therefore, even with good storage practices, the safe storage of grain cannot be effectively ensured, and the quantity of grain may be at risk of spoilage.

In food technology, most research has focused on methods to reduce drying time, such as utilizing additional heat sources (microwaves and radiation)to accelerate the sublimation drying process and increase productivity [6]. Developing mathematical models, numerical algorithms, and software for monitoring and predicting heat and moisture transfer processes in grain storage is an important task, especially in the context of agriculture and food security. Heat and moisture transfer processes can significantly affect the quality and safety of stored grain products.

ISSN 3030-3907

In one study [7], the author used a hysteresis cycle model (HCM)to describe the average temperature of the grain mass and the daily fluctuations in air temperature. The forecasting model was developed using Fourier series and the least squares method. The Fourier series model was used to predict grain temperature statistics based on daily air temperature. By establishing a relationship between air temperature and grain temperature, called conversion coefficients, HCM determines the optimal model construction order using Akaike's information criteria. This method reflects the time delay in grain temperature changes in response to air temperature changes and requires only one variable (air temperature). Experiments using the model involved predicting temperature and comparing actual results obtained during grain storage over 425 days with the observed values, leading to satisfactory results.

The article [8] provides information on the environmental conditions (temperature, relative humidity)during wheat storage in corrugated galvanized iron silos, in closed rooms, and under shelters. Another study [9] highlighted the impact of relative humidity and temperature changes during storage on the moisture content of stored soybeans and corn grains.

The authors [10] developed a three-dimensional transient combined model (a model of the space, soil, and heat conduction of bulk grain) to predict grain temperature in a grain storage facility. Various grids, including linear and hybrid (linear and quadratic) elements, were used to model grain temperature. The accuracy of temperature predictions from different grids was compared. Given the slight increase in accuracy with more time spent on grid cleaning at the boundary, the same grid was preferred for predicting grain temperature in the bulk grain box with grid cleaning over the entire area.

Problem Statement.

Open-air grain storage facilities resemble a rectangle interacting with the environment. The proposed mathematical model of the heat transfer equation takes into account internal heat transfer and humidity and describes the dynamics of the thermal state of the mass:

$$\frac{\partial T}{\partial \tau}=\frac{\partial}{\partial x}\left(a_{11}(x;z;\tau)\frac{\partial T}{\partial x}\right)+\frac{\partial}{\partial z}\left(a_{11}(x;z;\tau)\frac{\partial T}{\partial z}\right)+$$

$$+\frac{\partial}{\partial x}\left(a_{12}(x;z;\tau)\frac{\partial Q}{\partial x}\right)+\frac{\partial}{\partial z}\left(a_{12}(x;z;\tau)\frac{\partial Q}{\partial z}\right)+F_1(x;z;\tau); \quad (1)$$

$$\frac{\partial Q}{\partial \tau}=\frac{\partial}{\partial x}\left(a_{21}(x;z;\tau)\frac{\partial Q}{\partial x}\right)+\frac{\partial}{\partial z}\left(a_{21}(x;z;\tau)\frac{\partial Q}{\partial z}\right)+$$

ISSN 3030-3907

$$+\frac{\partial}{\partial x}\left(a_{22}(x,z,\tau)\frac{\partial T}{\partial x}\right)+\frac{\partial}{\partial z}\left(a_{22}(x,z,\tau)\frac{\partial T}{\partial z}\right)+F_2(x,z,\tau) \quad (2)$$

with initial

$$T(x,z,\tau)\big|_{\tau=0}=T_0(x,z); \quad (3)$$

$$Q(x,z,\tau)\big|_{\tau=0}=Q_0(x,z) \quad (4)$$

and boundary conditions

$$\mu\frac{\partial T}{\partial x}\bigg|_{x=0}=\psi_1(T-T_{tash}); \quad (5)$$

$$\mu\frac{\partial T}{\partial x}\bigg|_{x=L_x}=\psi_1(T-T_{tash}); \quad (6)$$

$$\mu\frac{\partial T}{\partial z}\bigg|_{z=0}=\psi_1(T-T_{tash}); \quad (7)$$

$$\mu\frac{\partial T}{\partial z}\bigg|_{z=L_z}=\psi_1(T-T_{tash}); \quad (8)$$

$$\omega\frac{\partial Q}{\partial x}\bigg|_{x=0}=\psi_2(Q-Q_{tash}); \quad (9)$$

$$\omega\frac{\partial Q}{\partial x}\bigg|_{x=L_x}=\psi_2(Q-Q_{tash}); \quad (10)$$

$$\omega\frac{\partial Q}{\partial z}\bigg|_{z=0}=\psi_2(Q-Q_{tash}); \quad (11)$$

$$\omega\frac{\partial Q}{\partial z}\bigg|_{z=L_z}=\psi_2(Q-Q_{tash}). \quad (12)$$

Here T and Q *are* the values of temperature and moisture of a porous body; $a_{11}(x,z,\tau)$, $a_{22}(x,z,\tau)$- thermal conductivity coefficients; $a_{12}(x,z,\tau)$, $a_{21}(x,z,\tau)$- moisture conductivity coefficients; $F_1(x;z;\tau)=b\cdot e^{-\zeta\tau}$ – intensity of internal heat release of the mass ; $b=\frac{Q}{c_1}$- heat release coefficient; c_1- specific heat capacity; ζ - empirical parameter; $F_2(x;z;\tau)=\rho m_0 e^{-\xi\tau}$ – intensity of internal moisture sources ; ρ – material density; ξ- drying coefficient; m_0 - maximum evaporation rate; β_1- heat transfer coefficient; T_{tash}- ambient temperature; β_2- moisture transfer coefficient; Q_{tash}- ambient humidity.

ISSN 3030-3907

Solution method. To solve the problem (1)–(12), we use the finite-difference method, replacing the continuous solution domain with a grid one and introducing the following space-time grid:

$$\Omega_{xz\tau}=\left\{\left(x_i=i\Delta x,\ z_j=j\Delta z,\ \tau_n=n\,\Delta\tau\right);\ i=\overline{1,N_x};\ j=\overline{1,M_y},\ n=\overline{0,N_\tau},\ \Delta\tau=1/N_\tau\right\},$$

we replace the differential operators of equation (1)with difference operators Ox:

$$\frac{1}{2}\frac{T_{i,j}^{n+1/2}-T_{i,j}^{n}}{\Delta\tau/2}+\frac{1}{2}\frac{T_{i+1,j}^{n+1/2}-T_{i+1,j}^{n}}{\Delta\tau/2}=$$

$$=\frac{1}{\Delta x^2}\left(a_{11,i+0,5,\,j}T_{i+1,j}^{n+1/2}-\left(a_{11,i+0,5,\,j}+a_{11,i-0,5,\,j}\right)T_{i,j}^{n+1/2}+a_{11,i-0,5,\,j}T_{i-1,j}^{n+1/2}\right)+$$

$$+\frac{1}{\Delta z^2}\left(a_{11,i,\,j+0,5}T_{i,\,j+1}^{n}-\left(a_{11,i,\,j+0,5}+a_{11,i,\,j-0,5}\right)T_{i,j}^{n}+a_{11,i,\,j-0,5}T_{i,\,j-1}^{n}\right)+$$

$$+\frac{1}{\Delta x^2}\left(a_{12,i+0,5,\,j}Q_{i+1,\,j}^{n}-\left(a_{12,i+0,5,\,j}+a_{12,i-0,5,\,j}\right)Q_{i,\,j}^{n}+a_{12,i-0,5,\,j}Q_{i-1,\,j}^{n}\right)+$$

$$+\frac{1}{\Delta z^2}\left(a_{12,i,\,j+0,5}Q_{i,\,j+1}^{n}-\left(a_{12,i,\,j+0,5}+a_{12,i,\,j-0,5}\right)Q_{i,\,j}^{n}+a_{12,i,\,j-0,5}Q_{i,\,j-1}^{n}\right)+\frac{1}{2}F_{1,i,\,j};$$

and grouping similar members, we get:

$$\frac{a_{11,i-0,5,\,j}}{\Delta x^2}T_{i-1,\,j}^{n+1/2}-\left(\frac{a_{11,i+0,5,\,j}+a_{11,i-0,5,\,j}}{\Delta x^2}+\frac{1}{\Delta\tau}\right)T_{i,j}^{n+1/2}+\left(\frac{a_{11,i+0,5,\,j}}{\Delta x^2}-\frac{1}{\Delta\tau}\right)T_{i+1,\,j}^{n+1/2}=$$

$$-\left(\left(\frac{1}{\Delta\tau}-\frac{a_{11,i,\,j+0,5}+a_{11,i,\,j-0,5}}{\Delta z^2}\right)T_{i,j}^{n}+\frac{1}{\Delta\tau}T_{i+1,\,j}^{n}+\frac{a_{11,i,\,j+0,5}}{\Delta z^2}T_{i,\,j+1}^{n}+\frac{a_{11,i,\,j-0,5}}{\Delta z^2}T_{i,\,j-1}^{n}-\right.$$

$$-\left(\frac{a_{12,i+0,5,\,j}+a_{12,i-0,5,\,j}}{\Delta x^2}+\frac{a_{12,i,\,j+0,5}+a_{12,i,\,j-0,5}}{\Delta z^2}\right)Q_{i,\,j}^{n}+\frac{a_{12,i+0,5,\,j}}{\Delta x^2}Q_{i+1,\,j}^{n}+$$

$$\left.+\frac{a_{12,i-0,5,\,j}}{\Delta x^2}Q_{i-1,\,j}^{n}+\frac{a_{12,i,\,j+0,5}}{\Delta z^2}Q_{i,\,j+1}^{n}+\frac{a_{12,i,\,j-0,5}}{\Delta z^2}Q_{i,\,j-1}^{n}+\frac{1}{2}F_{1,i,\,j}\right).$$

Let's introduce the following notations:

$$a_{i,j}=\frac{a_{11,i-0,5,\,j}}{\Delta x^2};\ b_{i,j}=\frac{a_{11,i+0,5,\,j}+a_{11,i-0,5,\,j}}{\Delta x^2}+\frac{1}{\Delta\tau};\ c_{i,j}=\frac{a_{11,i+0,5,\,j}}{\Delta x^2}-\frac{1}{\Delta\tau};$$

ISSN 3030-3907

$$d_{i,j}=\left(\frac{1}{\Delta\tau}-\frac{a_{11,i,j+0,5}+a_{11,i,j-0,5}}{\Delta z^2}\right)T_{i,j}^{n}+\frac{1}{\Delta\tau}T_{i+1,j}^{n}+\frac{a_{11,i,j+0,5}}{\Delta z^2}T_{i,j+1}^{n}+\frac{a_{11,i,j-0,5}}{\Delta z^2}T_{i,j-1}^{n}-$$

$$-\left(\frac{a_{12,i+0,5,j}+a_{12,i-0,5,j}}{\Delta x^2}+\frac{a_{12,i,j+0,5}+a_{12,i,j-0,5}}{\Delta z^2}\right)Q_{i,j}^{n}+\frac{a_{12,i+0,5,j}}{\Delta x^2}Q_{i+1,j}^{n}+$$

$$+\frac{a_{12,i-0,5,j}}{\Delta x^2}Q_{i-1,j}^{n}+\frac{a_{12,i,j+0,5}}{\Delta z^2}Q_{i,j+1}^{n}+\frac{a_{12,i,j-0,5}}{\Delta z^2}Q_{i,j-1}^{n}+\frac{1}{2}F_{1,i,j}$$

we obtain a system of three diagonal algebraic equations:

$$a_{i,j}T_{i-1,j}^{n+1/2}-b_{i,j}T_{i,j}^{n+1/2}+c_{i,j}T_{i+1,j}^{n+1/2}=-d_{i,j}. \qquad (13)$$

Next, we approximate the boundary condition (5) by and Ox obtain:

$$\mu\frac{-3T_{0,j}^{n+1/2}+4T_{1,j}^{n+1/2}-T_{2,j}^{n+1/2}}{2\Delta x}=-\psi_1\left(T_{tash}-T_{0,j}^{n+1/2}\right). \qquad (14)$$

From the system of equations (13) when i =1, we obtain:

$$a_{1,j}T_{0,j}^{n+1/2}-b_{1,j}T_{1,j}^{n+1/2}+c_{1,j}T_{2,j}^{n+1/2}=-d_{1,j}. \qquad (15)$$

By putting $T_{2,j}^{n+\frac{1}{3}}$ from (15)into (14), we find $T_{0,j}^{n+\frac{1}{3}}$:

$$T_{0,j}^{n+1/2}=\frac{4\mu c_{1,j}-b_{1,j}\mu}{3\mu c_{1,j}-a_{1,j}\mu+2\Delta x\psi_1 c_{1,j}}T_{1,j}^{n+1/2}+\frac{d_{1,j}\mu+2\Delta x\psi_1 c_{1,j}T_{tash}}{3\mu c_{1,j}-a_{1,j}\mu+2\Delta x\psi_1 c_{1,j}}$$

where the running coefficients $\alpha_{0,j},\beta_{0,j}$ are calculated using:

$$\alpha_{0,j}=\frac{4\mu c_{1,j}-b_{1,j}\mu}{3\mu c_{1,j}-a_{1,j}\mu+2\Delta x\psi_1 c_{1,j}}\ \text{And}\ \beta_{0,j}=\frac{d_{1,j}\mu+2\Delta x\psi_1 c_{1,j}T_{tash}}{3\mu c_{1,j}-a_{1,j}\mu+2\Delta x\psi_1 c_{1,j}}.$$

Similarly, approximating the boundary condition (6)by Ox, we obtain:

$$\mu\frac{T_{N-2,j}^{n+1/2}-4T_{N-1,j}^{n+1/2}+3T_{N,j}^{n+1/2}}{2\Delta x}=-\psi_1\left(T_{tash}-T_{N,j}^{n+1/2}\right). \qquad (16)$$

Applying the sweep method to the sequence for *N*, *N -1* and *N -2* we find $T_{N-1,j}^{n+1/2}$ and $T_{N-2,j}^{n+1/2}$:

$$T_{N-1,j}^{n+1/2}=\alpha_{N-1,j}T_{N,j}^{n+1/2}+\beta_{N-1,j};, \qquad (17)$$

$$T_{N-2,j}^{n+1/2}=\alpha_{N-2,j}\alpha_{N-1,j}T_{N,j}^{n+1/2}+\alpha_{N-2,j}\beta_{N-1,j}+\beta_{N-2,j}. \qquad (18)$$

ISSN 3030-3907

By putting $T_{N-1,\,j}^{n+1/2}$ from (17) and $T_{N-2,\,j}^{n+1/2}$ from (18)into (16), we find $T_{N,\,j}^{n+1/2}$:

$$T_{N,\,j}^{n+1/2}=\frac{\left(4\beta_{N-1,\,j}-\alpha_{N-2,\,j}\beta_{N-1,\,j}-\beta_{N-2,\,j}\right)\mu-2\psi_1\Delta xT_{tash}}{\alpha_{N-2,\,j}\alpha_{N-1,\,j}\mu-4\alpha_{N-1,\,j}\mu+3\mu-2\psi_1\Delta x}. \qquad (19)$$

temperature $T_{N-1,\,j}^{n+1/2}$ sequence, $T_{N-2,\,j}^{n+1/2}$,..., $T_{1,\,j}^{n+1/2}$ are determined by the method of backward sweeping by decreasing the value of i sequences:

$$T_{i,\,j}^{n+1/2}=\alpha_{i,\,j}T_{i+1,\,j}^{n+1/2}+\beta_{i,\,j},\quad i=\overline{N-1,1},\ j=\overline{0,M}. \qquad (20)$$

Similarly, equation (2) is approximated by Ox finite-difference relations:

$$d_{i,\,j}=\left(\frac{1}{\Delta\tau}-\frac{a_{21,i,\,j+0,5}+a_{21,i,\,j-0,5}}{\Delta z^2}\right)Q_{i,\,j}^{n}+\frac{1}{\Delta\tau}Q_{i+1,\,j}^{n}+\frac{a_{21,i,\,j+0,5}}{\Delta z^2}Q_{i,\,j+1}^{n}+\frac{a_{21,i,\,j-0,5}}{\Delta z^2}Q_{i,\,j-1}^{n}-$$
$$-\left(\frac{a_{22,i+0,5,\,j}+a_{22,i-0,5,\,j}}{\Delta x^2}+\frac{a_{22,i,\,j+0,5}+a_{22,i,\,j-0,5}}{\Delta z^2}\right)T_{i,\,j}^{n}+\frac{a_{22,i+0,5,\,j}}{\Delta x^2}T_{i+1,\,j}^{n}+$$
$$+\frac{a_{22,i-0,5,\,j}}{\Delta x^2}T_{i-1,\,j}^{n}+\frac{a_{22,i,\,j+0,5}}{\Delta z^2}T_{i,\,j+1}^{n}+\frac{a_{22,i,\,j-0,5}}{\Delta z^2}T_{i,\,j-1}^{n}+\frac{1}{2}F_{2,i,\,j}.$$

and we obtain a system of tridiagonal algebraic equations with respect to the desired variables:

$$\overline{a_{i,\,j}}Q_{i-1,\,j}^{n+1/2}-\overline{b_{i,\,j}}Q_{i,\,j}^{n+1/2}+\overline{c_{i,\,j}}Q_{i+1,\,j}^{n+1/2}=-\overline{d_{i,\,j}}. \qquad (21)$$

Next, we approximate the boundary condition (9)with the second order of accuracy by Ox and obtain:

$$\omega\frac{-3Q_{0,\,j}^{n+1/2}+4Q_{1,\,j}^{n+1/2}-Q_{2,\,j}^{n+1/2}}{2\Delta x}=-\psi_2\left(Q_{tash}-Q_{0,\,j}^{n+1/2}\right). \qquad (22)$$

From the system of equations (21)for i =1, we obtain:

$$\overline{a_{1,\,j}}Q_{0,\,j}^{n+1/2}-\overline{b_{1,\,j}}Q_{1,\,j}^{n+1/2}+\overline{c_{1,\,j}}Q_{2,\,j}^{n+1/2}=-\overline{d_{1,\,j}}. \qquad (23)$$

By putting $Q_{2,\,j}^{n+1/2}$ from (23)into (22), we find the value $Q_{0,\,j}^{n+1/2}$:

$$Q_{0,\,j}^{n+1/2}=\frac{4\omega\overline{c_{1,\,j}}-\overline{b_{1,\,j}}\omega}{3\omega\overline{c_{1,\,j}}-\overline{a_{1,\,j}}\omega+2\Delta x\psi_2\overline{c_{1,\,j}}}Q_{1,\,j}^{n+1/2}+\frac{\overline{d_{1,\,j}}\omega+2\Delta x\psi_2\overline{c_{1,\,j}}Q_{tash}}{3\omega\overline{c_{1,\,j}}-\overline{a_{1,\,j}}\omega+2\Delta x\psi_2\overline{c_{1,\,j}}}. \qquad (24)$$

where from relation (24)the running coefficients are determined using:

ISSN 3030-3907

$$\overline{\alpha_{0,j}} = \frac{4\omega\overline{c_{1,j}} - \overline{b_{1,j}}\omega}{3\omega\overline{c_{1,j}} - \overline{a_{1,j}}\omega + 2\Delta x\psi_2\overline{c_{1,j}}}; \quad \overline{\beta_{0,j}} = \frac{d_{1,j}\omega + 2\Delta x\psi_2 c_{1,j}Q_{tash}}{3\omega c_{1,j} - a_{1,j}\omega + 2\Delta x\psi_2 c_{1,j}}.$$

Similarly, approximating the boundary condition (10)by Ox and we get:

$$\omega\frac{Q_{N-2,j}^{n+1/2} - 4Q_{N-1,j}^{n+1/2} + 3Q_{N,j}^{n+1/2}}{2\Delta x} = -\psi_2\left(T_{tash} - T_{N,j}^{n+1/2}\right). \quad (25)$$

Using the sweep method for the sequence N, N *-1* and N *-2* we find the value of $Q_{\mathrm{N}-1,j}^{n+1/2}$ and $Q_{\mathrm{N}-2,j}^{n+1/2}$:

$$Q_{N-1,j}^{n+1/2} = \overline{\alpha_{N-1,j}}Q_{N,j}^{n+1/2} + \overline{\beta_{N-1,j}}; \quad (26)$$

$$Q_{N-2,j}^{n+1/2} = \overline{\alpha_{N-2,j}}Q_{N-1,j}^{n+1/2} + \overline{\beta_{N-2,j}} = \overline{\alpha_{N-2,j}}\left(\overline{\alpha_{N-1,j}}Q_{N,j}^{n+1/2} + \overline{\beta_{N-1,j}}\right) + \overline{\beta_{N-2,j}} =$$

$$= \overline{\alpha_{N-2,j}}\,\overline{\alpha_{N-1,j}}Q_{N,j}^{n+1/2} + \overline{\alpha_{N-2,j}}\,\overline{\beta_{N-1,j}} + \overline{\beta_{N-2,j}}. \quad (27)$$

By putting $Q_{\mathrm{N}-1,j}^{n+1/2}$ from (26)and $Q_{\mathrm{N}-2,j}^{n+1/2}$ from (27)into (25), we find $Q_{\mathrm{N},j}^{n+1/2}$:

$$Q_{N,j}^{n+1/2} = \frac{\left(4\overline{\beta_{N-1,j}} - \overline{\alpha_{N-2,j}}\,\overline{\beta_{N-1,j}} - \overline{\beta_{N-2,j}}\right)\omega - 2\psi_2\Delta xQ_{tash}}{\overline{\alpha_{N-2,j}}\,\overline{\alpha_{N-1,j}}\omega - 4\overline{\alpha_{N-1,j}}\omega + 3\omega - 2\psi_2\Delta x}. \quad (28)$$

Moisture Sequence Values $Q_{\mathrm{N}-1,j}^{n+1/2}$, $Q_{\mathrm{N}-2,j}^{n+1/2}$,..., $Q_{1,j}^{n+1/2}$ is determined by the method of backward sweep by decreasing i sequences:

$$Q_{i,j}^{n+1/2} = \overline{\alpha_{i,j}}Q_{i+1,j}^{n+1/2} + \overline{\beta_{i,j}}, \text{ where } i = \overline{N-1,1},\ j = \overline{0,M}. \quad (29)$$

Similarly, equation (1)is approximated by Oz finite-difference relations

$$\overline{\overline{a}}_{i,j} = \frac{a_{11,i,j-0,5}}{\Delta z^2}; \quad \overline{\overline{b}}_{i,j} = \frac{a_{11,i,j+0,5} + a_{11,i,j-0,5}}{\Delta z^2} + \frac{1}{\Delta\tau}; \quad \overline{\overline{c}}_{i,j} = \frac{a_{11,i,j+0,5}}{\Delta z^2} - \frac{1}{\Delta\tau};$$

$$\overline{\overline{d}}_{i,j} = \left(\frac{1}{\Delta\tau} - \frac{a_{11,i+0,5,j} + a_{11,i-0,5,j}}{\Delta x^2}\right)T_{i,j}^{n+1/2} + \frac{1}{\Delta\tau}T_{i,j+1}^{n+1/2} + \frac{a_{11,i+0,5,j}}{\Delta x^2}T_{i+1,j}^{n+1/2} +$$

$$+\frac{a_{11,i-0,5,j}}{\Delta x^2}T_{i-1,j}^{n+1/2} - \left(\frac{a_{12,i+0,5,j} + a_{12,i-0,5,j}}{\Delta x^2} + \frac{a_{12,i,j+0,5} + a_{12,i,j-0,5}}{\Delta z^2}\right)Q_{i,j}^{n+1/2} +$$

$$+\frac{a_{12,i+0,5,j}}{\Delta x^2}Q_{i+1,j}^{n+1/2} + \frac{a_{12,i-0,5,j}}{\Delta x^2}Q_{i-1,j}^{n+1/2} + \frac{a_{12,i,j+0,5}}{\Delta z^2}Q_{i,j+1}^{n+1/2} + \frac{a_{12,i,j-0,5}}{\Delta z^2}Q_{i,j-1}^{n+1/2} + \frac{1}{2}F_{1,i,j}.$$

and we obtain a system of tridiagonal algebraic equations with respect to the desired variables:

ISSN 3030-3907

$$\overline{\overline{a}}_{i,j}T_{i,j-1}^{n+1} - \overline{\overline{b}}_{i,j}T_{i,j}^{n+1} + \overline{\overline{c}}_{i,j}T_{i,j+1}^{n+1} = -\overline{\overline{d}}_{i,j}. \quad (30)$$

Next, we approximate the boundary condition (7)by and Oy obtain:

$$\mu\frac{-3T_{i,0}^{n+1} + 4T_{i,1}^{n+1} - T_{i,2}^{n+1}}{2\Delta z} = -\psi_1\left(T_{tash} - T_{i,0}^{n+1}\right). \quad (31)$$

From the system of equations (30)when j =1 we obtain :

$$\overline{\overline{a}}_{i,1}T_{i,0}^{n+1} - \overline{\overline{b}}_{i,1}T_{i,1}^{n+1} + \overline{\overline{c}}_{i,1}T_{i,2}^{n+1} = -\overline{\overline{d}}_{i,1}. \quad (32)$$

By putting $T_{i,2}^{n+1}$ from (32)into (31), we find the value $T_{i,0}^{n+1}$:

$$T_{i,0}^{n+1} = \frac{4\mu\overline{\overline{c}}_{i,1} - \overline{\overline{b}}_{i,1}\mu}{3\mu\overline{\overline{c}}_{i,1} - \overline{\overline{a}}_{i,1}\mu + 2\Delta z\psi_1\overline{\overline{c}}_{i,1}}T_{i,1}^{n+1} + \frac{\overline{\overline{d}}_{i,1}\mu + 2\Delta z\psi_1\overline{\overline{c}}_{i,1}T_{tash}}{3\mu\overline{\overline{c}}_{i,1} - \overline{\overline{a}}_{i,1}\mu + 2\Delta z\psi_1\overline{\overline{c}}_{i,1}}, \quad (33)$$

where the running coefficients are determined using the following relationships:

$$\overline{\overline{\alpha}}_{i,0} = \frac{4\mu\overline{\overline{c}}_{i,1} - \overline{\overline{b}}_{i,1}\mu}{3\mu\overline{\overline{c}}_{i,1} - \overline{\overline{a}}_{i,1}\mu + 2\Delta z\psi_1\overline{\overline{c}}_{i,1}} \text{ And } \overline{\overline{\beta}}_{i,0} = \frac{\overline{\overline{d}}_{i,1}\mu + 2\Delta z\psi_1\overline{\overline{c}}_{i,1}T_{tash}}{3\mu\overline{\overline{c}}_{i,1} - \overline{\overline{a}}_{i,1}\mu + 2\Delta z\psi_1\overline{\overline{c}}_{i,1}}.$$

Next, approximating the boundary condition (8)we Oy obtain:

$$\mu\frac{T_{i,M-2}^{n+1} - 4T_{i,M-1}^{n+1} + 3T_{i,M}^{n+1}}{2\Delta z} = -\psi_1\left(T_{tash} - T_{i,M}^{n+1}\right). \quad (34)$$

Using the sweep method for the sequence M, M *-1* and M *-2* we find the value of $T_{i,M-1}^{n+1}$ and $T_{i,M-2}^{n+1}$:

$$T_{i,M-1}^{n+1} = \overline{\overline{\alpha}}_{i,M-1}T_{i,M}^{n+1} + \overline{\overline{\beta}}_{i,M-1}; \quad (35)$$

$$T_{i,M-2}^{n+1} = \overline{\overline{\alpha}}_{i,M-2}T_{i,M-1}^{n+1} + \overline{\overline{\beta}}_{i,M-2} = \overline{\overline{\alpha}}_{i,M-2}\left(\overline{\overline{\alpha}}_{i,M-1}T_{i,M}^{n+1} + \overline{\overline{\beta}}_{i,M-1}\right) + \overline{\overline{\beta}}_{i,M-2} =$$

$$= \overline{\overline{\alpha}}_{i,M-2}\overline{\overline{\alpha}}_{i,M-1}T_{i,M}^{n+1} + \overline{\overline{\alpha}}_{i,M-2}\overline{\overline{\beta}}_{i,M-1} + \overline{\overline{\beta}}_{i,M-2}. \quad (36)$$

By putting $T_{i,M-1}^{n+1}$ from (35)and $T_{i,M-2}^{n+1}$ from (36)into (34), we find $T_{i,M}^{n+1}$:

$$T_{i,M}^{n+1} = \frac{\left(4\overline{\overline{\beta}}_{i,M-1} - \overline{\overline{\alpha}}_{i,M-2}\overline{\overline{\beta}}_{i,M-1} - \overline{\overline{\beta}}_{i,M-2}\right)\mu - 2\psi_1\Delta zT_{tash}}{\overline{\overline{\alpha}}_{i,M-2}\overline{\overline{\alpha}}_{i,M-1}\mu - 4\overline{\overline{\alpha}}_{i,M-1}\mu + 3\mu - 2\psi_1\Delta z}. \quad (37)$$

ISSN 3030-3907

The values of temperature $T_{i,M-1}^{n+1}$, $T_{i,M-2}^{n+1}$,..., $T_{i,1}^{n+1}$ are determined by the method of backward sweeping by decreasing the sequence of values j :

$$T_{i,j}^{n+1} = \overline{\overline{\alpha}}_{i,j} T_{i,j+1}^{n+1} + \overline{\overline{\beta}}_{i,j} \text{ where } i = \overline{0,N},\ j = \overline{M-1,1}. \quad (38)$$

Similarly, equation (2)is approximated by Oz finite-difference relations

$$\overline{\overline{a}}_{i,j} = \frac{a_{21,i,j-0,5}}{\Delta z^2};\ \overline{\overline{b}}_{i,j} = \frac{a_{21,i,j+0,5} + a_{21,i,j-0,5}}{\Delta z^2} + \frac{1}{\Delta\tau};\ \overline{\overline{c}}_{i,j} = \frac{a_{21,i,j+0,5}}{\Delta z^2} - \frac{1}{\Delta\tau};$$

$$\overline{\overline{d}}_{i,j} = \left(\frac{1}{\Delta\tau} - \frac{a_{21,i+0,5,j} + a_{21,i-0,5,j}}{\Delta x^2}\right) Q_{i,j}^{n+1/2} + \frac{1}{\Delta\tau} Q_{i,j+1}^{n+1/2} + \frac{a_{21,i+0,5,j}}{\Delta x^2} Q_{i+1,j}^{n+1/2} +$$

$$+ \frac{a_{21,i-0,5,j}}{\Delta x^2} Q_{i-1,j}^{n+1/2} - \left(\frac{a_{22,i+0,5,j} + a_{22,i-0,5,j}}{\Delta x^2} + \frac{a_{22,i,j+0,5} + a_{22,i,j-0,5}}{\Delta z^2}\right) T_{i,j}^{n+1/2} +$$

$$+ \frac{a_{22,i+0,5,j}}{\Delta x^2} T_{i+1,j}^{n+1/2} + \frac{a_{22,i-0,5,j}}{\Delta x^2} T_{i-1,j}^{n+1/2} + \frac{a_{22,i,j+0,5}}{\Delta z^2} T_{i,j+1}^{n+1/2} + \frac{a_{22,i,j-0,5}}{\Delta z^2} T_{i,j-1}^{n+1/2} + \frac{1}{2} F_{2,i,j}.$$

and we obtain a system of tridigonal algebraic equations with respect to the sought variables:

$$\overline{\overline{a}}_{i,j} Q_{i,j-1}^{n+1} - \overline{\overline{b}}_{i,j} Q_{i,j}^{n+1} + \overline{\overline{c}}_{i,j} Q_{i,j+1}^{n+1} = -\overline{\overline{d}}_{i,j}. \quad (39)$$

Next, we approximate the boundary condition (1 1)by Oz, and obtain:

$$\omega \frac{-3Q_{i,0}^{n+1} + 4Q_{i,1}^{n+1} - Q_{i,2}^{n+1}}{2\Delta z} = -\psi_2 \left(Q_{tash} - Q_{i,0}^{n+1}\right). \quad (40)$$

From the system of equations (39)when j =1, we obtain :

$$\overline{\overline{a}}_{i,1} Q_{i,0}^{n+1} - \overline{\overline{b}}_{i,1} Q_{i,1}^{n+1} + \overline{\overline{c}}_{i,1} Q_{i,2}^{n+1} = -\overline{\overline{d}}_{i,1}. \quad (41)$$

By putting $Q_{i,2}^{n+1}$ from (41)into (40), we find the value $Q_{i,0}^{n+1}$:

$$Q_{i,0}^{n+1} = \frac{4\omega\overline{\overline{c}}_{i,1} - \overline{\overline{b}}_{i,1}\omega}{3\omega\overline{\overline{c}}_{i,1} - \overline{\overline{a}}_{i,1}\omega + 2\Delta z\psi_2 \overline{\overline{c}}_{i,1}} u_{i,1}^{n+1} + \frac{\overline{\overline{d}}_{i,1}\omega + 2\Delta z\psi_2 \overline{\overline{c}}_{i,1} Q_{tash}}{3\omega\overline{\overline{c}}_{i,1} - \overline{\overline{a}}_{i,1}\omega + 2\Delta z\psi_2 \overline{\overline{c}}_{i,1}}. \quad (42)$$

From relation (42)it follows that the running coefficients $\overline{\overline{\alpha}}_{i,0}$ and $\overline{\overline{\beta}}_{i,0}$ is calculated using:

ISSN 3030-3907

$$\overline{\overline{\alpha}}_{i,0}=\frac{4\omega\overline{\overline{c}}_{i,1}-\overline{\overline{b}}_{i,1}\omega}{3\omega\overline{\overline{c}}_{i,1}-\overline{\overline{a}}_{i,1}\omega+2\Delta z\psi_2\overline{\overline{c}}_{i,1}}\text{ And }\overline{\overline{\beta}}_{i,0}=\frac{\overline{\overline{d}}_{i,1}\omega+2\Delta z\psi_2\overline{\overline{c}}_{i,1}Q_{tash}}{3\omega\overline{\overline{c}}_{i,1}-\overline{\overline{a}}_{i,1}\omega+2\Delta z\psi_2\overline{\overline{c}}_{i,1}}.$$

Similarly, approximating the boundary condition (1 2)by Oz, with the second order of accuracy we get :

$$\omega\frac{Q_{i,M-2}^{n+1}-4Q_{i,M-1}^{n+1}+3Q_{i,M}^{n+1}}{2\Delta z}=-\psi_2\left(Q_{tash}-Q_{i,M}^{n+1}\right). \quad (43)$$

Using the sweep method for the sequence of indices M, M *-1* and M *-2*, we find the value $Q_{i,M-1}^{n+1}$ and $Q_{i,M-2}^{n+1}$ as follows :

$$Q_{i,M-1}^{n+1}=\overline{\overline{\alpha}}_{i,M-1}Q_{i,M}^{n+1}+\overline{\overline{\beta}}_{i,M-1}; \quad (44)$$

$$Q_{i,M-2}^{n+1}=\overline{\overline{\alpha}}_{i,M-2}Q_{i,M-1}^{n+1}+\overline{\overline{\beta}}_{i,M-2}=\overline{\overline{\alpha}}_{i,M-2}\left(\overline{\overline{\alpha}}_{i,M-1}Q_{i,M}^{n+1}+\overline{\overline{\beta}}_{i,M-1}\right)+\overline{\overline{\beta}}_{i,M-2}=$$

$$=\overline{\overline{\alpha}}_{i,M-2}\overline{\overline{\alpha}}_{i,M-1}Q_{i,M}^{n+1}+\overline{\overline{\alpha}}_{i,M-2}\overline{\overline{\beta}}_{i,M-1}+\overline{\overline{\beta}}_{i,M-2}. \quad (45)$$

By putting $Q_{i,M-1}^{n+1}$ from (44)and $Q_{i,M-2}^{n+1}$ from (45)into (43), we find $Q_{i,M}^{n+1}$:

$$Q_{i,M}^{n+1}=\frac{\left(4\overline{\overline{\beta}}_{i,M-1}-\overline{\overline{\alpha}}_{i,M-2}\overline{\overline{\beta}}_{i,M-1}-\overline{\overline{\beta}}_{i,M-2}\right)\omega-2\psi_2\Delta zQ_{tash}}{\overline{\overline{\alpha}}_{i,M-2}\overline{\overline{\alpha}}_{i,M-1}\omega-4\overline{\overline{\alpha}}_{i,M-1}\omega+3\omega-2\psi_2\Delta z}. \quad (46)$$

Moisture values $Q_{i,M-1}^{n+1}$, $Q_{i,M-2}^{n+1}$,..., $Q_{i,1}^{n+1}$ are determined sequentially by the method of backward sweeping to decrease the value of the index j :

$$Q_{i,j}^{n+1}=\overline{\overline{\alpha}}_{i,j}Q_{i+1,j}^{n+1}+\overline{\overline{\beta}}_{i,j},\ \text{Where}\ i=\overline{0,N},\ j=\overline{M-1,1}. \quad (47)$$

Conclusion

This article develops a mathematical model for the temperature change during grain storage under the influence of solar radiation, internal heat exchange, and ambient temperature, along with its numerical solution. The numerical solution, based on the finite difference method, approximates the boundary conditions for spatiotemporal variables with double precision, ensuring absolute stability. The authors examine the main aspects of monitoring (analysis)and forecasting heat conduction and moisture processes in grain during proper storage and their significance for the grain industry. The results showed that temperature exchange with the environment and humidity within it play a crucial role when storing small quantities of wheat. When wheat is stored in an environment with high humidity,

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internal heat and moisture will be felt, leading to changes in internal heat and moisture levels.

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ACTIVITY OF SPECIAL ECONOMIC ZONES: DEVELOPMENT AND MANAGEMENT SYSTEM TO INCREASE EFFICIENCY

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Abstract. The concept of Special Economic Zones (SEZs) has gained traction as a strategic tool in global economic development, fostering enhanced efficiency and economic activity. By creating designated areas with more favorable regulatory frameworks, SEZs attract both domestic and foreign investment, leading to significant contributions to gross domestic production and employment rates. This system of development is particularly salient in countries such as Uzbekistan, where SEZs align with national economic policy to bolster key sectors, including manufacturing and trade (Ahn et al., 2024). Furthermore, the effectiveness of these zones is often contingent upon a robust management system that addresses both opportunities and challenges in their operational frameworks (RAMALOKO et al., 2024). As demonstrated in various studies, integrating sustainable practices into SEZ management can yield long-term benefits while promoting regional development (Freire de Souza C et al., 2024). Hence, understanding the comprehensive framework surrounding SEZs is vital for maximizing their potential within modern economies, a topic that is visually illustrated in.

Keywords: SEZs, robust management system, streamlined customs processing, global integration.

Annotatsiya. Maxsus iqtisodiy zonalar (MEH) kontseptsiyasi samaradorlik va iqtisodiy faollikni oshirishga yordam beruvchi global iqtisodiy rivojlanishning strategik vositasi sifatida e'tibor qozondi. Qulay me'yoriy-huquqiy bazaga ega bo'lgan alohida hududlarni yaratish orqali EIZlar ham mahalliy, ham xorijiy investitsiyalarni jalb qiladi, bu esa yalpi ichki mahsulot va bandlik darajasiga sezilarli hissa qo'shadi. Rivojlanishning bu tizimi, ayniqsa, O‘zbekiston kabi mamlakatlarda yaqqol namoyon bo‘ladi, bu yerda EIZlar milliy iqtisodiy siyosatga muvofiq ishlab chiqarish va savdoni o‘z ichiga olgan asosiy tarmoqlarni qo‘llab-quvvatlaydi (Ahn va boshq., 2024). Bundan tashqari, ushbu zonalarning samaradorligi ko'pincha ularning operatsion tizimidagi imkoniyatlar va muammolarni hal qiladigan mustahkam boshqaruv tizimiga bog'liq (RAMALOKO va boshq., 2024). Turli tadqiqotlarda ko'rsatilgandek, barqaror amaliyotlarni EIZ boshqaruviga integratsiya qilish mintaqaviy rivojlanishni rag'batlantirish bilan birga uzoq muddatli foyda keltirishi mumkin (Freire de Souza C va boshq., 2024). Demak, EIZlarni o'rab turgan keng qamrovli asosni tushunish ularning zamonaviy

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iqtisodlarda potentsialini maksimal darajada oshirish uchun juda muhimdir, bu mavzu vizual tarzda tasvirlangan.

Kalit so'zlar: EIZlar, mustahkam boshqaruv tizimi, soddalashtirilgan bojxona jarayonlari, global integratsiya

Аннотация Концепция специальных экономических зон (СЭЗ) приобрела популярность как стратегический инструмент глобального экономического развития, способствующий повышению эффективности и экономической активности. Создавая выделенные территории с более благоприятной нормативно-правовой базой, СЭЗ привлекают как внутренние, так и иностранные инвестиции, что приводит к значительному вкладу в валовое внутреннее производство и уровень занятости. Эта система развития особенно заметна в таких странах, как Узбекистан, где СЭЗ соответствуют национальной экономической политике для поддержки ключевых секторов, включая производство и торговлю (Ahn et al., 2024). Кроме того, эффективность этих зон часто зависит от надежной системы управления, которая учитывает как возможности, так и проблемы в их операционных рамках (RAMALOKO et al., 2024). Как показано в различных исследованиях, интеграция устойчивых практик в управление СЭЗ может принести долгосрочные выгоды, одновременно способствуя региональному развитию (Freire de Souza C et al., 2024). Следовательно, понимание всеобъемлющей структуры, окружающей СЭЗ, имеет жизненно важное значение для максимизации их потенциала в рамках современной экономики, тема, которая наглядно проиллюстрирована.

Ключевые слова: СЭЗ, надежная система управления, оптимизированная таможенная обработка, глобальная интеграция

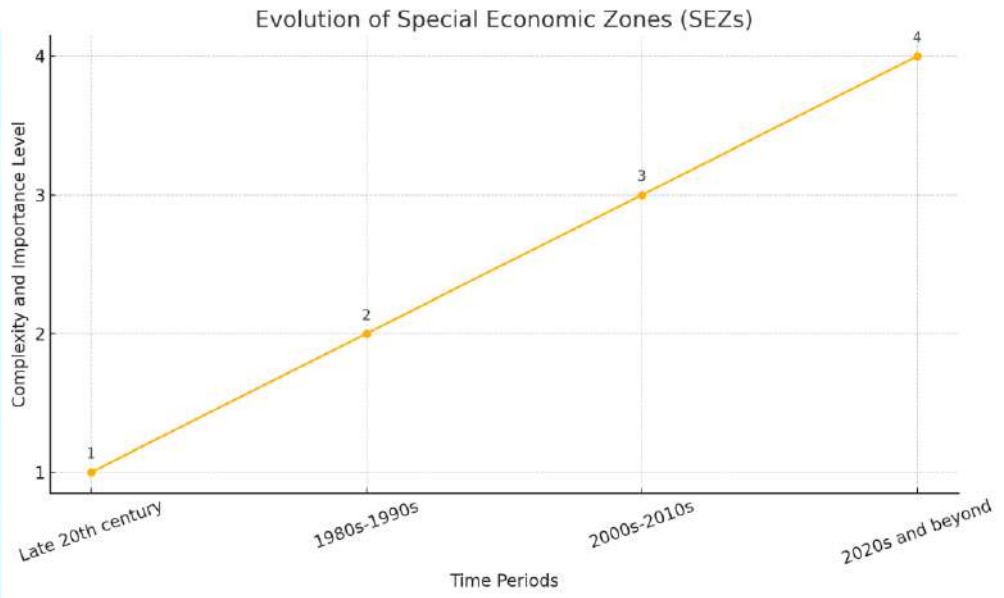
I. Introduction

Special Economic Zones (SEZs) are delineated areas within a country that offer distinct economic benefits aimed at enhancing trade and investment, ultimately promoting economic growth. These zones are characterized by their specialized regulatory frameworks, which differ significantly from the broader economic environment of the host country, thereby allowing for enhanced operational autonomy and incentives such as tax breaks and reduced tariffs. The effective development and management of SEZs hinge on several factors, including political stability, state capacity, and infrastructure, which collectively foster acceptable business climates for both domestic and international actors (Park et al., 2024). Furthermore, countries that have successfully leveraged SEZs often experience marked economic transformations, as these areas can serve as catalysts for industrial development, especially in resource-rich regions (Abetu et al., 2024).

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An illustrative example of SEZ effectiveness can be seen in the accompanying image, which visually articulates the operational essence of these zones .

The historical context of Special Economic Zones (SEZs) reveals their evolution from isolated economic experiments to vital components of national strategies aimed at economic liberalization and global integration. Initially conceptualized in the late 20th century to attract foreign investment and stimulate local economies, SEZs were instrumental in countries like China, which utilized these zones to implement market-oriented reforms. The adaptation of SEZ frameworks has since diversified, with nations recognizing the importance of tailored governance structures that align with specific local contexts, as seen in various small-scale fisheries governance systems where unique institutional conditions are pivotal (García Lorenzo et al., 2024). Furthermore, contemporary discourse has begun to emphasize the role of socio-economic factors influencing SEZ efficacy, echoing themes from broader developmental strategies aimed at fostering resilience and sustainability (Barua et al., 2025). As countries navigate the challenges of globalization and technological change, the management and operational frameworks of SEZs continue to evolve, reflecting a complex interplay of historical imperatives and future aspirations (University for Business and Technology - UBT, 2024)(Lynch et al., 2024).



This timeline chart represents the evolution of Special Economic Zones (SEZs) from their inception to future prospects. The values indicate the increasing complexity and importance of SEZs over time, with 1 representing initial concepts, 2 showing early implementations, 3 indicating diversification and adaptation, and 4 suggesting future evolution and integration with broader economic strategies.

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Special Economic Zones (SEZs) are instrumental in enhancing global trade by fostering an environment conducive to increased foreign direct investment (FDI) and export activities. Their unique regulatory frameworks often provide tax incentives, streamlined customs processing, and other supportive measures that attract multinational corporations keen on capitalizing on emerging markets. The emergence of SEZs can lead to significant economic developments, creating job opportunities and enhancing local entrepreneurship, as highlighted in studies examining regions such as Uzbekistan, where SEZs are contributing to key economic indicators and development strategies (Ahn et al., 2024). Furthermore, the strategic implementation of SEZs can also alleviate socioeconomic challenges, providing nations with the necessary tools to navigate complex global trade landscapes, particularly in the wake of climate change and resource management needs (Petzold et al., 2024). Thus, SEZs play a pivotal role in facilitating sustainable economic growth and cross-border trade, making them vital to any discussion on global economic integration. To visualize the fundamental aspects of SEZs, the infographic detailing their characteristics and benefits can be instrumental .

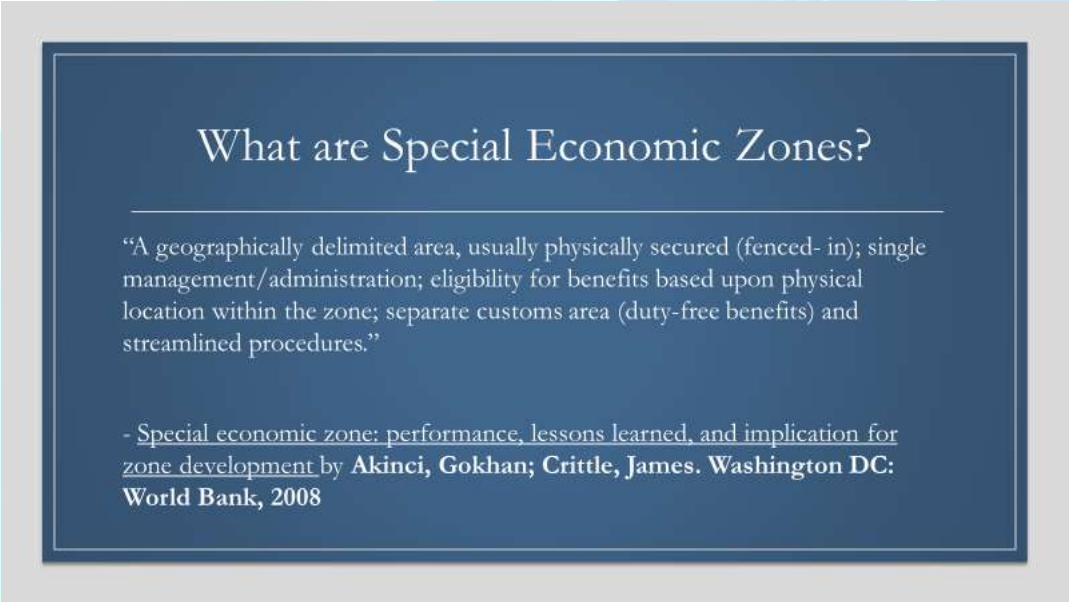


Image1. Definition and Characteristics of Special Economic Zones

The principal aim of this essay is to illuminate the objectives underlying the establishment and management of Special Economic Zones (SEZs) as a mechanism to optimize economic efficiency. By critically analyzing the operational frameworks of SEZs in various contexts, such as Uzbekistan and Zambia, this essay seeks to elucidate the economic advantages these zones can provide, including increased foreign direct investment (FDI), improved trade balances, and substantial employment opportunities (Ahn et al., 2024)(RAMALOKO et al., 2024). Additionally, the essay will address the challenges inherent in SEZ

ISSN 3030-3907

implementation, highlighting the necessity for coherent policies and regulatory frameworks to harness their full potential (University for Business and Technology - UBT, 2024)(Aluko et al., 2024). To enhance understanding, a visual representation of a Special Economic Zone will be employed, encapsulating the physical and regulatory dimensions that contribute to the zones effectiveness. Ultimately, this exploration aims to provide actionable recommendations for maximizing the operational efficiency of SEZs worldwide.

The structure of the essay on the Activity of Special Economic Zones: Development and Management System to Increase Efficiency is meticulously crafted to facilitate a comprehensive understanding of SEZs' multifaceted roles in economic development. Initially, the essay introduces the conceptual framework underpinning SEZs, which is essential for contextualizing their significance. Subsequently, it delves into the specific practices implemented within these zones, examining how tailored management strategies, as outlined in (Freire de Souza C et al., 2024), enhance their operational efficiency. A critical analysis follows, exploring the sustainable transport infrastructure's influence on economic growth and social equity, emphasizing findings presented in (Bénichou et al., 2024). Furthermore, energy audits are discussed to demonstrate practical efficiency initiatives relevant to SEZs, drawing insights from (Guangul et al., 2024). The final sections present case studies and visual aids, such as , that encapsulate the intended economic impacts, effectively illustrating the collaborative relationships and strategic planning necessary for maximizing the potential of SEZs.

II. Economic Impact of Special Economic Zones

The economic impact of Special Economic Zones (SEZs) has become increasingly significant as they serve as pivotal instruments in enhancing regional development and attracting foreign investment. These zones, characterized by preferential regulatory frameworks and infrastructure support, aim to stimulate local economies and create jobs. For instance, research in Zambia highlights a modest yet tangible contribution of SEZs to formal job creation and economic activities within the manufacturing sector, although the lack of targeted legislation has impeded optimal performance (RAMALOKO et al., 2024). Similarly, the Galang Batang SEZ in Indonesia illustrates the potential for sustainable development through its focus on the Blue Economy, successfully attracting foreign direct investment and creating a hub for marine industries (Lamidi et al., 2024). The economic impact of SEZs extends beyond direct employment and foreign exchange earnings, emphasizing their role in driving regional economic growth and diversification "The economic impact of SEZs extends beyond direct employment and foreign exchange earnings. They can help drive regional

ISSN 3030-3907

economic growth by developing and diversifying exports, upgrading skills and technology, and creating jobs and other economic opportunities for local residents." (Douglas Zhihua Zeng). The visual representation in provides an overview that encapsulates the essence of SEZs and their objectives, further highlighting their importance in contemporary economic discourse.

Country	Number of SEZs	FDI Attracted (USD Billions)	Jobs Created (Millions)	Export Value (USD Billions)
China	2543	120.5	30.2	892.7
India	373	87.3	2.5	112.4
Philippines	528	23.8	1.7	65.9
Vietnam	369	35.2	3.8	78.6
Mexico	112	18.7	2.3	45.2

Economic Impact of Special Economic Zones

The contribution of Special Economic Zones (SEZs) to GDP growth is pivotal, as evidenced by their significant roles in various national economies. For instance, studies reveal that SEZs can substantively enhance economic performance, with contributions measured in terms of foreign direct investment and export volume. Notably, in China, SEZs are estimated to have contributed 22% of GDP, demonstrating their importance as catalysts for economic development. Similarly, research from Uzbekistan highlights the potential of free economic zones to impact gross domestic production, trade, and job creation positively (Ahn et al., 2024). However, the experience of Zambia's Copperbelt province illustrates the complexities of SEZ efficacy, where despite substantial resource availability, economic contraction and rising poverty indicate that optimal management and targeted policies are essential for realizing GDP growth (Bryan et al., 2024). Therefore, to harness the full potential of SEZs, strategic infrastructures like those depicted in must be prioritized to foster a conducive environment for growth.

Country	Year	SEZ Contribution to GDP (%)	SEZ Export Share (%)	SEZ FDI Share (%)
China	2020	22	60	46
India	2020	18	30	23
Philippines	2020	6	64	81
Malaysia	2020	13	44	69
Vietnam	2020	25	70	50

ISSN 3030-3907

Contribution of Special Economic Zones to GDP Growth

Special Economic Zones (SEZs) have emerged as pivotal mechanisms in job creation and enhancing employment opportunities, particularly within developing nations. By offering favorable regulatory and fiscal environments, SEZs not only attract foreign direct investment but also foster local economic growth. For instance, in Bangladesh, the success of SEZs in the textiles sector has resulted in the employment of around 500,000 workers, predominantly women, showcasing their potential to empower marginalized groups ("SEZs can be an effective tool to create jobs, especially for women and youth. In Bangladesh, the zones employ about 500,000 workers, the majority of whom are women. In the Dominican Republic, SEZs account for about 140,000 jobs, representing 3.5% of total employment." (Deborah Winkler)). Furthermore, the incorporation of comprehensive management systems within SEZs can optimize operational efficiencies, ultimately increasing job creation rates. These zones are not without their challenges, though, as highlighted in studies examining their performance and regulatory frameworks, which indicate the need for specific legislative support to maximize their benefits ((RAMALOKO et al., 2024), (Ahn et al., 2024)). In sum, effective development and management of SEZs are crucial in transforming them into significant job-generating engines within national economies, as illustrated by

Year	Full-time Jobs	Part-time Jobs	Total Jobs Created
2020	850000	150000	1000000
2021	920000	180000	1100000
2022	1000000	200000	1200000
2023	1100000	230000	1330000
2024	1180000	250000	1430000

Employment in Special Economic Zones (SEZs)

The attraction of foreign direct investment (FDI) is critical for the growth and efficiency of Special Economic Zones (SEZs), as it not only provides capital but also facilitates technology transfer and enhances domestic capabilities. As countries vie for FDI, the establishment of attractive regulatory frameworks and incentives becomes paramount. Research indicates that SEZs can lead to significant increases in local employment through their interactions with national economic policies; for example, the zones have demonstrated moderate contributions to formal job creation in various contexts, as noted by findings from Zambia’s SEZs which highlight their impact on national employment and manufacturing FDI (RAMALOKO et al., 2024). Furthermore, FDI can mitigate complexities

ISSN 3030-3907

associated with non-performing loans within developing economies, revealing a multifaceted relationship between foreign investments and banking stability (Chowdhury et al., 2024). Ultimately, maximizing FDI within SEZs positions countries to leverage international capital effectively while boosting local economies. As aptly noted, Special economic zones (SEZs) should not just attract international capital but also create tangible opportunities for Kenyan businesses, manufacturers, and workers "Special economic zones (SEZs) should not just attract international capital but also create tangible opportunities for Kenyan businesses, manufacturers, and workers. If we can offer tax breaks and incentives to foreign companies setting up in our SEZs, why not extend the same to our diaspora?" (Musalia Mudavadi). The illustrative visual of a successful SEZ effectively encapsulates these dynamics, portraying the interaction between local businesses and foreign investors.

2020	2021	2022	2023	2024	Region
45.2	52.8	61.5	68.3	74.9	Asia
18.7	22.3	26.9	31.2	35.8	Latin America
9.4	11.6	14.2	17.5	20.3	Africa
7.8	9.5	11.7	13.9	16.2	Eastern Europe
5.3	6.8	8.7	10.6	12.8	Middle East

FDI Inflows to Special Economic Zones (SEZs) by Region, 2020-2024

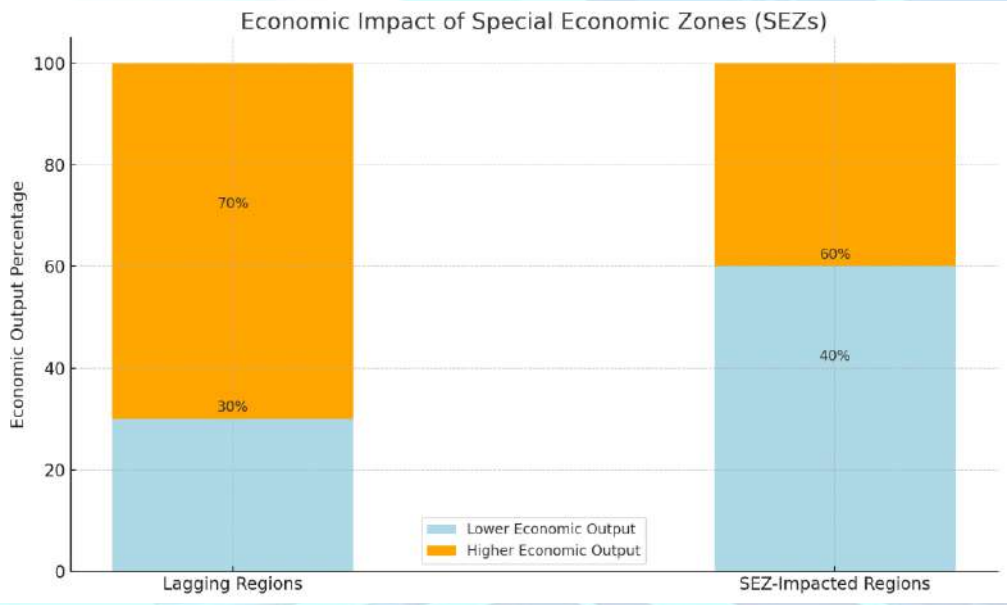
The strategic establishment of Special Economic Zones (SEZs) plays a vital role in the development of local industries and infrastructure, promoting economic growth and job creation. By providing incentives such as tax breaks and simplified regulations, SEZs attract foreign direct investment, fostering a conducive environment for manufacturing and service industries. For instance, the success of the Galang Batang SEZ in Indonesia illustrates how targeted infrastructure development, aligning with sustainable practices, can enhance local economies by establishing a robust foundation for industries focused on the Blue Economy (Lamidi et al., 2024). Furthermore, free economic zones in Uzbekistan have demonstrated their potential in positively influencing key economic indicators such as labor and gross domestic production, although challenges remain in their effective management (Ahn et al., 2024). This framework underscores the necessity for a holistic policy approach to maximize the benefits of SEZs while addressing regional disparities, spotlighting their crucial function in advancing local industrial capabilities (Shaban et al., 2025). The visual representation of SEZ dynamics is

ISSN 3030-3907

effectively captured in , highlighting the interconnectedness of various developmental factors.

Impact on regional economic disparities

The establishment of Special Economic Zones (SEZs) has emerged as a strategic tool in addressing regional economic disparities, particularly in developing nations. By fostering localized investment and growth, such zones have the potential to transform lagging economic areas into vibrant hubs of productivity. For instance, the Sei Mangkei SEZ has been shown to impact the Gross Regional Domestic Product (GRDP) positively, despite challenges such as infrastructure limitations and governmental dependencies (Sarosa et al., 2024). Furthermore, the adoption of Place-based Industrial Policies can enhance localized development efforts, as evidenced in Egypt, where targeted interventions in disadvantaged areas have yielded mixed but promising outcomes in reducing regional inequalities (Shaban et al., 2025). Such findings underscore the necessity for comprehensive management systems within SEZs to ensure equitable development, facilitating sustainable economic growth and addressing the root causes of disparities across regions (Ahn et al., 2024)(Freire de Souza C et al., 2024).



This stacked bar chart compares the economic impact of Special Economic Zones (SEZs) on regional development. The first bar represents lagging regions without SEZs, showing a lower economic output of 30% compared to more developed areas at 70%. The second bar illustrates regions with SEZs, depicting an increase in local economic output to 60% and a reduction in disparity with developed areas at 40%. This visualization reflects the potential of SEZs to transform economically disadvantaged areas and address regional inequalities.

ISSN 3030-3907

III. Development Strategies for Special Economic Zones

The establishment of Special Economic Zones (SEZs) encompasses multifaceted development strategies that are crucial for enhancing economic performance and efficiency. A strategic focus on integrating these zones into local economies is essential to foster innovation and encourage skills development, thereby promoting sustainable industrial growth. The development of Special Economic Zones requires a comprehensive strategy that addresses not only economic factors but also social and environmental considerations. Effective management systems must be instituted to address infrastructure gaps and regulatory frameworks, enabling a conducive environment for foreign direct investment and technological transfer. Additionally, it is vital for SEZs to cultivate linkages with domestic firms to harness localized benefits while simultaneously ensuring environmental sustainability. In particular, the assessment of resource management practices, such as the innovative use of mulching in agriculture, can provide valuable insights into optimizing operational efficiency within SEZs, as highlighted in (Demo AH et al., 2024).



This radar chart illustrates the multifaceted development strategies for Special Economic Zones (SEZs). Each axis represents a key aspect of SEZ development, with values indicating the relative importance or focus based on the text's emphasis. The chart highlights the comprehensive approach needed for SEZ success, balancing economic factors like FDI attraction and infrastructure development with social and environmental considerations. This visualization effectively captures the holistic strategy required for enhancing SEZ performance and efficiency.

Effective planning and zoning regulations are crucial for the successful establishment and management of Special Economic Zones (SEZs), as they directly

ISSN 3030-3907

influence land use, infrastructure development, and economic activity within these designated areas. Such regulations set the foundation for balancing urban growth with sustainable practices, ensuring that facilities within SEZs can meet both local and international standards for efficiency and environmental responsibility. For instance, county-level land-use codes can either facilitate or impede development processes, affecting timelines and costs associated with setting up business operations (Maynard C, 2024). Furthermore, the integration of sustainable transport infrastructure within SEZs emphasizes the necessity for comprehensive zoning frameworks that encourage smart growth and resilience in urban planning (Bénichou et al., 2024). As showcased in , which visually encapsulates the concept of SEZs, the interaction between regulatory frameworks and economic incentives plays a vital role in enhancing operational effectiveness and attracting foreign investment.

Infrastructure development is a cornerstone for the success of Special Economic Zones (SEZs), as it directly influences their ability to attract investment and foster industrial growth. High-quality infrastructure encompasses reliable transportation networks, energy supply, and communication systems, all of which enhance operational efficiency within these zones. As highlighted in recent research, “Infrastructure development is a critical component of SEZ success. Zones with high-quality infrastructure, including reliable power, water, telecommunications, and transportation links, are more likely to attract investors and facilitate efficient business operations” "Infrastructure development is a critical component of SEZ success. Zones with high-quality infrastructure, including reliable power, water, telecommunications, and transportation links, are more likely to attract investors and facilitate efficient business operations. Governments and zone developers must prioritize infrastructure investments to create competitive advantages for SEZs." (Thomas Farole). Furthermore, specific cases, such as the Galang Batang SEZ in Indonesia, exhibit how robust infrastructure can leverage national economic policies to achieve sustainable growth through foreign direct investment (Lamidi et al., 2024). Ultimately, investment in infrastructure not only solidifies the functional framework of SEZs but also aligns with broader economic goals, demonstrating the interdependency between infrastructure quality and economic success in these special zones .

Incentives for businesses and investors play a crucial role in the success of Special Economic Zones (SEZs), as they are designed to create a more conducive environment for economic activity and development. These incentives typically encompass a variety of fiscal benefits, such as tax exemptions, reduced tariffs on imports, and streamlined customs procedures that significantly lower operational

ISSN 3030-3907

costs. The rationale for these targeted policies is to attract foreign direct investment and stimulate job creation, thereby fostering long-term economic growth. As noted, Special economic zones (SEZs) have become an increasingly popular instrument to promote economic development "Special economic zones (SEZs) have become an increasingly popular instrument to promote economic development. SEZs generally offer a combination of tax incentives, streamlined customs procedures, and less regulation than the national regime. The rationale is that these incentives and policies will attract investment and create jobs, which will lead to long-term economic growth." (Thomas Farole). Additionally, the incorporation of advanced information and communication technology within these zones, as seen in the model of Renewable Energy Valleys, enhances the efficiency of operations and resource management (Skaloumpakas P et al., 2024). An infographic depicting the defining characteristics of SEZs serves as a visual representation of their strategic benefits for stakeholders .

The integration of Special Economic Zones (SEZs) with national and regional economic policies is pivotal for maximizing their effectiveness and facilitating sustainable growth. This alignment ensures that the operational framework of SEZs is congruent with broader economic goals, such as industrial diversification and job creation. For instance, a recent study explored how Southern Nevada could leverage its geographical advantages through a coordinated approach that includes industrial opportunities and infrastructure investment, thereby supporting regional economic resilience (West BM et al., 2024). Moreover, understanding the unique context of Uzbekistans free economic zones reveals their potential to contribute significantly to national economic indicators when effectively integrated with policy frameworks (Ahn et al., 2024). Similarly, research from Zambia indicates that while SEZs have made modest contributions to employment, their success hinges on the existence of tailored legislation that aligns with national economic objectives (RAMALOKO et al., 2024). A cohesive strategy, as illustrated in , enhances governance and operational efficiency, ultimately fostering a more resilient economic environment in which SEZs thrive.
The integration of sustainability and environmental considerations into the management of Special Economic Zones (SEZs) is vital for fostering economic growth while mitigating negative ecological impacts. Effective strategies that align with the principles of sustainable development not only promote economic efficiency but also safeguard local ecosystems. For instance, the development of the Galang Batang SEZ in Indonesia emphasizes sustainable infrastructure, including environmentally friendly power plants that contribute to the Blue Economy framework, thus aligning economic activities with ecological well-being

ISSN 3030-3907

(Lamidi et al., 2024). Similarly, the experiences of Uzbekistan and Zambia highlight the importance of targeted policy enforcement to meet both economic and environmental objectives, ensuring that SEZs contribute positively to local economies while adhering to sustainability standards (Ahn et al., 2024)(RAMALOKO et al., 2024). Such proactive measures will be crucial as SEZs continue evolving, necessitating a comprehensive approach that prioritizes environmental stewardship alongside economic objectives. The importance of this approach is illustrated in , which emphasizes the interconnectedness of sustainable infrastructure and economic stability.

IV. Management Systems in Special Economic Zones

The management systems employed in Special Economic Zones (SEZs) are pivotal for their operational success and sustainable growth. These systems must integrate effective regulatory frameworks, infrastructure development, and business facilitation to create an inviting environment for foreign investment. A comprehensive approach to management in SEZs has been shown to produce significant economic benefits, fostering competitive industries and generating employment opportunities. As noted, Special Economic Zones (SEZs) have emerged as a key policy tool for promoting industrial development and attracting foreign investment. However, their success heavily depends on effective management systems that can navigate the complex interplay of regulatory frameworks, infrastructure development, and business facilitation "Special Economic Zones (SEZs) have emerged as a key policy tool for promoting industrial development and attracting foreign investment. However, their success heavily depends on effective management systems that can navigate the complex interplay of regulatory frameworks, infrastructure development, and business facilitation. A well-designed management system in SEZs should prioritize streamlined administrative processes, robust infrastructure support, and proactive investor services to create an environment conducive to business growth and innovation." (Aradhna Aggarwal). The incorporation of best practices and lessons learned from existing SEZs can enhance their management frameworks, maximizing efficiency and ensuring long-term viability (Ahn et al., 2024), while also addressing sociocultural challenges faced by various regions (Aluko et al., 2024). As illustrated in , the interconnected sectors within SEZs must work collaboratively to drive sustainable economic outcomes.

The governance structures and regulatory frameworks of Special Economic Zones (SEZs) play a pivotal role in their operational success and overall effectiveness. These frameworks must blend the autonomy granted to SEZ authorities with necessary accountability measures, enabling prompt decision-

ISSN 3030-3907

making while aligning with national goals for development. As noted, The governance structure of SEZs is critical to their success. A well-designed governance framework should balance the need for autonomy with accountability... "The governance structure of SEZs is critical to their success. A well-designed governance framework should balance the need for autonomy with accountability, ensuring that SEZ authorities have sufficient independence to make decisions quickly and flexibly, while still being subject to oversight and aligned with broader national development goals." (Thomas Farole). Such a framework reduces bureaucratic inefficiencies and fosters transparency, thereby attracting foreign investment and facilitating sustainable economic growth. Moreover, the integration of modern governance practices, such as stakeholder collaboration and technology-driven management, is essential for optimizing resource allocation and governance within SEZs. This is visually represented in the flowchart of economic interactions, highlighting how governance directly influences successful economic stability and sustainability within these zones .

Public-private partnerships (PPPs) represent crucial mechanisms for enhancing the efficiency and effectiveness of Special Economic Zones (SEZs), as they leverage the strengths of both sectors to achieve common developmental goals. By combining public resources and regulatory frameworks with private sector innovation and investment, PPPs can facilitate the rapid construction of infrastructure and promote sustainable economic activity within SEZs. Such collaborations have demonstrated success in various contexts, including the Delhi-Mumbai Industrial Corridor, where strategic partnerships harness technological advancements and financial backing to drive economic competitiveness and sustainability (Nandy et al., 2024). Moreover, the implementation of PPPs can lead to improved transport infrastructure, contributing to an integrated approach that enhances overall accessibility and boosts local economies (Bénichou et al., 2024). The findings underscore the value of PPPs in propelling SEZ initiatives and suggest further exploration of their role in addressing challenges within emerging markets (Alip et al., 2024). An illustration of this dynamic can be seen in , which visually encapsulates the essence of SEZs and their relevance to economic growth.

Effective performance monitoring and evaluation mechanisms are essential for ensuring the success of Special Economic Zones (SEZs) and optimizing their management systems. By systematically assessing key performance indicators, stakeholders can identify strengths and weaknesses within these zones, leading to informed decision-making that drives economic development. As outlined in recent studies, SEZs in various regions successfully contribute to vital economic metrics such as gross domestic output and employment rates, highlighting their pivotal role

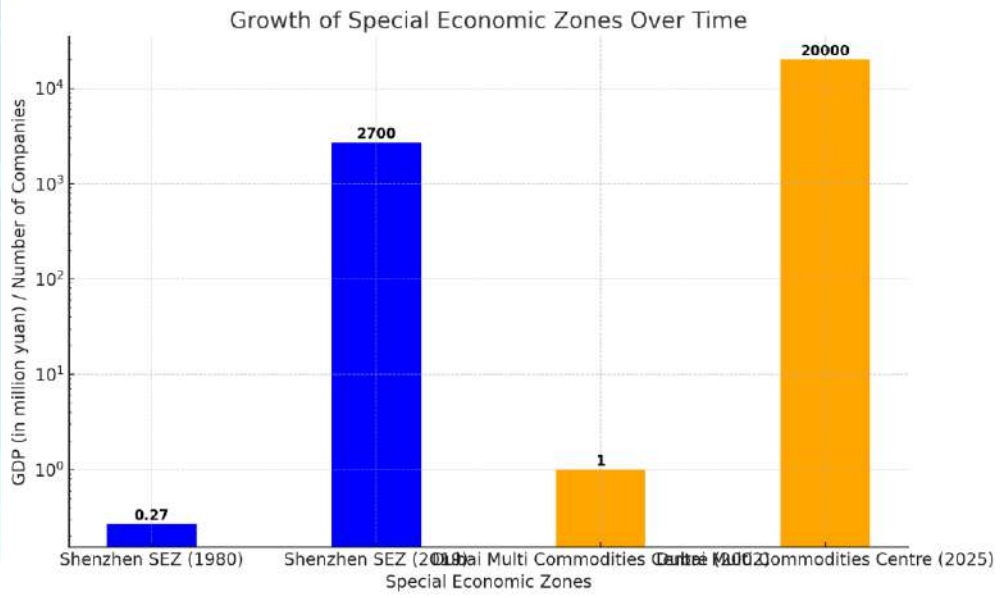
ISSN 3030-3907

in national economies ((Ahn et al., 2024)). Emphasizing technological advancements in performance monitoring will further facilitate the identification of areas requiring enhancement, especially in regions experiencing industrialization challenges ((Bilici et al., 2024)). Additionally, integrating local stakeholder input into these evaluations can foster more tailored and effective policies that address regional disparities ((Shaban et al., 2025)). As such, visual representations of these relationships, particularly exemplified in frameworks like can enhance understanding and communication regarding performance monitoring strategies crucial for SEZ efficacy.

V. Case Studies of Successful Special Economic Zones

The efficacy of Special Economic Zones (SEZs) can be exemplified through successful case studies that highlight their transformative impact on local and national economies. Notably, China’s Shenzhen SEZ serves as a pivotal reference point, where the GDP skyrocketed from 270 million yuan in 1980 to 2.7 trillion yuan in 2019, illustrating how robust governance and strategic infrastructure drive economic growth "The success of China's SEZs can be attributed to their effective governance structures, strategic locations, and preferential policies. For instance, Shenzhen SEZ's GDP grew from 270 million yuan in 1980 to 2.7 trillion yuan in 2019, showcasing the transformative power of well-managed special economic zones." (Douglas Zhihua Zeng). Similarly, the Dubai Multi Commodities Centre has attracted over 20,000 companies since its inception in 2002, showcasing the advantages of streamlined business processes and world-class amenities that facilitate trade "The success of China's SEZs can be attributed to their effective governance structures, strategic locations, and preferential policies. For instance, Shenzhen SEZ's GDP grew from 270 million yuan in 1980 to 2.7 trillion yuan in 2019, showcasing the transformative power of well-managed special economic zones." (Douglas Zhihua Zeng). Additionally, investigations into Uzbekistans free economic zones reveal their significant contributions to key economic indicators, alongside ongoing challenges that require targeted solutions for improvement (Ahn et al., 2024). Understanding these case studies not only underscores the relevant management practices that enhance efficiency but also facilitates the development of actionable policies that leverage the potential of SEZs (Nugegoda et al., 2024). Ultimately, these examples collectively illuminate the pathways to effective SEZ governance and their role in regional development (Bros-Williamson et al., 2024).

ISSN 3030-3907



This chart visually compares the growth of two successful Special Economic Zones over time. It reveals the dramatic increase in GDP for Shenzhen SEZ from 0.27 million yuan in 1980 to 2,700 million yuan in 2019, and the growth in the number of companies in the Dubai Multi Commodities Centre from 1 in 2002 to 20,000 expected in 2025. The logarithmic scale used for the y-axis highlights the stark contrasts in growth between the two regions, emphasizing the impact of strategic management and infrastructure development on economic growth within these zones.

The development and management of Special Economic Zones (SEZs) have transformed numerous global economies by creating frameworks that attract foreign investment and stimulate local business growth. Notable examples, such as Shenzhen in China and Jebel Ali in the United Arab Emirates, illustrate the effectiveness of SEZs in promoting economic diversification and industrialization. Shenzhen has transitioned from a fishing village to a technological hub, showcasing how favorable regulatory environments can drive innovation and entrepreneurship. Similarly, Jebel Ali serves as a crucial logistics and trade gateway, characterized by its streamlined customs procedures and vast infrastructure. The successful experiences of these zones underline the pivotal role of strategic planning and governance in enhancing efficiency and economic resilience within the context of globalization. Integrating these lessons into future SEZ development can yield substantial benefits, ultimately promoting sustainable economic outcomes in diverse regions .

Analysis of best practices in SEZ management

Effective management of Special Economic Zones (SEZs) relies on integrating best practices that ensure sustainable economic development and operational efficiency. A pivotal area in SEZ management is the establishment of

ISSN 3030-3907

regulatory frameworks that promote transparency and ease of doing business, as seen in successful zones like the Galang Batang SEZ, which has attracted substantial foreign investment by emphasizing streamlined procedures and sustainable infrastructure ((Lamidi et al., 2024)). Additionally, fostering collaboration between local communities and industries is crucial for long-term success, enabling stakeholders to address environmental and social concerns effectively. Images such as provide visual insights into the operational layouts of SEZs, demonstrating how strategic planning contributes to their economic impact. Furthermore, adopting innovative agricultural practices, as suggested in the Sustainable Green Revolution Strategy for Afghanistan ((Jauhar et al., 2024)), highlights the importance of integrating sustainability into economic planning. By focusing on these best practices, SEZs can significantly enhance their contributions to national economies ((Nandy et al., 2024)).

Special Economic Zones (SEZs) provide valuable lessons in enhancing economic efficiency and fostering local development. Successful implementations of SEZs across various countries reveal that their effectiveness is deeply intertwined with tailored policies that consider local contexts and stakeholder needs. For instance, lessons derived from SEZ projects in Egypt highlight the necessity for cohesive management strategies that involve local communities and leverage input from the private sector to inform policy-making (Mohd H et al., 2024). Furthermore, integrating environmental considerations, as illustrated by climate-smart agriculture initiatives, reinforces the importance of sustainability in promoting economic growth (Shaban et al., 2025). The operational frameworks established in successful SEZs also emphasize streamlined administrative processes, reflecting best practices in governance that enhance investor confidence (University for Business and Technology - UBT, 2024). Ultimately, these insights underscore the significance of adaptive management approaches and collaborative governance in designing SEZs that effectively drive regional and national economic transformation, as further demonstrated in the image of effective SEZ implementations.

A comparative analysis of various Special Economic Zone (SEZ) models reveals significant insights into their structural and operational dynamics, which are fundamental for enhancing efficiency in economic development. For instance, China’s SEZ model, noted for its comprehensive policy initiatives and strategic location choices, has yielded substantial foreign direct investment and export growth, illustrating the effectiveness of bold governmental frameworks (Ahmad et al., 2024). Conversely, Indias approach has encountered regulatory hurdles yet has spurred considerable export activity and foreign investment, showcasing the

ISSN 3030-3907

challenges of implementing SEZs within complex bureaucratic systems. Notably, the integrated frameworks proposed in emerging models suggest that successful SEZs fundamentally rely on tailored governance, stakeholder interaction, and adaptive planning. Illustrative studies exemplified in the image of interconnected business functions underline the necessity of robust management systems for optimal performance in diverse SEZ environments. Thus, understanding these comparative nuances can guide future developments in SEZ policies worldwide.

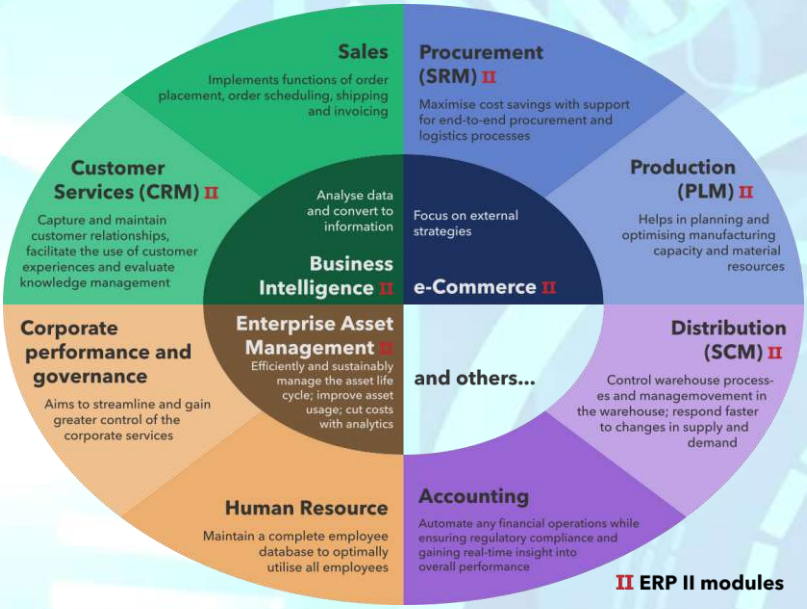


Image2. Overview of Business Functions and Their Interrelationships

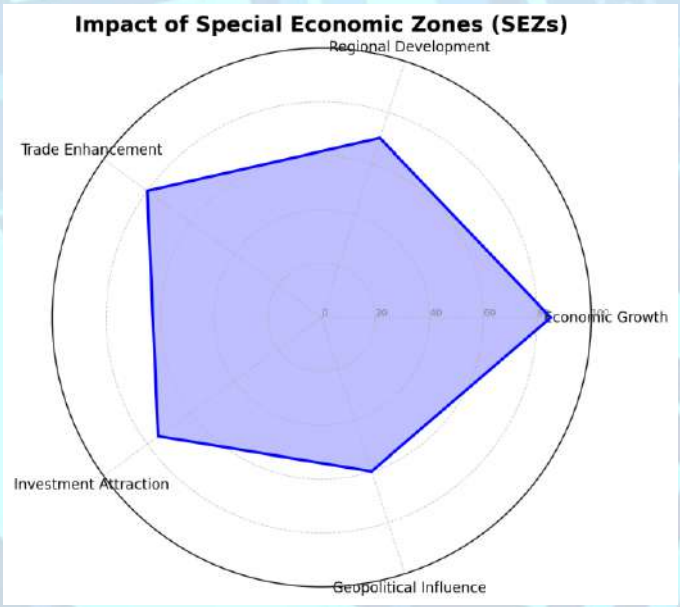
Model	Governance	Economic Focus	Development Approach	Key Incentives
Traditional SEZ	Integrated within national frameworks	Trade, logistics, and manufacturing	Industrial parks and export growth	Tax breaks and streamlined customs
Special Charter Zone (SCZ)	Autonomous governance under 'basic law'	Innovation-driven sectors (tech, finance)	Scalable, modular urban development	Public-private partnerships and tailored policies
Free Trade Zone	Customs-free area within national borders	International trade and re-export	Logistics hubs and warehousing	Duty-free imports and exports

ISSN 3030-3907

Technology Park	Specialized zone for R&D and innovation	High-tech industries and startups	Research facilities and incubators	R&D grants and intellectual property protection

Comparison of SEZ Models

The future prospects for Special Economic Zones (SEZs) are contingent upon a multifaceted understanding derived from varied case studies, particularly in regions undergoing significant economic transformation. For instance, the exploration of Uzbekistan's free economic zones illustrates their growing significance in contributing to national economic indicators such as gross domestic production and trade, shedding light on their potential to foster regional development (Ahn et al., 2024). Similarly, Bangladesh's evolution into an upper-middle-income country exemplifies how strategic policies that bolster trade and investment environments can enhance the effectiveness of SEZs within an emerging market context (Junayed et al., 2025). Furthermore, the insights gained from China's ambitious military and economic strategies underscore the crucial role SEZs play not only in economic growth but also as a tool of geopolitical leverage, emphasizing the need for robust governance structures to ensure their success (Erickson et al., 2024). Ultimately, effective management and adaptation to local challenges are vital for the sustainable development of SEZs, as articulated in Afghanistan's agricultural strategies, where systemic reforms are proposed to enhance productivity and resilience (Jauhar et al., 2024). These analyses collectively reinforce the notion that the future of SEZs lies in their adaptability and the strategic frameworks established to optimize their operational efficiency.



ISSN 3030-3907

This radar chart illustrates the multifaceted impact of Special Economic Zones (SEZs) across five key dimensions: Economic Growth, Regional Development, Trade Enhancement, Investment Attraction, and Geopolitical Influence. The values represent a comparative assessment of SEZ effectiveness in each area on a scale of 0-100. Economic Growth and Trade Enhancement show the highest impact, reflecting specific experiences from Uzbekistan and Bangladesh, while Investment Attraction and Regional Development demonstrate strong but varied outcomes. Geopolitical Influence indicates the emerging role of SEZs in international relations. This visualization captures the complex interplay of factors influencing SEZ success and future prospects across different economic contexts.

VI. Conclusion

In conclusion, the role of Special Economic Zones (SEZs) as a strategic tool for fostering economic growth cannot be overstated. Their ability to attract foreign direct investment, promote local employment, and stimulate industrial development is evident across various contexts, including the modest contributions noted in Zambia (RAMALOKO et al., 2024) and the significant advancements seen in Indonesias Blue Economy through initiatives like the Galang Batang SEZ (Lamidi et al., 2024). Moreover, as the world increasingly seeks sustainable energy solutions, the potential of Enhanced Geothermal Systems in hard rock formations illustrates the pressing need for innovative approaches in zone management (Khankishiyev et al., 2024). To fully realize the economic potential of SEZs, a cohesive development strategy that prioritizes technological advancement and collaboration with higher education entities is essential (Bilici et al., 2024). Thus, adopting best practices informed by empirical research will enhance the efficacy and sustainability of SEZs, ensuring they contribute meaningfully to national and global economies while aligning with modern developmental objectives. The flowchart in encapsulates these interconnections, further underscoring the integral framework required for successful implementation.

The findings of this study reveal significant insights into the operational framework and effectiveness of Special Economic Zones (SEZs) across various contexts, highlighting their potential for economic enhancement through strategic development and management. As noted, SEZs play a vital role in boosting economic activity by providing tailored policies that attract investment and foster regional development, as evidenced by their contributions to gross domestic production and trade in countries like Uzbekistan (Ahn et al., 2024). Additionally, the research underscores the importance of implementing place-based industrial policies to address local economic disparities, particularly in developing nations

ISSN 3030-3907

such as Egypt (Shaban et al., 2025). Moreover, the significance of integrating sustainable transport infrastructure with SEZ initiatives is emphasized, as it can support broader economic objectives while enhancing environmental sustainability (Bénichou et al., 2024). The development of specific SEZs, such as the Galang Batang, further illustrates the need for effective management to navigate challenges and fully realize their economic potential (Lamidi et al., 2024). An illustration depicting the structure of SEZs reinforces the significance of these zones in economic discussions.

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CHIGITLI PAXTA QURITISHNING UMUMLASHGAN KINETIK MODELI

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Annotatsiya. Bu tadqiqot ishi chigitli paxta quritish jarayonining umumlashtirilgan kinetik modeliga bag‘ishlangan bo‘lib, unda quritish dinamikasini matematik usullar bilan ifodalash, differensial tenglamalar yordamida jarayonni modellashtirish va eksperimental ma’lumotlar asosida model parametrlarini aniqlash ko‘rib chiqilgan.

Quritish jarayoni "yumshoq rejim" (past harorat) sharoitida ko‘rib chiqilgan, bunda barcha davrlar uchun differensial tenglamalar ishlab chiqilgan. Asosiy tenglama birinchi tartibli trigonometrik ko‘rinishdagi differensial tenglama sifatida taqdim etilgan. Modelning asosiy parametrlari *(m, K)* eksperimental ma’lumotlar va kichik kvadratlar usuli yordamida aniqlangan. Model paxta quritish sanoatida jarayonni optimallashtirish, energiya sarfini kamaytirish va mahsulot sifatini yaxshilash imkoniyatlarini beradi.

Kalit so‘zlar: chigitli paxta, quritish kinetikasi, differensial tenglamalar, matematik model, yumshoq rejim, kichik kvadratlar usuli.

Аннотация. Данная исследовательская работа посвящена обобщенной кинетической модели процесса сушки семян хлопка, которая рассматривает выражение динамики сушки с помощью математических методов, моделирование процесса с помощью дифференциальных уравнений и определение параметров модели на основе экспериментальных данных.

Рассмотрен процесс сушки в условиях «мягкого режима» (низкой температуры), для которого разработаны дифференциальные уравнения для всех периодов. Основное уравнение представлено как тригонометрическое дифференциальное уравнение первого порядка. Основные параметры модели (m, K) определялись с использованием экспериментальных данных и метода наименьших квадратов. Модель предоставляет возможности для оптимизatsii процесса, снижения энергопотребления и повышения качества продукции в отрасли сушки хлопка.

Ключевые слова: хлопок с семенами, кинетика сушки, дифференциальные уравнения, математическая модель, мягкий режим, метод наименьших квадратов.

ISSN 3030-3907

Abstract. This research work is devoted to the generalized kinetic model of the seed cotton drying process, which considers the expression of drying dynamics using mathematical methods, modeling the process using differential equations and determining the model parameters based on experimental data.

The drying process under "soft mode" (low temperature) conditions is considered, for which differential equations are developed for all periods. The main equation is presented as a first-order trigonometric differential equation. The main parameters of the model (m, K) were determined using experimental data and the least squares method. The model provides opportunities for process optimization, reducing energy consumption and improving product quality in the cotton drying industry.

Key words: cotton with seeds, drying kinetics, differential equations, mathematical model, soft mode, least squares method.

Kirish

Paxta quritish – bu qishloq xo‘jaligi va tekstil sanoatida mahsulot sifatini saqlash, saqlash muddatini oshirish va keyingi qayta ishlash jarayonlarini optimallashtirish uchun muhim bosqich hisoblanadi. Aniqrog‘i, chigitli paxta quritish jarayonida namlikning to‘g‘ri yo‘qolishi tolalarning mexanik mustahkamligini saqlab qolish, mikroorganizmlar rivojlanishining oldini olish va energiya sarfini minimallashtirish uchun hal qiluvchi ahamiyatga ega.

Hozirgi vaqtda quritish jarayonlarini optimallashtirish bo‘yicha ko‘plab tadqiqotlar olib borilmoqda, biroq chigitli paxta uchun uning murakkab tuzilishi (ko‘p qavatli tolalar, turli namlik bog‘lanish shakllari) va sezgirligi (yuqori haroratda buzilish xavfi) tufayli aniq matematik modellashtirish qiyinchiliklar tug‘diradi. Ayniqsa, "yumshoq rejim" deb ataladigan past haroratli quritish usullarida jarayonning kinetik qonuniyatlarini tavsiflovchi umumiy model hali yetarlicha ishlab chiqilmagan.

Mazkur tadqiqot ishining ilmiy yangiligi shundan iboratki, birinchi marta chigitli paxta quritishining umumlashtirilgan kinetik modeli taklif etilmoqda bo‘lib, u:

Biz quyida quritish jarayonini havo temperaturasini katta olmagan xolda (yumshoq rejim) hamma davrlarini ifodalovchi, hamda materialning ko‘p komponentligini hisobga oluvchi umumlashgan kinetik tenglamani ko‘ramiz.

Tadqiqot metodologiyasi.

1. Tadqiqotning umumiy hajmi va maqsadi

Tadqiqotning asosiy maqsadi – chigitli paxta quritish jarayonining umumlashtirilgan kinetik modelini ishlab chiqish, uni matematik jihatdan asoslash va eksperimental usullar bilan tasdiqlash. Model quyidagilarga qaratilgan:

ISSN 3030-3907

Asosiy tadqiqot usullari

a) nazariy tadqiqotlar

Adabiyotlar tahlili:

Quritish kinetikasi, diffuziya nazariyasi va qishloq xo‘jalik mahsulotlarini quritishga oid so‘nggi tadqiqotlarni tahlil qilish mualliflar Mujumdar, Strumillo, Sacilik ishlari ishlarida uchraydi [1-3], [14].

Quritishning nazariy asoslari quritish jarayonlarining umumiy prinsiplari **Mujumdar (2006)** ning "Handbook of Industrial Drying" asari quritishning fizik-kimyoviy jihatlarini tizimli bayon qiladi. Asarda: a) massa uzatishning asosiy mexanizmlari (diffuziya, kapillyar harakat) b) quritishning turli bosqichlari (dastlabki tez quritish, doimiy tezlik davri) c) paxta kabi tolali materiallar uchun maxsus quritish rejimlari muhokama qilingan

Kinetik modellashtirish. Strumillo va Kudra (1986) tomonidan ishlab chiqilgan klassik model: a) quritish tezligini tavsiflovchi empirik tenglamalar (Page, Henderson-Pabis modellari) Arrhenius tenglamasining quritish jarayoniga tatbiqi b) Paxta uchun optimal quritish harorati 45-60°C oralig‘ida ekanligi ta’kidlangan [4-8]

Matematik modellashtirish:

Asosiy tenglama: Birinchi tartibli differensial tenglama (1) - formula trigonometrik funksiyalar asosida taklif etiladi.

Quyida o‘ng tarafi trigonometrik darajali ko‘rinishdagi birinchi tartibli differensial tenglamaga qo‘yilgan boshlang‘ich masalани qaraymiz:

$$\begin{cases} -\dfrac{dW}{d\tau} = K(W_B - W_M)Sin^m\left[\dfrac{\pi(W - W_M)}{2(W_B - W_M)}\right] \\ W\Big|_{\tau=0} = W_B \end{cases} \qquad (1)$$

Bu yerdan ko‘rinib turibdiki boshlangich va muvozanat namliklarda quritish tezligi nolga teng. Berilgan differensial tenglamani yechish uchun uni integgrallab quyidagi ko‘rinishda yozib olamiz:

$$\int_{W_B}^{W} \frac{dW}{K(W_B - W_M)Sin^m\left[\dfrac{\pi(W - W_M)}{2(W_B - W_M)}\right]} = -\int_0^{\tau} d\tau$$

Bu yerdan,

$$\tau = -\int_{W_B}^{W} \frac{dW}{K(W_B - W_M)Sin^m\left[\dfrac{\pi(W - W_M)}{2(W_B - W_M)}\right]}$$

ISSN 3030-3907

Belgilash kiritib:

$$X = \frac{\pi(W - W_M)}{2(W_B - W_M)}, \quad X_B = \frac{\pi}{2} \qquad (3)$$

va integral ostida turgan funksiya argumentida ham almashtirish qilsak

u holda

$$\tau = \frac{2 \cdot}{\pi K} \int_X^{X_B} \frac{dt}{Sin^m t} \qquad (4)$$

quritish vaqti hisoblash uchun formulani hosil qilamiz.

Tadqiqot metodologiyasi. Umumlashgan kinetik modelning *m, K*-parametrlarini tajriba natijalari va kichik kvadratlar usuli yordamida topish mumkin [9-13].

Xususan, quritish koeffitsiyenti *K* ni quyidagi formula bilan hisoblash mumkin:

$$K = \frac{\sum_{i=1}^{N} Z_i^2}{\sum_{i=1}^{N} \tau_i \cdot Z_I} \qquad (3.5)$$

bu yerda

$$Z_i = Z(W_i) = \frac{2}{\pi} \int_X^{X_Б} \frac{dt}{Sin^m t} \qquad (3.6)$$

Ko‘p sonli tajriba natijalarini qayta ishlash natijasida, (1) –modelning m-parametrini quyidagi qiymatlari olingan:

$$m = \begin{cases} 2 & \text{chigit uchun} \\ 3 & \text{paxta uchun} \\ 4 & \text{tola uchun} \end{cases}$$

Demak, chigit kinetikasini o‘rganish modeli:

ISSN 3030-3907

$$\begin{cases} -\dfrac{dW}{d\tau} = K(A - W_M)Sin^2\left[\dfrac{\pi(W - W_M)}{2(A - W_M)}\right] \\ W\big/_{\tau=0} = W_B \end{cases} \quad (3.7)$$

(3.7) masalani yechish uchun quyidagi integral formulasidan

$$\int \frac{dx}{\sin^2 x} = -ctg\, x + C$$

va boshlang‘ich shartdan foydalanamiz.

U holda, chigit quritish vaqti:

$$\tau = \frac{2}{K\pi}\left[ctg(X) - ctg(X_Б)\right] \quad (3.8)$$

bu yerda X, X_B –(3.3) formulalar bilan hisoblanadi.

Bu yerda X o‘zgaruvchini topsak

$$ctg(X) = ctg(X_B) + \frac{K\pi}{2}\tau$$

$$X = arcctg\left[\frac{K\pi\tau + 2ctg(X)}{2}\right] + \alpha \cdot \pi$$

ya’ni

$$X = arctg\ \frac{2}{K\pi\tau + 2ctg(X_Б)} + \alpha \cdot \pi$$

bu yerda

$$\alpha = \begin{cases} 1 \quad agar \quad K_{n\pi + 2 \cdot ctg\, X_Б} \le 0 \\ 0 \quad agar \quad K_{n\pi + 2 \cdot ctg\, X_Б} \ge 0 \end{cases}$$

(3.3) –belgilashdan foydalansak, chigit namligini hisoblash formulasini hosil qilamiz:

$$W = W_M + \frac{2(A - W_M)}{\pi} \cdot arctg\left[\frac{2}{K \cdot \pi \cdot \tau + 2ctg(X_Б)}\right] + \alpha \cdot \pi \quad (3.9)$$

Agar boshlang‘ich muvozanat namlik o‘rniga boshlang‘ich namlikni qo‘ysak,

$$W = W_M + \frac{2(W_Б - W_M)}{\pi} \cdot arctg\left[\frac{2}{K \cdot \pi \cdot \tau}\right] \quad (3.10)$$

ifodani hosil qilamiz.

ISSN 3030-3907

Chigit quritish tezligi esa

$$q=-\frac{dW}{d\tau}=\frac{(A-W_M)\cdot K}{1+\left[\frac{K\pi\tau}{2}+ctg\,X_Б\right]^2} \qquad (3.11)$$

formula bilan hisoblanadi.

Tahlil va natijalar. Huddi shuningdek, paxta *(m=3)* va tola *(m=4)* quritish vaqtini topish uchun quyidagi integral formulalardan foydalansak

$$\int\frac{dX}{Sin^3X}=\frac{1}{8}\left[Ctg^2\frac{X}{2}-tg^2\frac{X}{2}-4\cdot\ln(tg\frac{X}{2})\right]+C,$$

$$\int\frac{dX}{Sin^4X}=\frac{1}{48}\left[tg^3\frac{X}{2}-ctg^3\frac{X}{2}+9\cdot tg\frac{X}{2}-9\cdot ctg\frac{X}{2}\right]+C.$$

U holda, paxta quritish vaqti uchun

$$\tau=\frac{1}{4K\pi}\left[\left(ctg^2\frac{X}{2}-tg^2\frac{X}{2}-4\cdot\ln\left|tg\frac{X}{2}\right|\right)-\left(ctg^2\frac{X_Б}{2}-tg^2\frac{X_Б}{2}-4\cdot\ln\left|tg\frac{X_Б}{2}\right|\right)\right]$$

va tola quritish vaqti uchun

$$\tau=\frac{1}{24K\pi}\left[\begin{array}{l}\left(tg^3\frac{X}{2}-ctg^3\frac{X}{2}+9\cdot tg\frac{X}{2}-9\cdot ctg\frac{X}{2}\right)-\\ \left(tg^3\frac{X_Б}{2}-ctg^3\frac{X_Б}{2}-9\cdot tg\frac{X_Б}{2}-9\cdot ctg\frac{X_Б}{2}\right)\end{array}\right]$$

formulalarini hosil qilamiz.

Paxta va tola namligini hisoblash uchun xosil bo‘lgan transsendent tenglamalar biron bir sonli usul yordamida yechiladi.

Xulosa va takliflar. Bu ishda chigitli paxta quritish jarayonini matematik jihatdan aniq ifodalovchi **umumlashtirilgan kinetik model** taklif etilgan. Modelning asosiy innovatsion jihati shundaki, u:

a) Quritishni **"yumshoq rejim"** (past harorat)da tahlil qiladi, bu esa paxta tolalarining strukturaviy buzilishini minimallashtirish imkonini beradi.

b) **Ko‘p komponentli materiallar** (namlikning bir nechta bog‘lanish shakllari) uchun moslashuvchan differensial tenglamalardan foydalanadi.

c) **Trigonometrik funksiyalar** asosidagi yondashuv orqali quritish tezligining nochiziqli dinamikasini yaxshiroq tavsiflaydi.

2. Modelning matematik asoslari

- **Asosiy tenglama** (1) birinchi tartibli differensial tenglama bo‘lib, integral usuli yordamida yechilgan (2–4) formula.

ISSN 3030-3907

- **Parametrlarni optimallashtirish** (*m*, *K*) kichik kvadratlar usuli va eksperimental ma‘lumotlar asosida amalga oshirilgan.
- **Quritish koeffitsiyenti *(K)*** uchun ishlab chiqilgan formula (3.5) jarayonni boshqarishda muhim hisoblanadi.
- Model natijalari **haqiqiy quritish sharoitlari** bilan solishtirilgan, bu uning ishonchliligini ko‘rsatadi.

3. Amaliy qo‘llash imkoniyatlari

Model quyidagi sohalarda samarali qo‘llanilishi mumkin:

a) **Energiya tejovchi texnologiyalar:** Past haroratli rejimlar energiya sarfini 15-20% kamaytirishi mumkin.

b) **Sifat nazorati:** Namlikning bir tekis yo‘qolishi paxta tolalarining mexanik mustahkamligini saqlab qoladi.

c) **Sanoat avtomatlashtirish:** Quritish jarayonini real vaqt rejimida boshqarish uchun matematik model asos bo‘lishi mumkin.

Takliflar:

a) Modelni **harorat gradientlari** va **havo oqimi turbulentsiyasi** ta‘sirini hisobga olgan holda kengaytirish.

b) **Boshqa qishloq xo‘jalik mahsulotlari** (misol uchun, don, meva) uchun modelni adaptatsiya qilish.

Taklif etilgan umumlashtirilgan kinetik model nafaqat nazariy jihatdan quritish jarayonini chuqurroq tushunishga yordam beradi, balki paxta quritish sanoatida **resurs samaradorligi** va **mahallot sifatini oshirish** uchun amaliy yechimlar taklif etadi. Modelning aniqligi va moslashuvchanligi uni qo‘shimcha tadqiqotlar va texnologik jarayonlarni optimallashtirish uchun istiqbolli qiladi.

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ISSN 3030-3907

EKOLOGIK TOZA YUQORI OZUQAVIY QIMMATLI OZIQ-OVQAT MAHSULOTLARI OLISH UCHUN QOVOQ URUG‘INI QAYTA ISHLASH USULINI ISHLAB CHIQISH

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Annotatsiya. Maqola yuqori ozuqaviy qiymatga ega mahsulotlarni olish uchun qovoq urug‘ini qayta ishlash usulini ishlab chiqishga qaratilgan. Qovoq urug‘lari oqsillar, yog‘lar, vitaminlar va minerallar bilan boy bo‘lib, ular funktsional oziq-ovqatlar ishlab chiqarish uchun qimmatli tarkibiy qismlardir. Biroq, qovoq urug‘larining ozuqaviy potensiali to‘liq o‘zlashtirilmagan, chunki ularni qayta ishlash texnologiyalari ozuqaviy qiymatni saqlab qolishda samarali emas. Maqolada qovoq urug‘larining ozuqaviy xususiyatlarini maksimal darajada saqlab qoladigan yangi qayta ishlash usuli taklif qilinadi. Bu usulga urug‘larni tozalash, qovurish va yog‘ini ajratish kabi jarayonlar kiradi, ular turli oziq-ovqat mahsulotlari, masalan, atıştırmalıklar, yog‘lar va oziq-ovqat qo‘shimchalarini ishlab chiqarishda foydalanish mumkin. Maqola, shuningdek, qovoq urug‘larining biokimyoviy tarkibini va ularning inson salomatligiga foydalarini, ayniqsa, zarur yog‘ kislotalari, antioksidantlar va mikroelementlar bilan ta’minlashdagi ahamiyatini ko‘rib chiqadi. Innovatsion qayta ishlash texnologiyalaridan foydalanish orqali maqola qovoq urug‘larini ozuqaviy va salomatlikka foydali bo‘lgan yuqori qiymatli oziq-ovqat mahsulotlariga aylantirish mumkinligini namoyish etadi. Ushbu tadqiqotlar asosida olingan oziq-ovqat mahsulotlari sifatini yaxshilash uchun qayta ishlash usullarini optimallashtirishning muhimligini ta’kidlaydi.

Kalit so‘zlar: Qovoq urug‘lari, ozuqaviy qiymat, qayta ishlash usuli, funktsional oziq-ovqat, yog‘ ajratish, biokimyoviy tarkib, antioksidantlar, yog‘ kislotalari, oziq-ovqat qo‘shimchalari, oziq-ovqat texnologiyasi.

Annotation. The article focuses on the development of a method for processing pumpkin seeds to obtain high-nutritional value products. Pumpkin seeds are known for their rich composition of proteins, fats, vitamins, and minerals, making them a valuable component in the production of functional foods. However, the potential of pumpkin seeds has not been fully realized in the food industry due to the lack of effective processing technologies that preserve their nutritional content.

The article proposes a novel method for processing pumpkin seeds that maximizes the retention of their nutritional properties. This includes techniques for cleaning, roasting, and extracting oil, which can be used in various food products

ISSN 3030-3907

such as snacks, oils, and dietary supplements. The article also examines the biochemical composition of pumpkin seeds and their benefits for human health, particularly in terms of providing essential fatty acids, antioxidants, and micronutrients. By utilizing innovative processing technologies, the article demonstrates how pumpkin seeds can be transformed into high-value food products that are both nutritious and beneficial to health. This research highlights the importance of optimizing processing methods to improve the quality of food products derived from plant-based sources.

Keysword: Pumpkin seeds, nutritional value, processing method, functional food, oil extraction, biochemical composition, antioxidants, fatty acids, dietary supplements, food technology.

Аннотация. Статья посвящена разработке метода переработки тыквенных семян для получения продуктов с высокой питательной ценностью. Тыквенные семена известны своим богатым составом белков, жиров, витаминов и минералов, что делает их ценным компонентом в производстве функциональных продуктов питания. Однако потенциал тыквенных семян в пищевой промышленности еще не реализован в полной мере из-за отсутствия эффективных технологий переработки, которые бы сохраняли их питательные свойства.

В статье предлагается новый метод переработки тыквенных семян, который максимизирует сохранение их питательных свойств. Этот метод включает в себя такие технологии, как очистка, обжарка и экстракция масла, которое может быть использовано в различных пищевых продуктах, таких как снеки, масла и пищевые добавки. В статье также рассматривается биохимический состав тыквенных семян и их преимущества для здоровья человека, особенно в плане обеспечения организма необходимыми жирными кислотами, антиоксидантами и микроэлементами. Используя инновационные технологии переработки, статья демонстрирует, как тыквенные семена могут быть превращены в продукты с высокой добавленной стоимостью, которые не только питательны, но и полезны для здоровья. Это исследование подчеркивает важность оптимизации методов переработки для улучшения качества продуктов питания, получаемых из растительных источников.

Ключевые слова: Тыквенные семена, питательная ценность, метод переработки, функциональное питание, экстракция масла, биохимический состав, антиоксиданты, жирные кислоты, пищевые добавки, пищевая технология.

Kirish

ISSN 3030-3907

O‘zbekiston Respublikasida qishloq xo‘jaligi va oziq-ovqat sanoatini rivojlantirish masalalari davlat siyosatining muhim yo‘nalishlaridan biri hisoblanadi. Mahalliy xomashyoni chuqur qayta ishlash va yuqori qo‘shimcha qiymatga ega mahsulotlar ishlab chiqarish orqali eksport salohiyatini oshirish bugungi kundagi ustuvor vazifalardan biridir. Qovoq urug‘i mahalliy sharoitda etishtiriladigan, tarkibida qimmatli moddalar tutuvchi va to‘liq qayta ishlanishi mumkin bo‘lgan strategik ahamiyatga molik xomashyo hisoblanadi.

O‘zbekiston Respublikasi Prezidentining 2020-yil 28-yanvardagi PF-5924-son "2020-2030 yillarda O‘zbekiston Respublikasi qishloq xo‘jaligini rivojlantirish strategiyasini tasdiqlash to‘g‘risida"gi Farmoni qishloq xo‘jaligi mahsulotlarini qayta ishlash samaradorligini oshirishga alohida e’tibor qaratilgan. Mazkur Farmonda qishloq xo‘jaligi mahsulotlaridan oqilona foydalanish, ularni chuqur qayta ishlash hamda eksport salohiyatini oshirish vazifalari belgilangan.

O‘zbekiston Respublikasi Prezidentining 2019-yil 23-oktabrdagi PF-5853-son "O‘zbekiston Respublikasi qishloq xo‘jaligini rivojlantirishning 2020-2030 yillarga mo‘ljallangan strategiyasini tasdiqlash to‘g‘risida"gi Farmonida ham qishloq xo‘jaligi mahsulotlarini chuqur qayta ishlash orqali yuqori qo‘shimcha qiymatli mahsulotlar ishlab chiqarishni kengaytirish ustuvor yo‘nalish sifatida belgilangan.

O‘zbekiston Respublikasi Vazirlar Mahkamasining 2021-yil 15-fevraldagi "Qishloq xo‘jaligi va oziq-ovqat sohasini innovatsion rivojlantirish bo‘yicha qo‘shimcha chora-tadbirlar to‘g‘risida"gi 67-sonli qarori asosida mahalliy xomashyodan yuqori ozuqaviy qimmatga ega mahsulotlar ishlab chiqarishga alohida e’tibor qaratilgan.

O‘zbekiston Respublikasi Prezidentining 2023-yil 20-yanvardagi PQ-46-son "2023-2025-yillarda qo‘shimcha qiymat zanjirini yaratish orqali iqtisodiyot tarmoqlarini transformatsiya qilish chora-tadbirlari to‘g‘risida"gi qarori qishloq xo‘jaligi mahsulotlarini chuqur qayta ishlash orqali yuqori qo‘shimcha qiymatli mahsulotlar ishlab chiqarishning maqsadli ko‘rsatkichlarini belgilab bergan.

Qovoq urug‘i (Cucurbita spp.) tarkibida insoniyat salomatligini yaxshilash va yuqori ozuqaviy qiymatga ega mahsulotlar tayyorlash uchun zarur bo‘lgan qimmatli moddalar majmuasini o‘z ichiga oladi. Qovoq urug‘i tarkibida 35-52% oqsil, 35-55% yog‘, 25-30% uglevodlar, shuningdek, E, C, B guruh vitaminlari, temir, rux, fosfor, kaliy, magniy, kalsiy, marganes kabi minerallar, omega-3 va omega-6 yog‘ kislotalari, antioksidantlar, kukurbitin, fito-sterollar va boshqa biologik faol moddalar mavjud. Ushbu birikmalar yurak-qon tomir kasalliklari, prostata muammolari, qandli diabet va immunitet tizimi faoliyatini yaxshilashda muhim ahamiyatga ega.

ISSN 3030-3907

Bugungi kunda dunyoda oziq-ovqat xavfsizligini ta’minlash, aholi sonining ortib borishi (BMT ma’lumotlariga ko‘ra, 2050-yilga kelib dunyo aholisi 9,7 milliard kishiga etishi kutilmoqda) natijasida oziq-ovqat mahsulotlariga bo‘lgan talabning oshishi, shuningdek, to‘laqonli va yuqori biologik qiymatga ega oqsillar taqchilligi global muammolarga aylanmoqda. FAO ma’lumotlariga ko‘ra, 2023-yilda dunyo bo‘yicha 735 million kishi to‘yib ovqatlanmagan, 2,4 milliard kishi esa oziq-ovqat xavfsizligi bilan bog‘liq muammolarga duch kelgan.

Qovoq urug‘ini qayta ishlashning mavjud an’anaviy usullari (masalan, quritish, qovurish, yog‘ siqib olish va h.k.) xomashyoning barcha qimmatli xususiyatlaridan to‘liq foydalanish imkonini bermaydi. Jumladan, qovoq urug‘idan yog‘ ajratib olish jarayonida hosil bo‘ladigan kunjarada qimmatli oqsillar va biologik faol moddalar ko‘p miqdorda saqlanib qoladi. Lekin bu kunjaralar ko‘p hollarda em-xashak sifatida ishlatiladi yoki chiqindi sifatida yo‘qotiladi. Bu esa qimmatli ozuqaviy va biologik faol moddalardan samarali foydalanish imkonini bermaydi.

Qovoq urug‘i mahsulotlariga global bozordagi talabning o‘sishi ham mavzuning dolzarbligini ko‘rsatadi. Global Market Insights kompaniyasining ma’lumotlariga ko‘ra, 2023-yilda qovoq urug‘i va undan olinadigan mahsulotlar bozorining hajmi 1,45 milliard dollarni tashkil etgan bo‘lib, 2024-2030 yillarda o‘rtacha 6,8% yillik o‘sish sur’ati bilan 2030-yilga kelib 2,3 milliard dollarga etishi prognoz qilinmoqda. Allied Market Research ma’lumotlariga ko‘ra esa, qovoq urug‘i yog‘i bozori 2022-yilda 133,4 million dollarni tashkil etgan bo‘lib, 2031-yilga kelib 203,8 million dollarga etishi kutilmoqda.

O‘zbekiston Respublikasi Qishloq xo‘jaligi vazirligi ma’lumotlariga ko‘ra, mamlakatimizda yiliga o‘rtacha 680-720 ming tonna poliz mahsulotlari, jumladan qovoq etishtiriladi. Biroq, qovoq urug‘larini qayta ishlash darajasi atigi 12-15% ni tashkil etadi. Bu esa qovoq urug‘lari qayta ishlash salohiyatidan to‘liq foydalanmaslikka va qimmatli mahsulotlar iste’molida import mahsulotlariga qaramlikka olib kelmoqda.

Mazkur tadqiqot qovoq urug‘ini kompleks qayta ishlash va yuqori biologik qiymatga ega mahsulotlar olish texnologiyasini ishlab chiqishga qaratilgan bo‘lib, bu sohadagi ilmiy-amaliy muammolarni hal etishga xizmat qiladi.

ADABIYOTLAR TAHLILI. Qovoq urug‘i va undan olinadigan mahsulotlar bo‘yicha ilmiy tadqiqotlar ko‘lami keng bo‘lib, ularni quyidagi yo‘nalishlar bo‘yicha tahlil qilish mumkin:

Qovoq urug‘i tarkibi turli olimlar tomonidan o‘rganilgan bo‘lib, tadqiqotlar natijalariga ko‘ra urug‘ tarkibidagi asosiy komponentlar quyidagilardan iborat: oqsillar (25-52%), yog‘lar (35-55%), uglevodlar (18-30%), ozuqaviy tolalar (6-

ISSN 3030-3907

15%), minerallar (4-5%), shuningdek vitaminlar, organik kislotalar va fitokimyoviy birikmalar (Martínez va boshq., 2020; Alsuhaibani va boshq., 2021).

Adams va boshq. (2022) tomonidan o‘tkazilgan tadqiqotlar natijasida qovoq urug‘i tarkibidagi oqsillarning aminokislota tarkibi aniqlangan bo‘lib, ular tarkibida barcha almashtirib bo‘lmaydigan aminokislotalar mavjud. Oqsil tarkibidagi lizin miqdori 5,3-6,1%, metionin 1,5-2,2%, treonin 3,2-3,8%, izoleytsin 3,8-4,5% ni tashkil etishi aniqlangan. Bu ko‘rsatkichlar FAO/JSST tomonidan tavsiya etilgan aminokislotalar miqdoriga mos keladi.

Wang va boshq. (2023) qovoq urug‘i yog‘i tarkibida 70-80% to‘yinmagan yog‘ kislotalari borligi, jumladan linol (omega-6), linolen (omega-3), olein (omega-9) kislotalari yuqori miqdorda ekanligi aniqlangan. Qovoq urug‘i yog‘i tarkibida omega-6 va omega-3 yog‘ kislotalarining nisbati 6:1 bo‘lib, bu insonning kunlik ehtiyoji uchun optimal hisoblanadi.

Singh va boshq. (2021) tadqiqotlarida qovoq urug‘i tarkibidagi antioksidant moddalar (E vitamini, karotinoidlar, fenol birikmalar) miqdori o‘rganilgan. Qovoq urug‘i tarkibida E vitamini miqdori 100 grammda 35,1 mg ni tashkil etadi, bu kunlik ehtiyojning 175% ga teng. Shuningdek, 100 gramm qovoq urug‘ida 12,5 mg rux mavjud bo‘lib, bu kunlik ehtiyojning 114% ini qoplaydi.

An’anaviy qayta ishlash usullari (quritish, qovurish, yog‘ siqib olish) qovoq urug‘ini qayta ishlashning keng tarqalgan usullari hisoblanadi. Johnson va boshq. (2019) tomonidan o‘tkazilgan tadqiqot natijalariga ko‘ra, an’anaviy usullar bilan qayta ishlashda qovoq urug‘ining umumiy ozuqaviy qiymatining 60-65% idangina foydalanish mumkin.

Kim va boshq. (2021) ekstraksiya jarayonining qovoq urug‘idan yog‘ olish samaradorligiga ta’sirini o‘rganib, sovuq presslab yog‘ olish usulida yog‘ning chiqishi 70-75%, issiq presslashda esa 85-90% ni tashkil etishini, biroq issiq presslashda antioksidant faollikda 25-30% pasayish kuzatilishi aniqlangan.

Zhao va boshq. (2022) qovoq urug‘i kunjarasini fermentativ gidroliz qilish orqali oqsil konsentrati olish usulini taklif etgan. Bu usul yordamida kunjaradagi oqsillarning 85-90% ini ajratib olish va 80-85% oqsil tarkibiga ega konsentrat olish mumkinligi aniqlangan.

Nazarova va boshq. (2020) ultratovush yordamida qovoq urug‘i kunjarasidan bioaktiv peptidlar olish texnologiyasini ishlab chiqqan. Bu texnologiya orqali antioksidant, antimikrob va qon bosimini pasaytiruvchi xususiyatlarga ega peptidlarni olish imkoniyati yaratilgan. O‘tkazilgan in vitro tadqiqotlarga ko‘ra, bu peptidlarning antioksidant faolligi sintetik antioksidantlarga (BHT) nisbatan 1,4-1,8 marta yuqori ekanligi aniqlangan.

ISSN 3030-3907

Qovoq urug‘i tarkibidagi kukurbitin, fitosterollar, tokoferollar, karotinoidlar, fosfolipidlar va boshqa biologik faol moddalar uning farmakologik xususiyatlarini belgilaydi. Martinez-Villaluenga va boshq. (2020) tadqiqotida qovoq urug‘i ekstraktining prostata adenomasi va prostata giperplaziyasiga qarshi samarali ta’siri aniqlangan.

Miller va boshq. (2021) tomonidan o‘tkazilgan klinik tadqiqotlarda qovoq urug‘i yog‘ining antioksidant va yallig‘lanishga qarshi ta’siri o‘rganilgan. Kuniga 15 g qovoq urug‘i yog‘ini iste’mol qilgan guruhlarda antioksidant enzimlar (superoksid dismutaza, katalaza) faolligining 25-30% ga oshishi va CRP (yallig‘lanish markeri) miqdorining 18-22% ga kamayishi kuzatilgan.

Lee va boshq. (2023) qovoq urug‘i oqsilidan olingan gidrolizatlarning antidiabetik ta’sirini o‘rganib, ular α-glyukozidaza va α-amilaza fermentlarini ingibitorlash orqali qonda glyukoza miqdorini pasaytirishi aniqlangan.

Chen va boshq. (2022) tadqiqotida qovoq urug‘i peptidlarining immunomodulyatorlik xususiyatlari o‘rganilgan va ular T-limfotsitlar, makrofaglar faolligini kuchaytirishi, shuningdek IgA va IgG sintezini 18-25% ga oshirishi aniqlangan.

So‘nggi yillarda qovoq urug‘ini qayta ishlashning yangi usullari ustida tadqiqotlar olib borilmoqda. Cruz va hamkorlari (2022) subkritik CO_2 ekstraksiyasi yordamida qovoq urug‘idan ekologik toza yog‘ olish texnologiyasini ishlab chiqqan. Bu usul 92-95% chiqish darajasi bilan fitosterollarga boy yog‘ olish imkonini bergan.

Khalid va boshq. (2023) mikroto‘lqinli va ultratovushli ishlov berish kombinatsiyasidan foydalanib qovoq urug‘i kunjarasidan oqsil izolati olish usulini taklif qilgan. Bu usul oqsillarning 90-95% ini ajratib olish va 95-98% tozalikdagi oqsil izolati olish imkonini bergan.

Park va boshq. (2023) fermentativ gidroliz va membranali filtratsiya usullari kombinatsiyasi asosida qovoq urug‘i oqsillaridan funksional peptidlar olish texnologiyasini ishlab chiqqan. Bu texnologiya natijasida antioksidant, antimikrob, gipokolesterolemik ta’sirga ega peptidlar olingan.

Qovoq urug‘lari inson organizmi uchun juda foydali hisoblanadi. Ularning tarkibidagi omega-3 va omega-6 yog‘ kislotalari yurak va qon tomir tizimi uchun muhim ahamiyatga ega. Shuningdek, qovoq urug‘laridagi antioksidantlar erkin radikallarni neytrallashtirishga yordam beradi, bu esa yallig‘lanish jarayonlarini kamaytiradi va qarish jarayonini sekinlashtiradi.

Qovoq urug‘lari shuningdek, immun tizimini mustahkamlash, suyaklarni kuchaytirish va xolesterin darajasini normal holatda ushlab turishda yordam beradi.

ISSN 3030-3907

Urug‘lar tarkibidagi magniy va rux elementlari tananing energiya darajasini oshiradi va nerv tizimining salomatligini qo‘llab-quvvatlaydi.

Qovoq urug‘larini qayta ishlashda ilg‘or texnologiyalardan foydalanish, ularning ozuqaviy qiymatini oshirish va turli xil mahsulotlarni ishlab chiqarish imkoniyatlarini kengaytiradi. Bunday mahsulotlar nafaqat oziq-ovqat sanoatida, balki kosmetika va farmatsevtika sohalarida ham keng qo‘llanilishi mumkin.

Shuningdek, qovoq urug‘lari eksport uchun ham potensial resurs sifatida ishlatilishi mumkin, bu esa mahalliy iqtisodiyotning rivojlanishiga hissa qo‘shadi. Kelajakda qovoq urug‘laridan olingan mahsulotlar ishlab chiqarishni optimallashtirish, ekologik jihatdan toza va yuqori sifatli oziq-ovqat mahsulotlarini yaratishga imkon beradi.

Xulosa. Ushbu ishda yuqori ozuqaviy qiymatga ega mahsulotlarni olish uchun qovoq urug‘larini qayta ishlash usulini ishlab chiqish masalasi ko‘rib chiqildi. Qovoq urug‘lari o‘zining boy ozuqaviy tarkibi, jumladan, oqsillar, yog‘lar, vitaminlar va minerallar bilan ajralib turadi. Ularning tarkibida omega-3 va omega-6 yog‘ kislotalari, E vitamini, rux kabi mikroelementlar mavjud bo‘lib, bu ularni sog‘liq uchun foydali oziq-ovqat mahsulotlari ishlab chiqarishda keng qo‘llaniladigan xom ashyo sifatida ajralib turadi.

Ushbu ishda qovoq urug‘larining ozuqaviy xususiyatlarini maksimal darajada saqlab qolish uchun yangi qayta ishlash usuli taklif qilindi. Ushbu usulda urug‘larni tozalash, qovurish va yog‘ ajratish texnologiyalari qo‘llanilgan. Qovoq urug‘laridan ajratilgan yog‘ sifatli o‘simlik yog‘i sifatida foydalidir va u oziq-ovqat qo‘shimchalari, kosmetika sanoati hamda sog‘liqni saqlashda ishlatilishi mumkin.

Bundan tashqari, qovoq urug‘larining biokimyoviy tarkibi va ularning inson salomatligiga ta’siri ham chuqur tahlil qilindi. Qovoq urug‘lari yurak-qon tomir tizimi, immun tizimi va oshqozon-ichak tizimi uchun foydali bo‘lib, organizmni zarur ozuqaviy moddalarga to‘ldiradi. Ular antioksidantlar va mikroelementlar bilan boy bo‘lib, yallig‘lanish jarayonlarini kamaytirishga yordam beradi.

Shuningdek, qovoq urug‘larining qayta ishlash texnologiyalarini optimallashtirish va ularni sanoat miqyosida keng qo‘llash imkoniyatlari ham ko‘rib chiqildi. Ushbu usullarni ishlab chiqish orqali qovoq urug‘larini yuqori sifatli va ekologik toza oziq-ovqat mahsulotlariga aylantirish mumkin. Mahalliy ishlab chiqarish va eksport imkoniyatlarini kengaytirish orqali iqtisodiy o‘sishga katta hissa qo‘shilishi mumkin.

Bularning barchasi qovoq urug‘larining qayta ishlash texnologiyalarini rivojlantirish va samarali qo‘llash bo‘yicha yangi imkoniyatlar yaratadi. Kelajakda ushbu sohada yanada kengroq o‘rganishlar va texnologiyalarning

ISSN 3030-3907

takomillashtirilishi kutilmoqda, bu esa ozuqaviy qiymati yuqori, ekologik toza mahsulotlar ishlab chiqarishni yanada samarali qiladi.

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ISSN 3030-3907

ФАРҒОНА “АЗАМАТ САВДО ЗИЁ” МЧЖ ИШЛАБ ЧИҚАРИШ КОРХОНАСИ ЧИҚИНДИ СУВЛАРИНИНГ ҲОСИЛ БЎЛИЩИ ВА ТОЗАЛАЩ ТЕХНОЛОГИЯСИ.

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Аннотация: Ушбу мақолада саноат ишлаб чиқариш корхонаси чиқинди сувларининг ҳосил бўлищи ва тозалащ технологияси ўрганилди. Бунга кўра “Азамат Савдо Зиё” МЧЖ дан Фарғона шаҳрининг канализациясига чиқадиган оқава сувлар ва уларни қайта ишлаш тўғрисида фикр юритилган. Чиқинди сувнинг кимёвий таркиби ўрганиш натижасида керакли реагент ва тозалаш технологияси ишлаб чиқиш мақсадга мувофиқ бўлади.

Калит сўзлар: чиқинди сувлар, “Азамат Савдо Зиё” МЧЖ, оқава сувлар, фосфатлаш, мойсизлантириш, дисперс системалар, тозалаш, ифлословчи компонент, оҳак сути.

Аннотация: В данной статье изучены образование и технологии очистки сточных вод промышленных предприятий. В частности, рассматриваются сточные воды, сбрасываемые с ООО "Азамат Савдо Зиё" в канализацию города Ферганы, а также их переработка. В результате изучения химического состава сточных вод целесообразно разработать необходимые реагенты и технологии очистки.

Ключевые слова: сточные воды, "Азамат Савдо Зиё" МЧЖ, дренажные воды, фосфатирование, обезжиривание, дисперсные системы, очистка, загрязняющий компонент, известковое молоко.

Abstract: This article examines the formation and treatment technologies of industrial wastewater. In particular, it considers the wastewater discharged by LLC "Azamat Savdo Ziyo" into the sewer system of the city of Fergana, as well as their processing. As a result of studying the chemical composition of the wastewater, it is advisable to develop the necessary reagents and treatment technologies.

Keywords: wastewater, "Azamat Savdo Ziyo" LLC, drainage water, phosphatation, degreasing, dispersed systems, purification, contaminating component, lime milk.

Кириш

Ишлаб чиқариш корхоналарининг саноат чиқинди сувларини тозалаб технологияга жорий этиш иқтисодиётга ҳамда экологияга жуда катта фойда келтиради.

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Сувни муҳофаза қилиш обектларининг қурилиши ва сувни қайта ишлатиш тизими қувватини ошириш сув манбаларини умуман қуришдан ёки ифлосланишдан яхшироқ мухофаза қилиш, корхоналарда сувдан фойдаланишнинг нооқова тизимини қўллаш ва шунингдек, сув хўжалиги комплексларини бошқаришнинг автоматлашган тизимини ташкил этиш, мамлакатимиздаги сув ресурсларидан тўғри фойдаланиш, уларни хўжалик, саноат корхона чиқиндилари орқали ифлосланишдан сақлаш ва сувни тозалаш жараёнини яхши ташкил этиш орқали амалга оширилади. Юқоридагилардан кўриниб турибдики атроф-муҳитни ва сув ҳавзаларини муҳофаза қилиш учун оқова сувларни ҳавзаларга ташлашдан олдин чуқур тозалаш керак. Бундан ташқари ишлаб чиқариш (саноат) оқова сувлари жуда заҳарли ҳисобланиб, кимёвий (реагент) элементларга бой бўлади. Шу сабабдан ҳам ишлаб чиқариш (саноат) корхоналари оқова сувини қайта ишлашда ёпиқ тизим қўлланилса мақсадга мувофиқ ҳисобланади[1].

Экспериментал қисм. Саноат чиқинди сувларининг коллоид, эриган заррачалардан тозалашда деярли мураккаб усулларни қўллашга тўғри келади. Усулни танлаш заррачани қайси ҳолатда коллоид, молекуляр ёки диссоциаланган ион бўлганлигига боғлиқ. Коллоид заррачаларни йўқотиш учун қўйидаги физик-кимёвий усуллар – флотация, коагуляция ва флокуляциядан, коллоид заррачаларни кинетик барқарорлигини йўқотишда фойдаланилади. Физик-кимёвий усуллар эриган заррачаларни йўқотиш учун ҳам қўлланилади. Молекуляр ҳолатда бўлган заррачалардан тозалашда турли хил сорбентлар, аэрация усулида десорбциялаш, экстракция, дистилляция ва мембранали усулларидан фойдаланилади. Ионларни диссоциацияланган моддалардан тозалашда ион алмашиниш, қайтар (тескари) осмос ва сувга магнит билан ишлов бериш усуллари самарали ҳисобланади [2].

Саноат чиқинди сувларининг таркиби ҳамда экология ва атроф муҳитга таъсири даражаси ўрганиб чиқилди. Бунга кўра: кальций ва магний комплексометрик усул билан аниқланди. Бу усул кальций ва магний ионларининг трилон Б билан ўзаро таъсирида индикатор рангининг ўзгаришига асосланади Натрий эса оловли фотометрик усул билан аниқланади [3].

Сульфатлар гравиметрик усулда аниқланди. Бу усулда кислотали муҳитда сульфатларни барий хлорид билан чўктиришга, сўнгра чўкмани ювиш ва тортиш орқали аниқланади [4].

Хлор ҳажмий аргонтометрик усул билан аниқланди. Бу усулда кумуш ионларининг калий бихромат билан ўзаро таъсири кумуш хлорид чўкмаси суспензиясининг ранги ўзгаришига асосланган. Ишлаб чиқилаётган

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технологияда бирламчи хом-ашё ювилган оқава сувлар ва қайта ишлов берилган элекролитлар аралашмасидир [5].

Тадқиқотнинг мақсади ва усуллари. Фарғона “Азамат Савдо Зиё” МЧЖ оғир саноатга асосланган ишлаб чиқариш корхонасида ҳозирги кунда бурама мих (самарез) ишлаб чиқариш йўлга қўйилган. Ишлаб чиқариш кўлами йилдан йилга сезиларли ортиб сифат кўрсаткичлари ҳам яхшиланиб бормоқда. Корхонада бурама мих ишлаб чиқариш жараёнининг кетма-кетлиги қуйидагича.

1. Сим чўзиш
2. Пиширириш
3. Сим юзасини қоплама қилиш (фосфатирования)
4. Калибровка тўғрилаш
5. Кесиш каллак очиш
6. Резба очиш
7. Пиширириш
8. Галваника (фосфатирования)
9. Қадоқлаш

Бурама мих ишлаб чиқариш жараёнида сим юзасини фосфат қоплама қилиш ҳамда, пиширириш (термообработка) жараёнидан сўнг мих юзасини қоплама қилиш галваника яъни емирилиш, занглашга қаршилигини ошириш учун қўлланилади. Фосфатлашнинг моҳияти маҳсулот юза қисмида темир, рух ёки марганец фосфатидан ташкил топган ҳимояловчи қобиқни ҳосил қилишдан иборатдир. Қоплама қилиш жараёнида ҳар қандай параметр алоҳида эътибор бермоқ лозим, чунки жараёнда қайсидир параметрда (ҳарорат, босим, консентрация) ўзгариш бўлса чиқаётган махсулот сифатига катта таъсир кўрсатади. Шундай экан ишлаб чиқариш автоматик линиясини ишлаш режими ҳамда ишчи параметрларини тўғри тақсимлаш доим назоратда тутиш жуда муҳим технологик омил ҳиссобланади. Юқоридаги кетма-кетликдан келиб чиққан ҳолда сим ишлаб чиқариш ҳамда мих ишлаб чиқариш жараёнидаги қоплама, яъни фосфат қоплама қилиш орқали чиқаётган чиқинди сувни тозалаш ва ишлаб чиқаришга тадбиқ этиш корхона иқтисодиётига ҳамда экологияга жуда катта фойда келтиради.

Ускуна автоматик равишда қуйидаги кетма кетликда ишлайди.

Технологик жараён кетма-кетлиги: юклаш → ёғсизлантириш → ювиш → водород хлорид билан тозалаш (травление) → ювиш → юза қисмини активлаштириш → фосфатлаш → ювиш → юкни тушириш → дегидрация (қуритиш) → мойлаш → дегидрация (қуритиш).

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Бу операциялар, мойсизлантиришдан бошлаб якуний ювишга қадар кетма-кет ванналарда амалга оширилди. Маҳсулот махсус барабанларга юкланади ва бу барабанлар ускунанинг ўзидаги релс бўйлаб ҳаракатланувчи кран ёрдамида ванналарга автоматик равишда тушиб чиқади. Юклаш термик кайта ишлаш бўлимидан келган тайёр махсулот махсус барабанларга тўғрилагич ёрдамида юкланади.

Саноат ривожланиши натижасида, чекланган сув бассейнининг ифлосланиши, Ўзбекистонда табиий сувларни муҳофазалаш муаммосини жуда актуаллигини кўрсатади.

Сув ресурсларини саноат томонидан ифлосланишидан муҳофазалаш қуйидаги йўналишларда олиб борилмоқда:

- корхонанинг ўзида оқава сувларни канализацияга ташлашдан олдин локал тозалаш иншоотларида тозалаш;
- қайтар ва берк сув таъминотини жорий этиш, тозаланган сувни қайта ишлатиш;
- тозалашнинг кам чиқиндили технологиясини қўллаш.

“Азамат Савдо Зиё” МЧЖда Фарғона шаҳрининг канализациясига оқава сувларни ташлаш меъёрларига жавоб берадиган оқава сувларни тозалаш технологиясини танланди. Фосфатлаш линиясидаги оқава сувлар тозалашга йўналтирилади.

1-жадвал

“Азамат Савдо Зиё”МЧЖда Фарғона шаҳрининг канализациясига оқава сувларни ташлаш сифат ва миқдор таркиби

№	Жараён номи	Жиҳозлар сони, дона	Ванна таркиби, %	Ванна ҳажми, $м^3$	Оқизиш такрор ланиши	Тозалов тури
1.	Қайноқ мойсизлан Тириш	2	35-45	0,822	2-3 хафта	Барабан
2.	Зарарлан-тириш (травление)	2	22-28	0,822	2-3 хафта	Барабан
3.	Юза активацияси	1	0,1	0,63	Ҳар куни	Барабан
4.	Фосфатлаш	2	40-50	1,164	Оқизмас дан	Барабан
5.	Ювиш	6		0,63	Тўхтов сиз	Барабан

Мойсизлантирувчи қайта ишланган фосфатли ва рухли эритма мойсизлантириш эмульгирлаш маҳсулоти, механик юқорига олиб чиқувчи (взвеси) ва мойлар бўлган мураккаб тўрт фазали коллоид-дисперс тизимдир.

ISSN 3030-3907

Мойсизлантириладиган эритма юзасидан мойларни дастлабки олиб ташлаш маҳсулотларини тўхтовсиз технологик схемаси бўйича мойсизлантириш жараёнида содир бўлади. Бунинг учун тиндиргич типидаги мослама ишлатиш мақсадга мувофиқдир. Плёнкали мойлар ва енгил сувда эрийдиган фракциялар оқизма карманга, сўнг мой фракцияларини ажратувчи мосламага оқиб ўтади.

1-жадвалда келтирилган маълумотларга кўра, ҳулоса қилиш мумкинки, “Азамат Савдо Зиё” МЧЖда фосфатлаш ва рухлаш участкасида оқава сувларни ифлословчилар фосфат, рух, темир, мойлар ионлари ва канализацияга ташлаш меъёрларига жавоб бермайдиган ва дастлабки тозаловни талаб этадиган *pH* миқдори концентрациясидир.

Муҳокама ва натижалар. Саноат чиқинди сувларини очиқ сув ҳавзаларига ташлаш санитария қоида ва меъёрларига риоя қилишни талаб қилади. Шунинг учун, саноат чиқинди сувларини канализация тизимига ташлашдан аввал бир неча босқич тозалаш усулларини қўллаб, санитария ҳолатига салбий таъсир кўрсатмайдиган тозалаш усулларидан фойаланиб, саноат чиқинди сувларини сув ҳавзасига ташлаш керак.

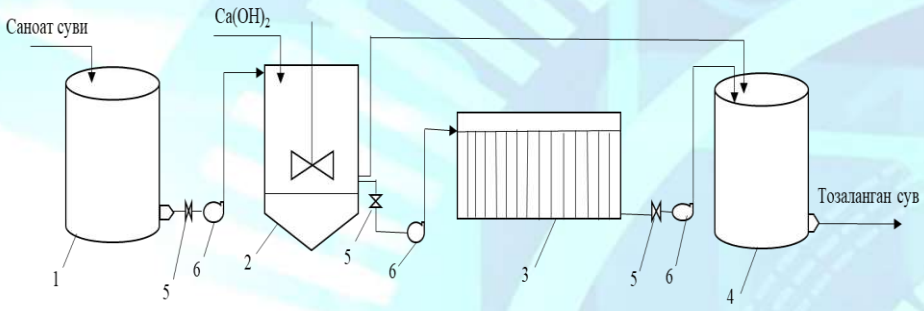
Оқава сувларни тозалаш иншоотларини унуморлиги, ишлаб чиқариш жараёнида ҳосил бўлаётган чиқинди сувнинг таркибига бевосита боғлиқ. Юқорида келтирилган маълумотлар асосида, оқава сувнинг таркибидаги табиат ва ҳайвонот оламига зарар етказиши мумкин бўлган кимёвий моддалардан тозалашга қаратилган.

Фарғона “Азамат Савдо Зиё” МЧЖ ишлаб чиқариш корхоналарида металлар юзасини каррозияга чидамлилигини ошириш (фосфатлаш, рухлаш) мақсадида кимёвий ишлов берилади. Ушбу жараёнда ҳосил бўлаётган саноат чиқинди сувларини тозалаш ҳамда ишлаб чиқаришда синов жараёнларини амалга ошириш, мақсадида тавсия этилаётган лаборатория қурилмаси ишлаб чиқилди (1-расм).

Корхона шароитида ҳосил бўладиган иккиламчи-ифлосланган техник сувлар, сув тозалаш бўлимига келганидан сўнг, чиқинди сувни йиғиш *1* бункерида тиндирилиб ўзи чўкиши мумкин бўлган моддалар идиш (чиқинди сув йиғгич) тубига чўкади ва маьлум бир тозаликка эришилади. Эритма таркибида қолган эриган моддалар аралаштиргич *2* га олинади. Бу жараёнда оқава сувнинг pH кўрсатгичи аниқ бўлиши жуда муҳум. Аралаштиргич ҳажми ишлаб чиқаришда ҳосил бўладиган чиқинди сувнинг миқдоридан келиб чиқиб танланади. Аралаштиргичга тушган чиқинди сув 5-7 % ли $Ca(OH)_2$ эритмасидан 2,5-3% қўшилади ва яхшилаб аралаштирилади. Сўнгра, аралашма 30 минут давомида тиндирилади. Юқори қисмидаги тозаланган

ISSN 3030-3907

сувнинг *pH* аниқланади ва тоза сув бўлими *4* га берилади, умумий эритманинг 1/3 қисмини эса пресс филтр *3* га берилади. Тозаланган сувнинг *pH* кўрсатгичи 6,5-8,5 мг/л атрофида бўлиши зарур, тозалаш жараёнида ишқордан *($Ca(OH)_2$)* фойдаланганимиз учун деярли *pH* 7 мг/л атрофида ўзгаради. Агарда pH - 9,5 мг/л гача кўтарилса *pH* тўғрилагичда хлорид кислота эритмаси ёрдамида пасайтирилади. Ҳар бир жараён оралиғида сув тозалаш жараёнида қувурлардан ҳаракатланиб кейинги жараёнга узатилади. Қувурлар бир бири билан *5* фланецлар ёрдамида бириктирилади ва *6* насослар орқали узатилади.



1-расм. Фарғона “Азамат Савдо Зиё” МЧЖ дан ажралиб чиқаётган техник сувни тозалаш лаборатория қурилмасининг технологик схемаси: 1-йиғгич, 2-аралаштиргич, 3-прессфилтр, 4-тозаланган сувни йиғиш бункери, 5-флянец, 6-насос.

Ишлаб чиқаришдан ҳосил бўлган чиқинди сувлар, сув тозалаш иншоотига берилади, ҳамда тозалаш натижасида тоза технологик сув ишлаб чиқариш жараёнига берилади. Сувни тозалаш натижасида, ўз навбатида чиқинди қуруқ масса фиртда ушлаб қолинади. Қуруқ масса йиғилиб ҳозирги кунда махсус ҳудудга, чиқинди сифатида олиб чиқиб кетилмоқда.

Оқава сувлардаги моддалар концентрацияси асосан оқава сувлар меъёрига боғлиқ бўлади, яъни оқава сувлар меъёри қанча кўп бўлса, уларнинг ифлослик концентрацияси шунча кам бўлади. Ўз-ўзича тиндиргичда чўкмайдиган қисмни фильтрлаш натижасида қуруқ масса шаклига келтирилди. Чўкинди, оқава сувларни қайта ишлаш жараёнида ҳосил бўлади. Сувсизлантирилгандан сўнг, чўкинди ҳажми – 0,35 т/сут, чўкинди намлиги 80%. Ишлаб чиқариш оқава сувларини тозалаш технологиясида вакум фильтрдан чиқаётган қуруқ массани таркиби қуйидагича:

2-жадвал

Фарғона “Азамат Савдо Зиё” МЧЖ сувидан ажратиб олинган чўкма таркиби

№	P_2O_5	Fe_2O_3	ZnO	CaO	MgO	TiO	SO_3	CuO	SrO	Cr
1	25,47	52,48	11,25	5,14	1,76	0,13	1,41	0,02	0,02	0,152

ISSN 3030-3907

2	24,92	52,57	11,49	5,24	1,76	0,15	1,22	0,03	0,02	0,154

2-жадвалда реакцияга киришган Fe_2O_3 52,5 г бирикмалари ҳосил қилади. P_2O_5 25 г, ZnO 11,3 % , CaO 5,2 % бор эканлигини кўриш мумкин. Ушбу таркибий қисмларни ренгенофлюроцент ёрдамида аниқланди.

Қуруқ масса таркибидан келиб чиқиб таркибидаги темир ва рух сақловчи бирикмаларни ажратиб олиб қолган қисмни ўғит ишлаб чиқариш учун хом-ашё сифатида фойдаланишимиз мумкин бўлади. Бунинг учун, ажратиб олинган қуруқ массани аммиакли эритма билан эритма муҳитига ўтказамиз. Эритма муҳитига ўтказилгандан сўнг, аммиак таъсир эттирилса *pH* 3-3,5 га этганда темир чўкмаси ҳосил бўлади.

Чиқинди таркибидаги рух бирикмаларини рух хлориди олиш жараёни бўйича дастлабки маълумотлар ўрганиш натижасида чиқинди таркибида 11,3 % атрофида рух оксиди борлигини ҳисобга олган ҳолда ишлаб чиқариш учун етарли бўлади.

Ҳулоса Ҳозирги кунда чиқиндисиз технологияга асосланган ишлаб чиқаришни ташкил этиш ҳамда ичимлик сувига бўлган эхтиёжни ҳиссобга олган ҳолда чиқинди сувларни тозалаб қайта ишлатиш айланма сув технологиясини ишлаб чиқиш мақсадга мувофиқ ҳиссобланади. Бундан ташқари ҳавонинг ифлосланиши тупроқ ва ўсимликларнинг зарарланишини олдини олган бўламиз.

Саноат сувларини таркибидаги ёғ ва ёғ махсулотларини тозалаш ҳамда органик бирикмаларни ажратиб олиб саноат учун хизмат қилишини таъминлаш жуда катта ишлаб чиқариш учун иқтисодий самара келтиради. Бундан ташқари чиқинди сув таркибидаги органик бирикмалар экин майдонлари канализация экология учун жуда хавфли ҳиссобланади шундай экан органик бирикмалар тозалаб шунчаки чиқинди сифатида ташлаб юбормаслик аксинча ишлаб чиқаришга тадбиқ этиш жуда муҳим ҳиссобланади. Саноатда термик ишлов бериш бўлимида совутиш мақсадида ишлатилаётган мойларни ўрнига тозалаш ва қайта ишлаш технология натижасида тозалаб ва қайта ишланган ёғ синов натижалари ўрганиб чиқилди ва ижобий натижага эришилди.

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INKLYUZIV TA’LIM JARAYONIDA DIFFERENSIAL YONDASHUVNING AHAMIYATI VA O‘ZIGA XOS XUSUSIYATI

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Annotatsiya: Ushbu maqolada bugungi kunda imkoniyati cheklangan yoshlar ta’limining mazmun-mohiyati, o‘quv jarayonida ta’limning modellashtirilgan istiqbolli, zamonaviy texnologiyalaridan foydalanish keltirilgan. Ehtiyojga qaratilgan differensial yondoshuv inklyuziv ta’lim jarayonida imkoniyatlarni kengaytirib ta’lim sifatini oshirishi uchun xizmat qiladi. O‘quvchilarning individual ehtiyojlariga mos ta’lim berish orqali ularning bilim olish samaradorligini oshirish masalasi yoritilgan.

Kalit so‘zlar: Ijtimoiy tenglik, kognitiv bilish, induviduallik, emperik bilish jarayonlari, infrastruktura, interfaol metodlar, kommunikativlik.

Аннотация: В этой статье в этой статье сегодня предоставляет содержание образования дети с ограниченными возможностями, использование моделированных и современных технологие в образовательном процесса Неограниченный дифференциальный подход к потребностям служит для улучшения качества образования за счет расширения возможностей в процессе инклюзивного образования. Благодаря образованию индивидуальные потребности студентов покрываются проблемой повышения эффективности обучения.

Ключевые слова: социальное равенство, когнитивное, ингибирование, пустые процессы знания, инфраструктура, интерактивные методы, коммуникации.

Annotation: In this article, today provides the content of youth education with disabilities, the use of modeled and modern technologies in the educational process. An unleavened differential approach to the needs serves to improve the quality of education by expanding the capabilities in the process of inclusive education. Through education, the individual needs of students are covered by the issue of increasing the effectiveness of learning.

Keywords: social equality, cognitive, inhibition, empty knowing processes, infrastructure, interactive methods, communications.

Kirish

ISSN 3030-3907

Bugungi kunda dunyo miqyosida keng targ‘ibot qilinayotgan va alohida e’tirof etilayotgan inklyuziv ta’lim strategiyasi, ya’ni alohida ta’limga ehtiyoji bo‘lgan bolalarni o‘qitish, tarbiyalash masalasi mamlakatimizda ustuvor vazifalardan biriga aylanmoqda. Bunda alohida ta’limga ehtiyojlari bo‘lgan bolalarning o‘ziga xos xususiyatlari, qobiliyatlari va cheklangan imkoniyatlarini inobatga olgan holda, ta’lim-tarbiya jarayonini samarali tashkil etishga qodir mahoratli ishchi dasturlarni tayyorlash alohida ahamiyat kasb etadi. Zero, inklyuziv ta’lim muhitida o‘quvchilarning funktsional inkoniyatlari kengayadi, zimmasiga yangi vazifalar yuklanadi bu esa undan yuqori darajali inklyuziv-metodik kompetentlikka ega bo‘lishini talab etadi.

Imkoniyati cheklangan o‘quvchilarning umumiy bo‘lgan bilim, ko‘nikma va malakalarining o‘ziga xos xususiyatlarini umumiy qilib ajratish mumkin. Bilim olishdagi muammolar masalan, xotiraning sustligi, bilish jarayonlarining maqsadga yo‘naltirilmaganligi, cheklanganligi, fikrlashning yetarlicha bo‘lmasligi o‘quvchilarga ta’lim jarayonida tushunishida hamda o‘zlashtirishida qiyinchiliklarni keltirib chiqaradi. Analiz va sintez jarayonlarining nomukammalligi tufayli ular masalani to‘liq emas, balki qismlarini idrok etadilar, yoki tasavvur ko‘nikmalarining yetarlicha shakllanmaganligi sababli tezda esdan chiqish holatlari kuzatiladi, voqea qismlarni bir butunga bog‘lay olmaydilar, sabab-oqibat aloqalarini o‘rnata olmaydilar. Shu sababli inklyuziv ta’lim sharoitida ishlayotgan o‘qituvchi birinchi navbatda sinfni o‘rganishi, har bir o‘quvchining xususiyatlari, uning imkoniyat darajadalarini aniqlashi, uni psixik, jismoniy o‘ziga xosliklarini hisobga olgan holda sinfda ishlashga jalb qilishi zarur. Mashhur rus olimi Vigotskiy aytganidek, har bir organizm induvidualdir, har bir bolalning ta’sir chegarasi hamda o‘zlashtirish qobiliyati, qiziqishlari mavjud. Shundan kelib chiqqan holda inklyuziv muhitda ishlayotgan har bir pedagog bolalarninng ehtiyojlariga va imkoniyatlaridan kelib chiqqan holda ish faoliyatini olib borsa bolada hamda sinf jamoasida ijobiy natijalarni qo‘lga kiritadi. Jahon tajribasiga nazar soladigan bo‘lsak, ta’lim samaradorligini oshirishda ehtiyojga asoslangan ta’lim tizimidan foydalanadi. Ushbu yondashuv AQSh, Finlyandiya, Yaponiya kabi rivojlangan mamlakatlarda keng qo‘llanilib kelinmoqda. Misol qilib oladigan bo‘lsak, Finlyandiya ta’lim tizimida har bir o‘quvchining qobiliyatini rivojlantirishga yo‘naltirilgan individual yondashuv muhim o‘rin egallaydi. Induvidual yondoshuvga asoslangan tizimning mohiyati shundaki, o‘quvchilarning qobiliyati, individual ehtiyojlari va qiziqishlarini inobatga olib, ta’lim jarayonini moslashtirishdan iborat.

METODOLOGIYA: Darsning sifatli va samarali tashkil qilish o‘qituvchining o‘z oldiga qo‘ygan maqsadi bilan aniqlanadi. Inklyuziv sinflarda darsga qo‘yiladigan

ISSN 3030-3907

maqsad umumiy o‘rta ta’lim sinflarinikidan farqli o‘laroq, korreksion maqsad ham mavjud bo‘ladi. Korreksion-rivojlantiruvchi vazifa o‘quvchini aqliy jarayonlarni, bolaning hissiy ixtiyoriy sohasini rivojlantirishga, mavjud kamchiliklarni maxsus pedagogik va psixologik usullar bilan tuzatish va qoplashga aniq yo‘naltirilgan bo‘ladi.. Ushbu vazifa juda aniq bo‘lishi va darsda maksimal darajada ishtirok etadigan aqliy funksiyalarni faollashtirishga qaratilgan bo‘lishi kerak. Korreksion-rivojlantiruvchi vazifani amalga oshirish yuqori aqliy funksiyalarni, hissiy-irodaviy, kognitiv sohalarni va boshqalarni takomillashtirish uchun darsga maxsus tuzatish va rivojlantirish mashqlarini kiritishni, bir nechta analizatorlarga asoslangan vazifalarni kiritishni va boshqalarni o‘z ichiga oladi. Imkoniyati cheklangan bolalar va o‘smirlarning bilimlari ularning shaxsiy xususiyatlari va qobiliyatlariga asoslangan holda belgilangan tartibda baholanadi.

Aqsh olimlarining aniqlashicha inklyuziv ta’lim muhitida ar bir o‘quvchining shaxsiyati va o‘ziga xosligini qadrlashga asoslangan inklyuziv amaliyotlar jamiyatda yanada adolatli ta’lim tizimini shakllantirishga xizmat qiladi. Mitchell va Sutherland (2020) tomonidan olib borilgan tadqiqotlar shuni ko‘rsatadiki, inklyuziv ta’limni rivojlantirish uchun ta’lim metodologiyalarini turli o‘quv ehtiyojlariga moslashtirish muhim ahamiyat kasb etadi. Ular tomonidan tavsiya etilgan usullar orasida differensial ta’lim, (o‘quvchilarning individual ehtiyojlari, qobiliyatlari va o‘qish sur’atlarini hisobga olgan holda ta’lim jarayonini tashkil etish usuli), formative (o‘quvchilarning bilim va ko‘nikmalarini doimiy ravishda) baholash va hamkorlikka asoslangan o‘qitish kabi strategiyalar mavjud. AQShda amalga oshirilgan tadqiqotlarda Needs Based Teaching (ehtiyojga asoslangan ta’lim) asosidagi differensial yondashuvdan foydalanilgan sinflarda o‘quvchilarning o‘zlashtirish darajasi 20% ga yuqori bo‘lgan (Tomlinson, 2021)

AMALIY ISHLAR BAYONI: differensial yondashuvni amalga oshirish bu har bir bola uchun alohida imkoniyat demakdir. Inklyuziv talim o‘qituvchisining dars mashg’ulotlari imkoniyati cheklangan bolalar uchun samarali bo‘lishi quyidagi omillarga bog’liq.

- o‘quvchilarning bag’rikenglik ruhida tarbiyalanganligi hamda jamoada do‘stona muhitning mavjudligiga (har bir o‘quvchi nogironligi bo‘lgan bolaga nisbatan achinish ko‘zi bilan emas , balki do‘stidek qarashi kerak)
- imkoniyati cheklangan bolalarning nuqsonidan kelib chiqqan holda sinf xonasi infrastruktura bilan ta’minlangan bo‘lishi, (inklyuziv maktablarda imkoniyati cheklangan bolalar uchun maxsus qurilmalar vositalar bilan ta’minlangan bo‘lishi kerak)

ISSN 3030-3907

- O‘qituvchi-pedagog imkoniyati cheklangan bola bilan ishlash ko‘nikmasini yetarlicha egallagan bo‘lishi kerak (alohida ta’limga ehtiyoji bo‘lgan bolaning diagnozi bilan tanishgan bo‘lishi kerak)
- Bunday bolalar uchun maxsus induvidullashgan yoki soda shakldagi o‘quv uslubiy qo‘llanmalardan kartochkalardan foydalanish maqsadga muofiqdir.

Inklyuziv sinflarda darslarni qurishda har bir o‘quvchining individual xususiyatlarini hisobga olish, differensial yondashuv orqali ta’lim samaradorligini oshirish mumkin. Differensial ta’limning vazifalari o‘quvchining o‘ziga xosligi (individualligini) ko‘rish, o‘z kuchiga ishonishga yordam berish va bu orqali pedagoglar sinf jamoasida bilim darajasi samaradorligini oshirishdan iborat. Differensial yondashuv o‘qituvchilardan ta’lim oluvchilarning individual xususiyatlari va o‘qish imkoniyatlari, kognitiv xususiyatlarini (idrok, diqqat, tafakkur, xotira va boshqa psixik jarayonlarning rivojlanish darajasi) ni, o‘quv fanlar bo‘yicha bilim, ko‘nikma, malakalar darajasini, tengdoshlari bilan muloqotga kirishishini va imkoniyatlarini o‘rganishni talab qiladi. Bu esa pedagogik jarayonda korreksion rivojlantiruvchi natijaga erishish maqsadida amaliy ishlash jarayonida ta’limni individuallashtirish imkonini beradi. Differensial yondashuv asosidagi ta’lim jarayonida o‘qituvchilar topshiriq bilan birga yordam elementlari mavjud bo‘lgan kartachalar; turli usullardan foydalanish o‘quvchiga yengillik olib keladi hamda darsga bo‘lgan qiziqishni oshiradi.

-darsda bajarish uchun muqobil (moslashtirilgan) topshiriqlar;

-o‘qituvchilar tomonidan mazmuni aniqlashtirilgan, soddalashtirilgan topshiriqlar;

- faoliyatning to‘g‘ri usullarini egallashga yordam beruvchi topshiriqlardan

- harakatga undovchi interfaol texnologiyalardan foydalanishi maqsadga muvofiq.

Inklyuziv ta’lim sharoitida o‘quv materiallarini alohida ta’lim ehtiyojlari bo‘lgan o‘quvchilarning ta‘limiy imkoniyatlariga moslashtirishda inklyuziv ta’lim texnologiyalaridan foydalaniladi. Inklyuziv ta’lim texnologiyalari ham o‘z navbatida tuzilishiga qarab 2 guruhga bo‘linadi;

1. Tashkiliy texnologiyalar:

Tashkiliy texnologiyaning ikkinchi nomi dasturlash yoki loyihalashtirish texnologiyasi deb nomlanadi. Bunda har bir maktabdagi o‘quvchilar jamoasi birgalikda faoliyat olib borilishiga aytiladi. O‘qituvchilar va boshqa mutaxassislar o‘rtasidagi jamoaviy hamkorlikni tashkil etish texnologiyalari. Har bir maktab jamoasida inklyuziv sinf tashkil qilingandan so‘ng har bir pedagog bu bolalarning ta’lim- tarbiya olishlari, unda kechayotgan psixik jarayonlar, oilaviy munosabati ota-ona bilan hamkorligi haqida axborotga ega bo‘lishi kerak. Inklyuziv sin

ISSN 3030-3907

aksariyat boshlang'ich sinflarda tashkil qilinganligi sababli, imkoniyati cheklangan bolalar bilan boshlang'ich sinf o'qituvchisidan tashqari maktab psixologi, maxsus pedagog hamda logoped, maktab hamshirasi, fan o'qituvchilari birgalikda faoliyat olib borishi kerak. Chunki bunday bolalar sog'lom bolalardan farqli o'laroq sog'ligida muammo bo'lganligi sababli e'tibor har tomonlama qaratilishi va ham imkoniyati cheklangan bolalar uchun ham sog'lom bolalar uchun komfort muhit yaratilgan bo'lishi kerak.

2.Ta'limiy texnologiyalar:

-turli xil ta'limiy ehtiyojlari bo'lgan bolalarga ta'lim-tarbiya berish jarayonida turli bilim va kompetentsiyalarini o'zlashtirishiga yordam beradigan texnologiyalar;

-differentsial ta'lim texnologiyalari, ta'lim jarayonini individuallashtirish texnologiyalari;

-bolalarnining o'qitishdagi qiyinchiliklarni, xulqidagi og'ishlarni bartaraf etishga yo'naltirilgan texnologiyalar.

-ijtimoiy (hayotiy) kompetentsiyalarini, shaxsiy sifatlarini rivojlantirishga qaratilgan texnologiyalari.

-ta'lim oluvchilarning yutuqlarini baholash texnologiyalari.

Bu texnologiya o'quvchilarga yengil, tushunarli, va qiziqarli materiallar taqdim etish orqali ularning muvaffaqiyatga erishish imkoniyatlarini oshiradi. O'quvchilarning motivatsiyasini oshirish va o'rganish samaradorligini yaxshilashda muhim rol o'ynaydi.

Alohida ta'lim ehtiyojlari bo'lgan o'quvchilarning intellektual va nutqiy rivojlanishining o'ziga xos xususiyatlari tufayli darslik yordamida yangi materialni tushuntirish tavsiya etilmaydi. Kerakli o'quv materialini to'liq o'zlashtirish uchun, bolalar uchun o'rganilayotgan materialning ko'rgazmali misollari bilan tasdiqlaydigan amaliy faoliyat va o'qituvchining tushuntirishlari bo'lishi kerak. Vizual usullardan amaliy usullar bilan birgalikda tabaqalashtirilgan foydalanish korreksion pedagogik ishlarning samaradorligini oshiradi. Bunday mashg'ulotlar barcha bolalar muvaffaqiyatlarga erishishga, o'qituvchiga korreksion ishlarining usullarini va individual yondashuvini to'g'ri amalga oshirishga yordam beradi. Inklyuziv ta'limning rivojlanishida o'ziga xos xususiyatlarga ega bo'lgan va oddiy o'quvchi juftlikda ishlash amaliyoti yaxshi samara beradi, bunda juftlik tarkibi asta-sekin o'zgaradi, maxsus ehtiyojlar o'quvchi yoniga yangi o'quvchi qo'shiladi.

Alohida ta'limiy ehtiyojlari bo'lgan o'quvchilarni inklyuziv sinflarda o'qitishda differensial yondashuvni amalga oshirish orqali yaxshi samaradorlikka erishish mumkin.

ISSN 3030-3907

Inklyuziv ta’limda duch kelinadigan asosiy muammolar va ularning yechimlari.

Inklyuziv ta’lim jamiyatning barcha qatlamlari uchun muhim bo‘lgan zamonaviy ta’lim konsepsiyasidir. Ushbu model har bir bolaning, jumladan, imkoniyati cheklangan bolalarning ham teng imkoniyatlar asosida ta’lim olishini ta’minlashga qaratilgan. Inklyuziv ta’lim nafaqat o‘quvchilarning individual ehtiyojlarini qondirish, balki ularni jamiyatga muvaffaqiyatli integratsiya qilish imkonini beradi. Inklyuziv ta’lim rivojlanishi orqali jamiyatda tenglik, bag‘rikenglik va adolat tamoyillari mustahkamlanadi. Har bir bolaning imkoniyatlaridan qat’i nazar, teng ta’lim olish huquqiga ega bo‘lishi ta’minlanadi. Bu esa, o‘z navbatida, inklyuziv ta’lim olgan bolalarning kelajakda jamiyatning to‘laqonli a’zosi sifatida faoliyat yuritishiga imkon yaratadi. Kelajakda inklyuziv ta’limni yanada rivojlantirish uchun davlat siyosati doirasida qator tashabbuslarni ilgari surish, pedagogik va psixologik xizmatlarni takomillashtirish, xalqaro tajribalardan foydalanish va ta’lim tizimini uzluksiz ravishda modernizatsiya qilish muhim ahamiyat kasb etadi. Ushbu yo‘nalishda olib boriladigan har qanday islohot nafaqat imkoniyati cheklangan bolalar, balki butun jamiyat uchun muhim ahamiyat kasb etishi shubhasizdir. Bu borada yurtimizda bir qancha qator loyihalar va tashabbuslar bo‘lishiga qaramay bugungi kunda bir qancha muammolar ham yoq emas. Ushbu muammoning eng asosiy uchtasini belgilab o‘tamiz.

Inkyuziv ta’limda uchrayotgan eng sezilarli muammolardan biri o‘qituvchilarning maxsus tayyorgarlik darajasining pastligidir. O‘qituvchilarda yetarlicha ma’lumot va axborotlarning mavjud bo‘lmasligidiagnozli bolalar bilan ishlash ko‘nikmalarining yaxshi rivojlanmaganligi, Imkoniyati cheklangan bolalar uchun umumiy ta’lim dasturlari moslashtirilmagan bo‘lishi mumkin. Ba’zan ular dars jarayoniga to‘liq moslasha olmaydi, shuningdek, sinfdoshlari ham ularga qanday munosabatda bo‘lishni bilmaydi va natijada sinfda do‘stona muhitning shakllanmasligi, imkoniyati cheklangan bolalarga nisbatan past nazar bilan qarash holatlarining uchrashi kuzatiladi. Bu esa sinfda ta’lim sifatiga sezilarli ta’sir ko‘rsatadi.

Yechim: Maktab va ta’lim muassasalarida professional psixologlar va defektologlar faoliyat yuritishi lozim. Ular imkoniyati cheklangan bolalar bilan individual va guruhiy mashg‘ulotlar o‘tkazib, ularning ta’lim jarayoniga moslashuviga yordam berishi kerak. Ta’lim olish jarajonida esa maxsus o‘quv materiallarini ishlab chiqish, inklyuziv ta’lim uchun o‘quv dasturlarini moslashtirish, qo‘shimcha vizual, audio va interaktiv materiallar yaratish zarur. Har bir bolaga imkoniyati cheklangan bolaning o‘ziga xos xususiyati haqida tushuncha berib, yordamlashish kerakligi, ular ham inson sifatida hurmat qilinishi

ISSN 3030-3907

bilish jarayonlarida ko‘maklashish kerakligi, ko‘mak tushunchalarini erta yoshlaridan o‘rgatib borilishi kerak.

Navbatdagi dolzarb muammolardan biri esa ota-onalarning inklyuziv ta’lim haqida yetarli ma’lumotga ega emasligidir. Ba’zi ota-onalar inklyuziv ta’lim mohiyatini to‘laqonli anglamaganligi sabali tizimga shubha bilan qaraydi. Ular o‘z farzandining maxsus ta’lim ehtiyojlari haqida yetarli bilimga ega bo‘lmaganligi sababli, noto‘g‘ri qarorlar qabul qilishi mumkin. O‘qituvchilar va ota-onalar uchun inklyuziv ta’lim bo‘yicha maxsus kurslar tashkil etish bu muammoga yechim bo‘la oladi. Bu kurslar orqali ota-onalarga farzandining rivojlanishi, ta’lim jarayoniga moslashuvi va psixologik qo‘llab-quvvatlanishi bo‘yicha zarur bilim va ko‘nikmalar va qator tavsiyalar berib boriladi. Ota-onalarni huquqiy jihatdan qo‘llab-quvvatlash ham muammo yechimi bo‘lishi mumkin. Ota-onalar uchun maxsus maslahat markazlari ochilishi va u yerda psixolog, defektolog va ijtimoiy xodimlar, huquq targ’ibot organlari vakillari yordam berishi, ota-onalar orasida tajriba almashish tizimini yaratish va yo‘lga qo‘yish ularni bir joyga jamlovchi elektron ilova va vositalarni yaratish yordam beradi. Bu bilan maxsus bolalar uchun inklyuziv ta’limni qabul qilgan ota-onalar boshqalarga o‘z tajribalarini ulashishi va ularga maslahat berishlari mumkin. Inklyuziv ta’limning to‘laqonli amalga oshirilishi uchun ta’lim tizimi, jamiyat va ota-onalar hamkorlikda ishlashi kerak.

Shu o‘rinda inklyuziv ta’limni moliyalashtirish bilan bog’liq qator muammolarga duch kelyapmiz. Jamiyatda inklyuziv ta’limning ahamiyatini kengroq targ‘ib qilish, hukumat va nodavlat tashkilotlari tomonidan inklyuziv ta’limni qo‘llab-quvvatlash bo‘yicha maxsus loyihalar amalga oshirish, ijtimoiy reklama va ommaviy axborot vositalarining rolini oshirish, televideniye, radio va ijtimoiy tarmoqlarda inklyuziv ta’limning afzalliklari haqida keng targ‘ibot olib boorish sohaning yanada keng miqyosda tanilishi va jamiyatning inklyuziv ta’limga muhtoj bo‘lganqatlamini e’tiborini tortishga yordam beradi. Davlat va xususiy sektorda qo‘llab-quvvatlashmexanizmlarini yaratish esa inklyuziv ta’limga investitsiya kiritgan tashkilotlar uchun imtiyozlar berish, shuningdek, maxsus grantlar ajratish imkonini yaratadi.

Xulosa o‘rnida, inklyuziv ta’lim tizimida o‘qituvchilarda differensial yondoshuv asosida dars mashg’ulotlarini olib boorish har tomonla o‘quvchilar uchun sifatli ta’limning asosiy garovidir. Differensial yondashuv asosida har bir o‘quvchining individual xususiyatlarini aniqlash va shu asosida soddalashtirilgan yordamchi vositalardan foydalanish darsning sifatini oshirishni ta’minlaydi.

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ISSN 3030-3907

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ISSN 3030-3907

O‘ZBEKISTON IQTISODIYOTIGA ISLOM MOLIYASINING KIRIB KELISHI VA QARZ MUNOSABATLARIDA SMART CREDIT SCORING MODELLARI

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Annotatsiya: Maqolada yaqin 5 yil davomida O‘zbekiston iqtisodiyotida olib borilayotgan o‘zgarishlar, moliyaviy munosabatlarga berilayotgan innovatsion yechimlar va ularning huquqiy normalari o‘rganilgan. Jamiyatda islom moliyasiga bo‘lgan munosabat atroflicha o‘rganilib, moliyaviy munosabatlarda islom moliyasi xizmatlarini joriy qilish va uning huquqiy asoslari tahlil qilindi. Maqolaning asosiy nuqtasi sifatida qarz munosabatlarini islom me’yorlariga asoslangan holda sun’iy intellekt modellaridan foydalanib yangi model ishlab chiqish ko‘rsatmalari va xalqaro ilmiy resurslar tahlili keltirilgan.

Kalit so‘zlar: islom moliyasi, an’anaviy iqtisodiyot, qarz, kredit scoring, machine learning, sun’iy intellekt, fintech, bank.

Annotation: This article examines the changes in Uzbekistan’s economy over the past five years, the innovative solutions introduced in financial relations, and their legal frameworks. The society’s attitude toward Islamic finance is analyzed in detail, and the implementation of Islamic financial services in financial relations and their legal foundations are discussed. The main focus of the article is the development of a new model for debt relations based on Islamic principles, utilizing artificial intelligence models, along with an analysis of international scientific resources.

Keywords: Islamic finance, traditional economy, debt, credit scoring, machine learning, artificial intelligence, fintech, banking.

Аннотация: В статье рассматриваются изменения в экономике Узбекистана за последние пять лет, инновационные решения в финансовых отношениях и их правовые основы. Подробно анализируется отношение общества к исламским финансам, внедрение исламских финансовых услуг в финансовые отношения и их правовые основы. Основное внимание уделено разработке новой модели долговых отношений на основе исламских принципов с использованием моделей искусственного интеллекта, а также анализу международных научных ресурсов.

Ключевые слова: исламские финансы, традиционная экономика, долг, кредитный скоринг, машинное обучение, искусственный интеллект, финтех, банковское дело.

ISSN 3030-3907

Kirish

Qarz munosabatlari moliyaviy jarayonlarning muhim bir qismi bo‘lib, jamiyatda eng keng tarqalgan iqtisodiy munosabatdir. Qarzning inson va inson, inson va biznes, biznes va inson, biznes va biznes ko‘rinishlari mavjud. Har bir jihat o‘ziga xos bo‘lib, muammolar va unga berilayotgan yechimlar ham turlicha. Mazkur maqolada qarz beruvchi shaxs yoki biznes egasi, qarz oluvchi shaxsning (yoki biznesning) dinamik parametrlariga moslashgan holda qaror qabul qilishdagi muammosiga yechim izlanadi. Risk darajasini aniqlash hamda qarz oluvchining credit qobiliyatini baholashda ishlatilayotgan yechimlarni tahlil qilinadi.

Kredit qobiliyatni baholash yoki riskni darajasini aniqlash bu juda subyektiv bo‘lib, parametrlar turlicha va o‘zgaruvchan. Hozirda amalda ishlatilib kelinayotgan kredit skoring dasturlar Markaziy bank huzuridagi Kredit axborot almashinuvi markazidan olingan ma’lumotlarga asosan static modellar ustiga qurilganligi bilan ko‘p jarayonlarni o‘z ichiga ololmaydi.

O‘zbekiston Respublikasining Qonunchilik palatasining 2011-yil 11-avgustda “Kredit almashinuvi to‘g‘risida”gi qonuni ko‘rib chiqilib, ma’qullandi va qo‘shimcha o‘zgartirish va tuzatishlar bilan 2012-yil 1-yanvardan kuchga kirdi [1]. Qonundan asosiy maqsad kredit risklarni kamaytirish, kredit tashkilotlar o‘rtasidagi ma’lumotlar almashinuvini yaxshilash, qarzdorlarning kreditda layoqatliligini baholashni avtomatlashtirish, moliyaviy intizomni oshirishga qaratilgan. Markazda yillar davomida olib borilgan ishlari va moliyaviy institutlarning o‘zaro shaffof axborot almashinuvlari insonlar va bizneslar o‘rtasidagi kredit olish ko‘lamini sezilarli darajada oshirib yubordi. 2023-yilning 11-sentyabrida PF-158-son Farmon va PQ-300 sonli Qarorida “O‘zbekiston - 2030” strategiyasi ishlab chiqildi [2]. Strategiya - mamlakatning raqamli transformatsiyasi va iqtisodiy rivojlanishini ta’minlashga qaratilgan keng qamrovli dasturdir. Ushbu dasturda kreditlash tizimini raqamlashtirish va moliyaviy xizmatlarga kengroq kirishni ta’minlash orqali iqtisodiy o‘sishni ta’minlash maqsad qilingan. “O‘zbekiston - 2030” strategiyasining asosiy yo‘nalishlaridan biri sifatida har bir fuqaroning salohiyatini ro‘yobga chiqarish uchun munosib sharoitlar yaratish alohida ta’kidlab o‘tilgan. Aynan moliyaviy xizmatlar, kreditlash tizimini raqamlashtirish orqali quyidagi vazifalar qo‘yilgan:

- **Kredit scoring tizimlarini takomillashtirish - sun’iy intellekt va mashinaviy o‘rganish asosidagi modellarni joriy etish orqali kredit risklarini aniqlash va baholash samaradorligini oshirish;**
- **Moliyaviy inklyuziyani kengaytirish – raqamli moliyaviy xizmatlar orqali aholining keng qatlamlarini, ayniqsa an’anaviy bank xizmatlaridan foydalanmaydigan guruhlarning moliyaviy tizimga jalb qilish;**

ISSN 3030-3907

- **Fintech kompaniyalari bilan hamkorlik – innovatsion moliyaviy texnologiyalarni rivojlantirish va ularni kreditlash jarayonlariga integratsiya qilish;**

Hozirgi kundagi barcha moliya tashkilotlarida kredit risklarini aniq baholash moliyaviy barqarorlikni ta’minlashda muhim o‘rin egallaydi. An’anaviy banklarda bu jarayon raqamli texnologiyalar, xususan, machine learning (ML) va sun’iy intellekt algoritmlariga asoslangan avtomatlashtirilgan kredit scoring tizimlari bosqichma-bosqich amaliyotga chiqarib kelinmoqda. Lekin shunday modellarni to‘g‘ridan to‘g‘ri islomiy moliya institutlari misolida amalga oshirish uchun modelga berilayotgan ma’lumotlarning ishonchlilik darajasi va shariat tamoyillariga to‘g‘ri kelish yoki kelmasligini mutaxassislar xulosasi yordamida aniqlashtirilishi talab qilinadi.

O‘zbekiston Respublikasi Prezidenti Sh. Mirziyoyev Toshkent shahrida Islom Hamkorlik Tashkilotiga a’zo mamlakatlar Tashqi ishlar vazirlari kengashining 43-sessiyasi ochilish marosimida so‘zlagan nutqlarida: “Islom olami ulkan iqtisodiy, investitsion salohiyat, energetika resurslariga ega. Ulardan to‘g‘ri foydalanish, Islom hamkorlik tashkilotiga a’zo davlatlarning xalqaro savdo-iqtisodiy, moliyaviy, investitsion hamkorligini kengaytirish, mamlakatlarimizni birlashtiradigan transport yo‘llarini tashkil etish yuksak iqtisodiy taraqqiyot ko‘rsatkichlariga erishish imkonini beradi va bu pirovars natijada boshqa barcha sohalarning rivojlanishida asos bo‘lib xizmat qiladi” deb ta’kidladi.

ADABIYOTLAR TAHLILI.

Islom moliyasining zamonaviy tarixi 1975-yilda Islom taraqqiyot bankining tashkil qilinishi, islom moliyasining global bosqichga o‘tganligini ma’lum qildi. Islom bank-moliya tizimining 2008-yildagi jahon iqtisodiy inqirozi paytida barqaror faoliyati bilan birga o‘sish kuzatilganligi xalqaro e’tirofga sabab bo‘lib, moliya olamida katta qiziqish uyg‘otdi. An’anaviy moliyadan farqli ravishda islom moliyasida mavjud resurs va mablag‘larni jamiyat ichida adolatli taqsimlanishi asosiy mezon hisoblanadi. Biznesda sherikchilik natijasida olingan foyda va zarar ham adolatli taqsimlanishi uchun oldindan aniq belgilangan shartlar kelishiladi. Islom moliyasi an’anaviy moliyaning muqobil variant bo‘lib, an’anaviy moliya xizmatlarining barcha turdagisining alternativi hozirda mavjud. Shu bilan birga islom moliyasini turli iqtisodiy sharoitlarga moslashuvchanligi, adolatli yechimlarni taklif qilishi uni nafaqat islomiy davlatlar balki aholisi nomusulmon bo‘lgan davlatlarda ham islom moliyasi xizmatlari keng yoyilmoqda. “Islamic finance development report 2024” [2] ma’lumotlari Islom moliyasi xalqaro miqyosda yiliga 10%-20% gacha o‘sish bo‘lib, 2023-yilda 11% ga aktivlar o‘sib, 4,9 trillion AQSH dollariga yetdi. “Islamic corporation for the development of the

ISSN 3030-3907

private sektor” [3] prognoz qilishicha, 2027-yilga kelib, global islomiy moliya sanoati aktivlari 6,7 trillion AQSH dollariga yetishi taxmin qilinmoqda. Dunyoda 136 ta mamlakat islom moliyasini to‘liq yoki ayrim elementlarini amaliyotga joriy qilgan bo‘lib, bu davlatlar tarkibida aholisining ko‘p qismi musulmon bo‘lmagan davlatlar, Buyuk Britaniya (aholisining 4,4% musulmonlar tashkil etadi), AQSH (0,9%), Singapur (15,6%), Shvetsariya (5,2%), Kanada (3,2%), Avstraliya (3,2 %), Fransiya (4 %), Germaniya (3,5 %) va Rossiya (15 %) ham islomiy moliya xizmatlarini taklif qilib kelayotgan davlatlardandir [4].

O‘zbekistonda ham islom moliyasiga qizish kundan kunga ortib borib, prezident Sh. Mirziyoyevning 2020-yil 29-dekabrda Oliy Majlis palatalariga yo‘llagan Murojaatnomasida “… mamlakatimizda islomiy moliya xizmatlarini joriy etish bo‘yicha huquqiy bazani yaratish vaqti-soati keldi. Bunga Islom taraqqiyot banki va boshqa xalqaro moliya tashkilotlari ekspertlari jalb etiladi” [5]. 2023-yil 4-sentyabrda qabul qilingan PQ-292-sonli Prezident qarorida islom moliyasining huquqiy asoslarini shakllantirish bo‘yicha chora-tadbirlar belgilandi. Qaror islomiy xizmatlar, mahsulotlar va moliyaviy institutlarning huquqiy asosini yaratish, soliq to‘lashning xususiy hollari hamda islom moliyasi asosida jalb etilgan omonatlarni himoya qilish kabi masalalarni o‘z ichiga oladi. Topshiriqlar ijrosi sifatida Markaziy bankning 2024-yil 26-iyulda tasdiqlangan 3536-sonli qarori mikromoliya tashkilotlariga islomiy moliyaviy xizmatlarni tartibga solish va rivojlantirish bo‘yicha huquqiy normalar berildi. E’tiborli jihati shundagi shu kungacha qonun hujjatlarida islomiy atamalar ya’ni “muboraha”, “mushokara”, “ijara”, “sukuk”, “murohaba” kabi so‘zlar ishlatilmagan. Moliyaviy xizmatlarning turli ko‘rinishda va turli qatlamlar uchun mavjudligi jamiyatda iqtisodiy barqarorlikni ta’minlash bilan birgalikda, “yostiq ostida” saqlanib kelinayotgan mablag‘larni ham aktiv holatga keltirib, rivojlanishga munosib hissa qo‘shilishi ilmiy tadqiqotlarda isbotlangan.

2020-yil Birlashgan Millatlar Tashkiloti Taraqqiyot dasturi loyihasi davomida yurtimizdagi barcha qatlamlar o‘rtasida o‘tkazilgan so‘rovnomada biznes vakillari 38% va jismoniy shaxslarning 55% diniy qarashlari sababli an’anaviy kreditlardan foydalanmasliklarini aytishgan [6]. O‘zbekistonda islom moliya muassasalari ish boshlasa, 61% biznes vakillari va 75% jismoniy shaxslar xizmatlardan foydalanish istagini bildirishgan. Shu bilan birga 2021-yilda o‘tkazilgan tadqiqotlarda turli omillar sabab kichik va o‘rta biznesning taxminan 70% o‘z jamg‘armalari hisobiga yoki oila a’zolari, do‘stlaridan qarz olib o‘zini o‘zi moliyalashtirishga harakat qiladi. Bu ahamiyatli va o‘rganib, o‘zining maqbul yechimlarini kutayotgan katta masalalardan biridir. “Yostiq ostida” saqlanayotgan mablag‘lar iqtisodiyotga qo‘shilmay zarar bo‘lishi bir taraf bo‘lsa, inflatsiya [7]

ISSN 3030-3907

sabab o‘z egasiga ham ma’lum miqdorda zarar keltirishi ikkinchi tarafdir. Bunday mablag‘larni aktiv holatga keltirish uchun, ishonchli, halol va daromad olish ehtimoli yuqoriroq xizmatlar taklif qilinishi yechimning bir ko‘rinishi. Ta’kidlab o‘tish joizki, puxta o‘ylanmagan biznes, yoki qarz uza olish qobiliyatini to‘g‘ri baholamay, katta miqdorda qarz bo‘lib yurgan hamyurtlarimiz kam emas. Qarz beruvchi taraf pullarini berishga ishonchli, risk qilishga arziydigan odam (biznes) qidirsa, qarz olmoqchi odam halol, ribolarsiz sherikchilik qiluvchilarni qidiradi. Bu ikki tarafni bir nuqtada jamlovchi tizimga allaqachon ehtiyoj tug‘ilgan.

TADQIQOT METODOLOGIYASI.

Jamiyatda qarz va kredit munosabatlarida ishlatiladigan shaffof va ishonchli bo‘lgan, qarzdorning qarz uza olish qobiliyati yoki to‘lov qobiliyatini baholovchi va baholashda neyron tarmoq algoritmlaridan foydalanish orqali masalaga sun’iy intellektni qo‘shib baholash samaradorligini oshirish va moslashuvchan baholash modelini islom moliyasi xizmatlari doirasida ishlab chiqish.

MUHOKAMA VA NATIJALAR.

Islom moliyasi o‘ziga xos tamoyillarga asoslanganligi sababli kreditga layoqatlilik baholashda sun’iy intellektning modellarini Shariatga zid bo‘lmagan tarzda moslashtirish zarur. Misol uchun Logistik regressiya (Logistic Regression), Random Forest, Gradient Boosting Machines (XGBoost, LightGBM), Sun’iy neyron tarmoqlar (ANN, DNN) va boshqa modellar.

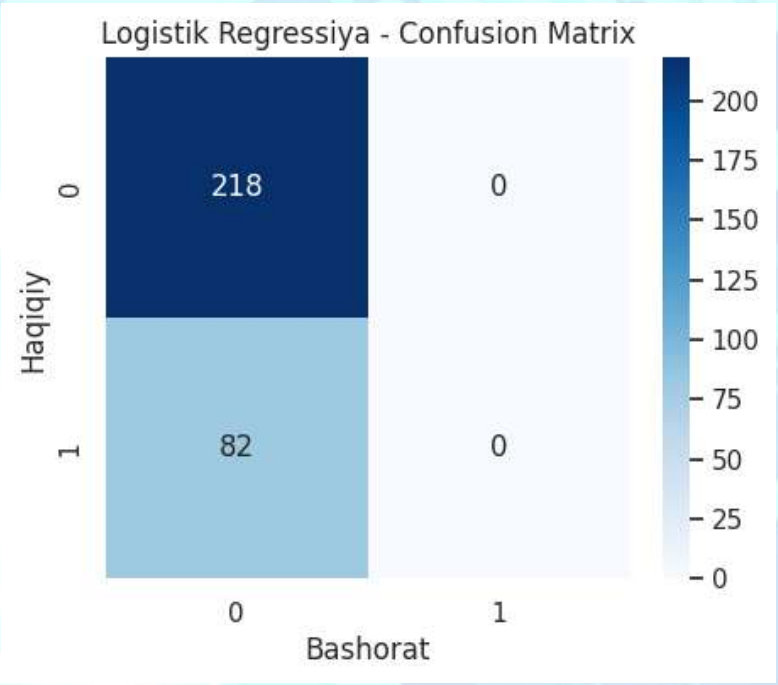
Quyida bir nechta sun’iy intellektning scoring modellarini tahlil qilamiz:

Logistik Regressiya (Logistic Regression)

$$p(x) = \frac{1}{1 + e^{-(\beta_0 + \beta_1 x_1 + \cdots + \beta_n x_n)}} \quad (1)$$

ISSN 3030-3907

Formuladagi (1) $\boldsymbol{\beta_1, \beta_2, \beta_3}$ ... – regressiya koeffitsiyentlari, $\boldsymbol{x_1, x_2, x_3}$ ... - qarz oluvchiga oid o‘zgaruvchilar (daromadi, qarzdorlik tarixi, xarajatlari…), $\boldsymbol{p(x)}$ soni 0 va 1 orasida bo‘lib, natija 1 ga yaqinlashgani sari qarz uza olish qobiliyati oshib boradi, yoki aksincha 0 ga yaqinlashgani sari qarz olishga layoqatsizligi ko‘rsatiladi.



1-rasm. Logistik regressiyada namunaviy ma’lumotlar asosida credit scoring modeli. Muallif tomonidan yaratilgan [8]

1. **Random Forest (Tasodifiy O‘rmon)**

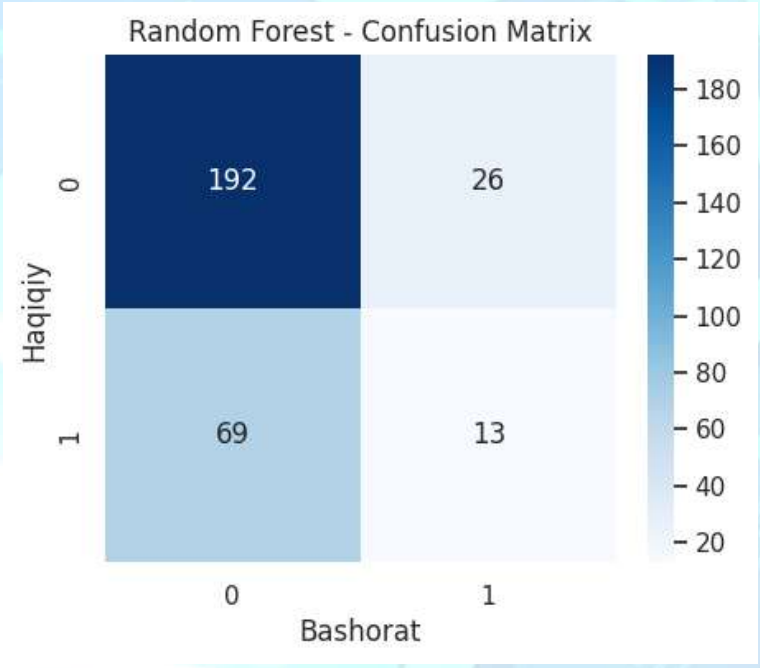
$$\hat{y}(x) = \frac{1}{T} \sum_{t=1}^{T} f_t(x) \quad (2)$$

(2) formulada: T - qaror daraxtlari (decision tree), $f_1(x), f_2(x), f_3(x)$… - qarz oluvchining parametrlari asosida qabul qilingan qarorlar.

Random Forest — bu bir nechta qaror daraxtlari kombinatsiyasidan iborat qo‘shma model bo‘lib, kredit skoring masalalarida yuqori aniqlikka erishish uchun qo‘llaniladi. Modelning asosiy g‘oyasi — **bagging** (bootstrap aggregating) usuli yordamida daraxtlar yig‘indisini qurish: har bir qaror daraxti ma’lumotning tasodifiy namunasi asosida o‘rgatiladi va yakunda barcha daraxtlar natijalari birlashtiriladi. Shu tariqa, har bir daraxt alohida oddiy model bo‘lsa-da, ularning yig‘indisi murakkabroq va aniqroq bashoratni ta’minlaydi, chunki individual daraxtlarning xatolari o‘rtacha hisobda kompensatsiya qilinadi. Quyida random

ISSN 3030-3907

forest modelining confusion matrix grafigi berilgan. Confusion matrix – Google colab muhitida Python dasturlash tili yordamida modelni grafik ko‘rinishda ifodalash uchun ishlatiladigan kutubxona.



3-rasm. Random forest yordamida yaratilgan credit scoring modeli. Muallif tomonidan yaratilgan[9].

XULOSA VA TAKLIFLAR.

Yuqorida tahlil qilingan logistik regressiya va random forest modellari bashoratlashda o‘ziga xos modellar bo‘lib, ikkisi ham samaradorlik koeffitsenti yuqori. Lekin taklif sifatida gibrid algoritm ishlab chiqilishi va algoritmga kiruvchi risk mezonlari foizga asoslanmagan, shariatga mos kelishi talab qilinadi. Bunday modelni yaratishda, ma’lumotlar bazasida foiz stavkalari va foizli qarzlar o‘rniga ijara, musharaka, mudaraba kabi instrumentlarga doir ma’lumotlar jamlanadi. Model parametrlari shu ma’lumotlarga muvofiq o‘rgatiladi. Halol moliyaviy ko‘rsatkichlar islom banklari uchun juda ahamiyatli hisoblanadi [10].

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РОЛЬ ЯЗЫКОВ ПРОГРАММИРОВАНИЯ В ПОВЫШЕНИИ ПРОФЕССИОНАЛЬНОЙ ПОДГОТОВКИ СТУДЕНТОВ

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Аннотация. В данной статье рассматривается вопросы влияния преподавания языков программирования на качества подготовки специалистов, профессиональная деятельность которых связана с обработкой больших объёмов информации. Большое внимание уделяется к выбору языка программирования для преподавания в высших учебных заведениях. Организация процесса преподавания языка программирования Python в высших учебных заведениях с учетом специфические особенности образовательных направлений позволяет достичь учебных, воспитательных и развивающих целей обучения, что приведет к повышению уровня готовности функционировать в цифровом обществе.

Ключевые слова: качество подготовки, образовательные направления, обучение, специфика, язык программирования Python.

Annotatsiya. Ushbu maqolada dasturlash tillarini o‘qitishning kasbiy faoliyati katta hajmdagi ma’lumotlarni qayta ishlash bilan bog‘liq bo‘lgan mutaxassislarni tayyorlash sifatiga ta’siri masalalari ko‘rib chiqiladi. Oliy o‘quv yurtlarida o‘qitish uchun dasturlash tilini tanlashga katta e'tibor qaratilmoqda. Bu o‘rinda oliy o‘quv yurtlarida Python dasturlash tilini o‘qitishni ta’lim yo‘nalishlarining o‘ziga xos xususiyatlarini hisobga olgan holda tashkil etish jarayoni o‘qitishning ta’limiy, tarbiyaviy va rivojlantiruvchi maqsadlariga erishishga imkon beradi. Bu esa bo‘lajak mutaxassislari raqamlashgan jamiyatdaga faoliyatga tayyorgarlik darajasini oshirishga xizmat qiladi.

Tayanch iboralar: tayyorgarlik darajasi, ta’lim yo‘nalishlari, o‘qitish, spetsifika, Python dasturlash tili.

Abstract. This article discusses the impact of teaching programming languages on the quality of training of specialists whose professional activities are associated with processing large amounts of information. Much attention is paid to the choice of a programming language for teaching in higher education institutions. The organization of the process of teaching the Python programming language in higher educational institutions, taking into account the specific features of educational directions, allows you to achieve educational, educational and developmental learning goals. And this will lead to an increase in the level of readiness of future specialists to function in the digital society.

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Keywords: quality of training, educational directions, training, specifics, Python programming language.

Введение

История свидетельствует о том, что программирование, зародившееся в 50-х годах XX века, сегодня превратилось в мощную IT-индустрию. Этот тип промышленности служит движущей силой всех сегментов современного цифрового общества и экономики. Данные о том, что 5 мировые ИТ-гиганты за 2023 год получили доходы в 535 миллиардов долларов, и при этом обеспечили работой почти 2 миллиона программистов [14] утверждают, что программирование стало и родом деятельности, и видом бизнеса для многих молодых людей. Растущая потребность в новых программных средствах сделала программирование одним из самых востребованных и современных видов деятельности, способных гарантировать большой доход. Рост числа ИТ-предприятий, а также цифровизация экономики создали проблему нехватки программистов.

Как правило, процесс разработки новых программных средств требует совместной работы программистов с высококвалифицированными специалистами в области рассматриваемого вопроса, что вызывает определённые неудобства и больших затрат всевозможных ресурсов. В устранении этих проблем важное значение имеют специалисты других отраслей, обладающие необходимыми знаниями и квалификациями по программированию. Такое обстоятельство позволить организовать процесса программных комплексов быстрыми, удобными, эффективными и экономичными способами. Такая ситуация должна найти свое отражение и в системе образования.

Студенты, как будущие участники оцифрованного общества, прекрасно чувствуют, что им придется вести управленческую, политическую, творческую, культурную, духовную или профессиональную деятельность в компьютеризованной среде. Также они знают, что, используя полученные знания в области информатики и программирование могут легко, удобно, быстро и качественно решать проблемы различной формы и содержания, с которыми они могут столкнуться в своей будущей профессиональной деятельности. Это обстоятельство приводит к формированию у них положительного отношения к информатике, информационно-коммуникационным технологиям, разработке и использованию новых программных средств.

Будущие специалисты должны обладать навыками профессиональной мобильности, достаточными для трудовой деятельности, способностью

ISSN 3030-3907

быстро адаптироваться к социальным, политическим, культурным, научным и практическим изменениям, происходящим в цифровом обществе. Решить эту проблему широким внедрением современных достижений и результатов информатики и информационных технологий (в том числе, языков программирования) как одной из общих междисциплинарных методологий. Только в этом случае молодой специалист сможет применить полученные знания, умения и навыки в процессе решения задач различных форм и содержания, с которыми он может столкнуться в своей профессиональной, политической, социальной, культурной, духовной и других видах деятельности.

ОБЗОР ЛИТЕРАТУРЫ

Анализ открытых источниках показал, научно-исследовательские работы, охватывающие вес спектр рассматриваемой темы пока отсутствуют. Но существуют большое количество работ, посвященные отдельным вопросам повышения уровня профессиональной подготовки студентов. Среди них можно отметить следующие научные исследования.

А. Сидоркин проанализировал возможности внедрения опыта американских вузов в основные направления потенциальной реформы педагогического образования в России [16]. У. Тайхлером изучены вопросы развития и изменения за последние полвека представлений о многообразии высшего образования [17]. М. Агранович исследовал действующих систем индикаторов образования, проанализировал проблемы и риски, связанные с их использованием [1].

Авторский коллектив под руководством Г. Чуприяновой изучали возможности повышения качества подготовки специалистов с высшим бухгалтерским и экономическим образованием [10]. Концептуальные принципы совершенствования профессиональной подготовки специалистов в информационно-образовательной среде высшей школы были рассмотрены научных трудах М. Коваля [12]. Гринберг Г.М. и другие учёные исследовали способов повышения качества подготовки кадров для высокотехнологичных отраслей промышленности на основе инновационного применения компетентностного подхода [4]. Научная команда М. Пинской анализирвали уровеней профессиональной подготовки молодых учителей в России, их трудоустройство, ввод в профессию и дальнейшее профессиональное развитие, трудности, которые они испытывают в трудовой деятельности [15]. ,И. Фролова и Л. Буланова изучали влияние качество подготовки специалиста на конкурентное преимущество вуза [11]. В.С. Круглик и В.В. Осадчий вели научно-исследовательскую работу по формированию компетентности в

ISSN 3030-3907

области программирования у будущих инженеров-программистов [7]. А.И. Бокарев и другие учёные исследовали теоретические и практические проблемы оценки управления образовательным процессом высших учебных заведений по результатам подготовки и выпуска специалистов [2]. А.М. Асташов и Л.М. Ошкина анализировали роль информационных технологий в реформировании инженерно-строительного образования [1]. Н.А. Отаханов сформулировал общие рекомендации преподавания языка программирования Python, учитывающие специфические особенности различных образовательных направлений [8].

Список таких работ можно продолжить. Анализ открытых источников показал, что исследования вопросов влияния языков программирования на уровень подготовленности студентов к профессиональной деятельности ещё не достаточны.

МАТЕРИАЛЫ И МЕТОДЫ

Как известно, что содержание и объем каждого запланированного учебного предмета определяются исходя из государственных стандартов и квалификационных требований, предъявляемых к профессиональной подготовленности будущих специалистов. Знания, полученные по этим дисциплинам, служат для формирования и развития у учащихся комплексных взглядов на свою будущую профессиональную деятельность.

Сформированное у студентов положительное отношение к профессиональной деятельности, приобретенные знания, компетенции, умения и навыки определяют уровень подготовки молодых специалистов к самостоятельной трудовой деятельности. В процессе подготовки к профессиональной деятельности студенты должны приобрести следующие образовательные качества:

– формирование позитивного и творческого отношения к профессиональной среде и деятельности;

– приобретение накопленных исторических опытов, соответствующих профессиональной деятельности;

– понимание нормативных документов и стандартов, характерных для профессиональной деятельности;

– приспособление к самостоятельной и коллективной профессиональной деятельности;

– изучение и сохранение профессиональных ценностей.

В подготовке специалистов с указанными качествами наряду с другими дисциплинами важное значение приобретает курс информатики и программирование. Как известно, что большинство профессиональных задач

ISSN 3030-3907

связаны с обработкой информации различной формы и содержания. Обычно такие данные составляют большой объем и для их обработки требуются специальные программные и технические средства, предназначенные для аналогичных ситуаций. Обычно, программные комплексы для больших задач разрабатываются командами программистов за счет огромных затрат труда, времени и других ресурсов. Даже для решения мелких типовых задач, часто встречающиеся в профессиональной и практической деятельности специалистов с помощью компьютера, требуются соответствующие программные средства. А что, если их нет? В таких случаях за созданием программных средств сотруднику придется либо обратиться к квалифицированным программистам, либо разработать самостоятельно. Если все-таки, специалист решил создать самостоятельно, то в таких ситуациях важную роль играют ранее полученные общие и профессиональные компетенции, связанные с программированием. Данное явление должно быть предусмотрено в процессе подготовки специалистов по ряду образовательных направлений, профессиональная деятельность которых связана с обработкой больших объемов информации.

Решение этой задачи требует обеспечения гармонии между профессиональными и фундаментальными знаниями в образовательных направлениях ВУЗ ов и требует установления интеграционных отношений между основами программирования и общепрофессиональными обязательными и специальными предметами. Знания, умения и навыки, полученные в процессе освоения этих дисциплин, служат прочной основой для принятия будущими специалистами оптимальных решений в практических ситуациях.

Преподавание языков программирования (особенно, предметно-ориентированных) в высших учебных заведениях с учётом квалификационных требований, сфер, объектов и видов профессиональной деятельности бакалавриатов должно оказывать выпускникам содействие в решении следующих профессиональных задач, характерных для образовательных направлений.

В научно-исследовательской деятельности:

– проведение научно-теоретических и прикладных исследований;

– вынесение научно обоснованных выводов на основе обработки результатов экспериментов;

– осуществление целенаправленного поиска, сортировки и обобщения информации о новейших научных, конструкторских, технологических и эксплуатационных достижениях;

ISSN 3030-3907

– решение типовых задач профессиональной деятельности в составе научно-исследовательского и производственного коллектива.

В проектно-конструкторской деятельности:

– создание и исследование математических, информационных и имитационных моделей по типовым задачам профессиональной деятельности;

– использование алгоритмических методов и вычислительной техники для решения прикладных задач в различных формах и содержаниях;

– составление алгоритмических и программных решений в области системного и прикладного программирования;

– использование современных языков программирования, баз данных, операционной системы, программного обеспечения и сетевых технологий в профессиональной деятельности

– применение на практике международных и профессиональных стандартов информационных технологий, современных парадигм и методик, инструментальных и вычислительных средств (в соответствии с профилем образовательных направлений).

В организационно-управленческой деятельности:

– формирование методов и механизмов мониторинга и оценки качества производственных процессов, связанных с созданием и использованием современной системы информационных технологий;

– внедрение инженерно-конструкторских решений в практику;

– создание планов выполняемых работ;

– осуществление контроль работ и оценка результатов;

– планирование ресурсов, необходимые для выполнения работ;

– проведение мониторинга соответствия производственных процессов требованиям системы контроля окружающей среды и безопасности труда.

В производственно-технологической деятельности:

– использование математических методов при обработке данных, полученных в результате экспериментальных исследований или профессиональной деятельности;

– решение практических задач численными и аналитическими методами, анализ и применение полученных результатов;

– хранение, сбор и обработка данных с использованием современных программных комплексов;

ISSN 3030-3907

– выполнение работ в производственных и научно-учебных лабораториях;

– создание и использование новых программных средств и автоматизированных систем.

В научно-педагогической и педагогической деятельности в образовательных учреждениях:

– проведение теоретических и практических занятий по учебным дисциплинам с использованием современных информационно-педагогических технологий;

– создание и использование новых педагогических программных средств и ресурсов обучения для проведения занятий по преподаваемому предмету.

Предоставление различных услуг:

– построение математико-информационной модели процессов для численного решения задач профессиональной деятельности и аналитическая интерпретация сложившейся ситуации;

– предоставление различных услуг по разработке и эксплуатацию программных продуктов.

Преподавание языков программирования с учетом специфические особенности образовательных направлений в высших учебных заведениях способствует приобретению студентами следующих компетенций, установленные квалификационными требованиями:

1. По общим компетенциям:

– знание актуальных вопросов государственной политики;

– умение самостоятельно анализировать социально-экономические проблемы и процессы;

– усвоение и использование их в профессиональной деятельности;

– овладение необходимыми знаниями и методами сбора, хранения, обработки и использования информации;

– умение самостоятельно принимать осознанные решения в своей профессиональной деятельности.

– 2. По профессиональным компетенциям:

– приобретение навыков поиска, анализа нормативных правовых актов и использования их в своей профессиональной деятельности;

– умение самостоятельно приобретать новые знания, работать над собой и организовывать свою трудовую деятельность на научной основе;

ISSN 3030-3907

– приобретение навыков математического моделирования реальных объектов и процессов;

– умение анализировать процессы, протекающие в сложных объектах, с помощью средств и прогнозировать их на основе результатов анализа;

– создание и исследование математических, информационных и имитационных моделей различных ситуаций профессиональной деятельности;

– овладение навыками количественного и качественного анализа при принятии управленческих решений;

– формирование экономических, финансовых и организационно-управленческих моделей путем их адаптации к конкретным задачам управления;

– обладание конкурентоспособной общепрофессиональной подготовкой по соответствующему направлению бакалавриата.

Для овладения этими компетенциями необходимо, чтобы информатика и преподавание языков программирования, являющихся одной из ее современных глав, стали одним из организующих компонентов фундаментальной системы подготовки кадров как неотъемлемой и важнейшей составляющей подготовки специалистов к профессиональной деятельности. Для эффективной организации этого процесса важно правильно определить цели и задачи преподавания языков программирования.

Целью преподавания языков программирования Python в высших учебных заведениях должна стать: подготовка специалистов, обладающих достаточным уровнем систематизированных знаний, умений и навыков по целенаправленному и целесообразному использованию средств языков программирования в соответствии с их профессиональной деятельностью в оцифрованном обществе.

Задачами преподавания языков программирования в высших учебных заведениях должны являтся:

– переосмысление роли языков программирования в процессе подготовки кадров и внесение соответствующих изменений в правого нормативных документациях образовательных направлений;

– обучение студентов работе с современными языками программирования, парадигмами и программными обеспечениями;

– ознакомление студентов с принципами разработки приложений с использованием языков программирования;

ISSN 3030-3907

– обучение основным структурам языков программирования;

– развитие умений и навыков по основам работ с алгоритмами обработки информации различной формы и содержания, характерные образовательным направлениям;

– формирование и совершенствование умений и навыков студентов по целенаправленному и рациональному использованию возможностей языка программирования, созданию новых программных средств и модернизацию существующих.

Для эффективного решения поставленных целей и задач студенты в рамках своих образовательных направлений должны глубоко осознавать, что знания языков программирования будут способствовать глубокому пониманию и проникновению в сущность изучаемых объектов, явлений и процессов и станет важнейшим инструментом профессиональной деятельности. Решение вышеуказанных задач требует включения в нормативные документы образовательных направлений учебных предметов, предусматривающих преподавания языков программирования и перенести их в раздел обязательных (или общепрофессиональных) дисциплин учебного плана. Можно запланировать преподавание нескольких языков программирования в областях обучения, профессиональная деятельность которых связана с разработкой программного обеспечения. Для образовательных направлений, квалификация которых требует умения и навыков обработки больших объемов информации, целесообразно предусмотреть преподавания одного, универсального и современного языка программирования.

Известно, что с 50-х годов XX века было разработано около 9000 языков программирования, и только около 50 из них используются в современной практике программирования [17]. Поэтому возникает резонный вопрос: какого языка программирования выбрать для обучения?

Выбираемый язык программирования для обучения должен стать важной основой для повышения уровня подготовки к профессиональной деятельности и формирования научно-практического мировоззрения у будущих молодых специалистов цифрового общества. Все этих языков преподавать невозможно в высших учебных заведениях. Поэтому, пока остается открытым вопрос о том, какого языка программирования выбрать для обучения. Вместо того, чтобы относится на эту проблему целенаправленно и всесторонно, некоторые просто выбирают самого современного и новейшего языка программирования, что считается неправильным. История языков программирования свидетельствует о том,

ISSN 3030-3907

огромное количество языков “потерялись” из-за того, что не смогли найти свое место, поклонников и области применения. На наш взглядь, при выборе языка программирования для обучения необходимо учитывать следующие обстоятельства:

1) непривлекаемость – выбранный язык может быть игнорирован многими программистами по разным причинам и как следствие, потерять свою репутацию;

2) сложность – многие специалисты предпочитают сложных языков программиривания. Н. Вирт таких языков сравнивает с “роскошными автомобилями, напичканными новейшими технологиями, прибамбасами и завлекалками” и говорит “люди по ошибке принимают сложность за изощренность” и ”самодельная сложность порождает множество проблем” [3]. Поэтому, сложные языки программирования, допускающие одних и тех инструкций выразить в разный вариантах вызывает множество вопросов в процессе обучения, что приведёт к снижению интереса студентов;

3) ограниченность применения – выбранный язык по сравнению с другими языками может не оказать большой помощи в решении задач профессиональной и жизнедеятельности будущих молодых специалистов.

Учёные предлагают выбирать язык программирования для обучения на основе следующих критериев [9]:

– специфика обучающихся;
– простота освоения;
– универсальность;
– практическая направленность;
– популярность;
– независимость.

Так как, язык программирования Python:

– подходить и школьникам, и студентам;
– упрощает процесс усвоения, так как имеет сравнительно простой синтаксис;
– поддерживает большинство парадигм программирования;
– позволяет решать широкого набора задач [13];
– имеет высокую репутацию по данным TIOBE [15], PyPL [16] и HeadHunter;
– предоставляет возможности открытого распространения,

его можно выбрать в качестве языка программирование для обучения. Согласно [13] язык Python позволяет решать наиболее распространённых

ISSN 3030-3907

проблем примерно в 40 видах профессиональной деятельности простыми, удобными и экономическими способами.

В [8] рекомендованы практические советы по преподаванию языка программирования Python с учётом специфических особенностей различных образовательных направлений. В этом случае, язык программирования Python может стать важным инструментом специалистов, профессиональная деятельность которых связана с обработкой больших объемов данных. Он позволит специалистам, обладающим достаточными знаниями о проблемах, часто возникающих в рамках профессиональной деятельности, разрабатывать полезных и пригодных программных продуктов для использования в рамках своих служебных обязанностей. И при этом специалисту не требуется высокая квалификация в области программирования.

Также при выборе языка программирования для обучения не помешает учесть новые направления олимпиад по программированию, такие как, задачи минимакса, лингвистики, искусственного интеллекта, взаимодействия в сети и т.д.

В процессе обучения основам программирования в вуза необходимо учитывать, что в практике программирования специалисты сталкиваются с множеством нововведений различных форм и содержания. Поэтому в образовательном процессе необходимо обучать будущих специалистов цифрового общества таким ситуациям, как:

– быстрому и самостоятельному оцениванию и осваиванию новшества, происходящие в обществе, социальной и экономической жизни, науке, технике и других сферах;

– приспосабливание к происходящим изменениям;

– умение и правильного подбора соответствующих технических, программных средств и языков программирования для решения новых задач, возникающих в их профессиональной деятельности.

В условиях оцифрованного общества вообще невозможно решить задач профессиональной деятельности без компьютерных и программных средств. В связи с этим можно сказать, что преподавание современных языков программирования приобретает первостепенное значение в повышении уровня подготовки к трудовой деятельности студентов образовательных направлений, деятельность которых связана со сбором, хранением, обработкой и передачей больших объемов информации.

ISSN 3030-3907

РЕЗУЛЬТАТЫ (ожидаемые)

Преподавание языков программирования в высших учебных заведениях станет важнейшим и полезным инструментом для решения следующих образовательных задач:

– формирование и развитие навыков системного, творческого, умственного, логического, планового мышления;

– усовершенствование приемов и процессов обработки новых данных;

– ознакомление с методами поиска, выявления и реализации оптимальных вариантов решения задач, касающихся жизнедеятельности и профессиональной деятельности;

– обучение навыкам и умениям сбора, хранения, обработки и передачи информации с помощью компьютеров;

– улучшение компетенции целенаправленного и целесообразного использования средств языков программирования в соответствии с их профессиональной деятельностью

– развитие умений и навыков изобретательности, познавательности, настойчивости и самостоятельности.

Из приведенной выше информации видно, что эффективное решение поставленных целей и задач способствует тому, что преподавание языков программирования в высших учебных заведениях положительно влияет на процесс подготовки молодых, интеллектуально развитых, всесторонне зрелых и активных спецаилистов, с повышенной готовностью функционировать в оцифрованном обществе.

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СТРОЕНИЕ, ФУНКЦИИ И ВЛИЯНИЕ ИЗОХОЛИНИНОВ НА СОСУДИСТУЮ СИСТЕМУ И ИХ РОЛЬ В МОДУЛЯЦИИ СОСУДИСТОГО ТОНУСА.

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Аннотация:В статье рассматриваются структура, функции и влияние изохинолиновых соединений на сосудистую систему человека. Авторы акцентируют внимание на биологически активных производных изохинолина, используемых в медицине, таких как папаверин, дротаверин, а также полусинтетические и синтетические соединения, обладающие спазмолитическим, противоопухолевым, анальгезирующим и противовоспалительным действием. Освещаются современные подходы к синтезу новых изохинолинов и их роль в коррекции сосудистого тонуса, лечении инфекционных, паразитарных и нейродегенеративных заболеваний. Работа подчёркивает перспективность изохинолинов в качестве основы для разработки новых лекарственных средств.

Ключевые слова: изохинолин, сосудистая система, сосудистый тонус, биологическая активность, спазмолитики, противоопухолевые соединения, антимикробные препараты, фармакология, алкалоиды, синтез гетероциклов.

Annotation: This article explores the structure, functions, and effects of isoquinoline compounds on the human vascular system. The authors highlight the biomedical importance of biologically active isoquinoline derivatives such as papaverine and drotaverine, as well as semi-synthetic and synthetic compounds with spasmolytic, antitumor, analgesic, and anti-inflammatory properties. The study reviews current approaches to the synthesis of new isoquinolines and their potential in modulating vascular tone, and in the treatment of infectious, parasitic, and neurodegenerative diseases. The work emphasizes the promising potential of isoquinolines as a foundation for the development of new pharmaceutical agents.

Keywords: isoquinoline, vascular system, vascular tone, biological activity, spasmolytics, antitumor compounds, antimicrobial agents, pharmacology, alkaloids, heterocyclic synthesis.

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Annotatsiya. Maqolada izokinolin birikmalarining tuzilishi, funktsiyalari va inson qon tomir tizimiga ta'siri ko'rib chiqiladi. Mualliflar tibbiyotda ishlatiladigan biologik faol izokinolin hosilalariga, masalan, papaverin, drotaverin va antispazmodik, antitümör, analjezik va yallig'lanishga qarshi ta'sirga ega yarim sintetik va sintetik birikmalarga e'tibor berishadi. Yangi izokinolinlarni sintez qilishning zamonaviy yondashuvlari va ularning qon tomir tonusini tuzatish, yuqumli, parazitar va neyrodejenerativ kasalliklarni davolashdagi roli yoritilgan. Ish yangi dori vositalarini ishlab chiqish uchun asos sifatida izokinolinlarning istiqbollarini ta'kidlaydi.

Kalit so'zlar: Izokinolin, qon tomir tizimi, qon tomir tonusi, biologik faollik, antispazmodiklar, antitumor birikmalar, mikroblarga qarshi vositalar, farmakologiya, alkaloidlar, heterosikl sintezi.

Введение

Изохинолин представляет собой важное соединение в химии гетероциклических соединений. Это производное бензольного кольца с атомом азота в составе гетероцикла. Изохинолин широко используется в различных научных областях, включая биомедицинские исследования, органический синтез и фармацевтику, благодаря своим уникальным физико-химическим свойствам и биоактивности.Химические свойства изохинолина обусловлены его структурой и способностью образовывать различные производные через реакции циклизации, функционализацию и присоединение других групп. Среди реакций синтеза изохинолинов особое значение имеет реакция Риттера, в которой используются нитрилы для получения различных производных изохинолина. Эта реакция позволяет строить новые структуры и улучшать функциональные свойства соединений.

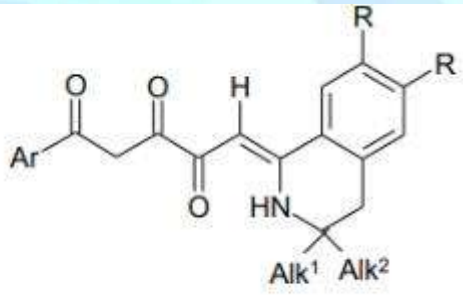
Производные изохинолина обладают разнообразной биологической активностью, которая подтверждена многими публикациями. Значительная часть публикаций посвящена разработке новых противомикробных средств, что оправдано ввиду постоянного появления резистентных штаммов микроорганизмов. Примером может служить разработка средств для борьбы с внутрибольничными возбудителями, в частности с золотистым стафилококком. Новый природный алкалоид, выделенный из культуры стрептомицетов L, обладает низкой токсичностью для человека и перспективной противомикробной активностью. Также авторы сообщают об его ингибирующем воздействии на βлактамазы, важную составляющую ряда резистентных штаммов. Данное соединение планируется применять в качестве первоначального соединения в поисках потенциально новой группы препаратов . Ряд авторов сообщают о вновь полученных потенциальных

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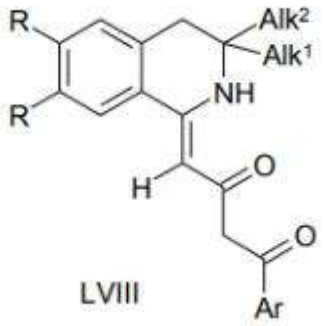
лекарственных препаратах для лечения паразитарных (лейшманиоз) и инфекционных болезней (малярия) [1]. В то же время многие структурные производные изохинолина позволяют корректировать нарушения работы нервной системы [3]. Известны соединения: антагонисты дофаминовых рецепторов [2], потенциальные препараты для лечения болезни Альцгеймера [5].Ряд растений, содержащих алкалоиды класса изохинолина, давно используют в медицине, история их применения насчитывает сотни лет, например, мак снотворный, мачок жёлтый, барбарис, ипекакуана, солянка Рихтера и многие другие. Из синтетических лекарственных веществ, производных изохинолина, наиболее широко известны папаверин и дротаверин, используемые в качестве спазмолитиков [8]. Имеют применение полусинтетические препараты, получаемые из морфина, такие как кодеин, дионин и др. которые включены в государственный реестр лекарственных средств или применялись до недавнего времени. Растительные алкалоиды и их синтетические аналоги содержат в своей структуре основный атом азота. В тоже время известны лекарственные вещества, производные изохинолина, в структуре которых атом азота не является оснóвным, например антигельминтный препарат празиквантель и гликвидон, применяемый в качестве антидиабетического средства [9]. Помимо препаратов, применяемых в медицине, в литературе описано громадное количество биологически активных изохинолинов. В этой области имеются сотни публикаций, изобретений и других печатных материалов. Химии изохинолинов посвящены обзоры и монографии, например [10]. Для выявления потенциальных лекарственных веществ актуально создание разнообразия структур, что может быть достигнуто использованием реагентов, дающих возможности новых химических превращений. Первым шагом в этом направлении является построение гетероциклической системы. Не прекращается целенаправленный синтез высокоактивных соединений для лечения других патологий. 1,2,3,4-Тетрагидроизохинолин является одним из наиболее распространенных гетероциклических каркасов, обнаруженных в различных перспективных и важных противоопухолевых антибиотиках. В большом числе работ сообщается о новых производных изохинолина, обладающих, цитотоксическим и противоопухолевым действием [6]. Производные 1,2,3,4-тетрагидроизохинолина, LIX, LX и LXI показали высокую цитотоксичность [7]. Следует отметить, что в рассмотренных литературных источниках встречаются новые вещества с такими видами активности как: противовирусная [3], анальгетическая, противовоспалительная. Приведенные в данных работах, соединения

ISSN 3030-3907

показали хороший уровень анальгетической и противовоспалительной активности, а соединения общей формулы LVII и LVIII с радикалами: R=H, Alk 1=Alk 2=Me, Ar=Ph и R=H, Alk 1=Me, Alk 2=Bu, Ar=C6H4OMe-p соответственно, превзошли по активности метамизол натрия.

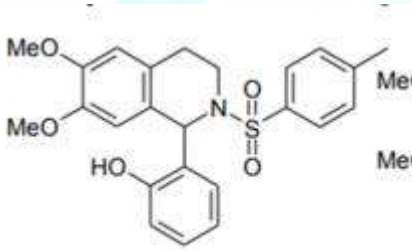


LVII

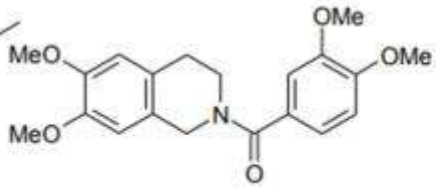


LVIII

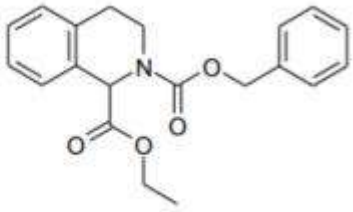
Не прекращается целенаправленный синтез высокоактивных соединений для лечения других патологий. 1,2,3,4-Тетрагидроизохинолин является одним из наиболее распространенных гетероциклических каркасов, обнаруженных в различных перспективных и важных противоопухолевых антибиотиках. В большом числе работ сообщается о новых производных изохинолина, обладающих, цитотоксическим и противоопухолевым действием [6]. Производные 1,2,3,4-тетрагидроизохинолина, LIX, LX и LXI показали высокую цитотоксичность [28].



LIX



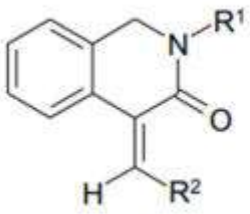
LX



LXI

В качестве примера соединений с высокой антипролиферативной активностью можно привести вещества структуры LXII, в качестве заместителей использовались R 1=Me, Bn; R 2=Ph, Me, п-толил.

25



LXII

Значительное внимание уделяется разработке препаратов против вируса иммунодефицита человека. Перспективным ингибитором развития

ISSN 3030-3907

вируса ВИЧ-1 в испытании на линии клеток авторы исследования [12] считают этил-1-бензил7-метоксиизохинолин-4-карбоксилат. В работе [13] сообщается о возможности применения производных 2-гидрокси-4-метоксикарбонилизохинолин-1,3(2H,4H)- дионов LXIII в комплексе с ионами магния или марганца как ингибиторов обратной транскриптазы ВИЧ-

Вывод:Изохинолиновые соединения представляют собой ценную группу гетероциклических веществ с широким спектром биологической активности. Проведённый обзор литературы показывает, что производные изохинолина обладают значительным потенциалом в фармакологии, особенно в качестве спазмолитиков, антимикробных, противоопухолевых, противовирусных и нейропротекторных средств. Их способность модулировать сосудистый тонус делает их перспективными кандидатами для терапии заболеваний сердечно-сосудистой системы. Современные подходы к синтезу и функционализации изохинолиновых структур открывают новые возможности для разработки эффективных и селективных лекарственных препаратов. Таким образом, дальнейшие исследования в этом направлении являются актуальными и востребованными для медицины и фармацевтики.

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ANABASIS APHYLLA O‘SIMLIGI TARKIBIDAN ANABAZIN ALKALOIDINI AJRATIB OLISH VA ANABAZIN SULFO BIRIKMASINI OLISH

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Annotatsiya: Anabasis aphylla o‘simligidan olingan anabazin alkaloidini sulfat kislota ishtirokida anabazin sulfo birikmasi olindi. Olingan modda qishloq xo‘jaligida turli xil shira kasalliklariga qarshi kurashishda foydalanildi.

Kalit so‘zlar: anabasis aphylla, anabazin, alkaloid, pestitsid, shira, afillin, afid.

Abstract: The anabasine alkaloid from the plant Anabasis aphylla was synthesized in the presence of sulfuric acid to form the anabasine sulfo compound. The obtained substance was used in agriculture to combat various aphid diseases.

Keywords: anabasis aphylla, anabasine, alkaloid, pesticide, aphid, aphillin, aphid

Аннотация: Сульфосоединение анабазина было получено путем обработки алкалоида анабазина из растения Anabasis aphylla серной кислотой. Полученное вещество использовалось в сельском хозяйстве для борьбы с различными заболеваниями тлей.

Ключевые слова: anabasis aphylla, анабазин, алкалоид, пестицид, тля, афиллин, тля

Kirish

Anabasis aphylla odatda itsigek nomi bilan tanilgan, Qrimning shimolida, Rossiyaning Janubiy Evropa qismida, Markaziy Osiyo va Kavkazda tarqalgan muhim ko‘p yillik buta o‘simlikdir. Itsegek(*Anabasis aphylla*) — O‘rta Osiyo cho‘l mintaqalarida ko‘p tarqalgan o‘simlik, asosan chala cho‘l va cho‘l hududlari hamda past tog‘ oldi hududlarida, ko‘chma qum va qumtepalarda o‘sadi, ba'zida u tuproqni mustahkamlash va qumtepalarni barqarorlashtirish uchun ekilgan[1]. Bargsiz Anabazis - 20-70 (ba’zan 80) sm balandlikdagi ko‘p yillik yarim buta o‘simlik bo‘lib, tuproqqa chuqur (5-12 m) kirib boradigan kuchli ildiz tizimiga ega. Poyasi, shu jumladan bir nechtasi, asosdan qarama-qarshi shoxlanadi. Ildizlari chuqur ildiz, kuchli, 10 m chuqurlikda tuproqqa chuqur kiradi. Poyasidagi barglar qisqargan. Pastdagi poyalari yog‘ochsimon, qo‘ng‘ir rangli, shoxlangan, ko‘p, yuqorisi esa o‘tsimon, qattiq, kulrang-yashil rangga ega(1-rasm). Bargsiz anabazisning yer ustki qismlari (o‘t) dorivor va texnik xom ashyo sifatida ishlatiladi, alkaloid olish uchun manba bo‘lib xizmat qiladi[2].

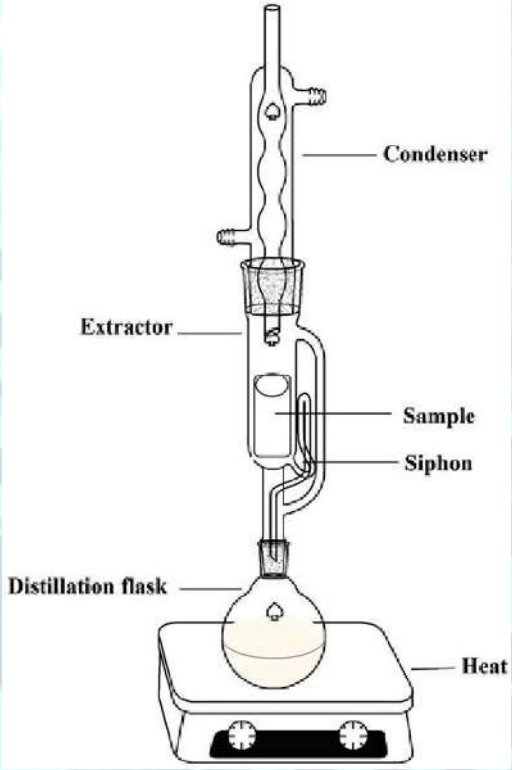
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1-rasm.anabasis aphylla yer ustki qismini ko‘rinishi

Foydalanilgan metodlar

Farg‘ona viloyati, Farg‘ona tumani adirliklaridan tarqalgan *Anabasis aphylla* o‘simligini yer ustki qismlarini terib , quritilgan o‘simlik xomashyosini olinib, amiak eritmasi bilan namlandi. 2 soatdan so‘ng namunalar birin ketin Sokslet qurilmasida (2-rasm) alkaloidlar to‘liq ajralgunga qadar xloroform bilan ekstarksiya qilindi.



2-rasm. Sokslet qurilmasi

Olingan xloroformli ekstrakt vakuum ostida quyiltirildi va spirt eritmasida xlorofill cho‘kmaga tushirildi. Ekstrakt xlorofilldan filtrlanib suvli spirt vakuumda quritildi. Quritilgan ekstraktni sulfat kislotada eritildi va ajratkich voronka orqali

ISSN 3030-3907

xloroformda yuvib olindi . Kislotali eritmaga amiak (muz solingan idishda) qo‘shildi va erkin alkaloidlar xloroform yordamida ajratib olindi. Xloroform suvdan quritilib haydaldi va alkaloidlar yig‘indisi vakuumda quritilib, tortib olindi. Tekshirishlar natijasida ajratib olingan modda Anabazin va Lyupenin ekanligi aniqlangan. *Anabasis aphylla* o‘simligi yer ustki qismini o‘rganish jarayonida 2 ta Lyupenin va anabazin alkaloidlari toza holatda ajratildi, ulardan Rf qiymatlari va suyuqlanish temperaturasi o‘lchandi.

Anabasis aphylla (ba'zan ***Anabasis aphyllana*** deb ataladi) - bu buta yoki o‘t o‘simliklar oilasiga mansub o‘simlikdir. U asosan O‘rta Osiyo va boshqa quruq mintaqalarda uchraydi. O‘simlikning ekstraktsiyasi ko‘pincha uning tibbiy yoki sanoat maqsadlarida ishlatilishi uchun amalga oshiriladi.

Anabasis aphylla o'simligidan anabazinni ajratib olish jarayoni bir nechta bosqichlardan iborat bo'lib, odatda kimyoviy ekstraksiya va tozalash usullarini o'z ichiga oladi. Anabazin alkaloidi bu o'simlikda mavjud bo'lib, uni ajratib olish uchun quyidagi umumiy jarayonlar amalga oshiriladi:

Farg‘ona viloyati, Farg‘ona tumanidan terib kelingan va quritib maydalangan *Anabasis aphylla* o‘simligining yer ustki qismi xomashyosi perkolyatorga joylashtirilib, o‘simlikni to‘liq qoplaguncha etil spirti bilan to‘ldirilib, bir sutkaga qoldirildi.

Bir sutkadan so‘ng, erituvchi o‘simlikdan filtrlanib ajratdik va vakuum ostida haydadik. Haydalgan erituvchi yana o‘simlik ustiga qo‘shildi. Bu jarayonni alkaloidlar o‘simlik tarkibida qolmaguncha takrorladik. Ajratib olingan ekstraktni vakuumda quritib, etil spirtida eritdik va xlorofillni cho‘kmaga tushirib oldik. Keyin ekstraktni xlorofilldan filtrlab, suvli spirt vakuum ostida haydadik. Quruq ekstrakt xloroformda eritildi ustiga sulfat kislota H_2SO_4 quyildi va ajratgich voronkada kislotali eritma ajratib olindi.

Kislotali eritma ishqor yordamida (NH_4OH) muzli xammomda olib boriladi, eritma qizib ketishini oldini olish maqsadida ishqor asta sekinlik bilan (kichik porsiyalarda qo‘shib borildi) ishqorlandi. Ishqoriy eritma ajratkich voronka orqali xloroformda yuvib olindi. Bu jarayon ishqorda alkaloid qolmaguncha bir necha bor takrorlandi. Xloroform suvdan quritilib haydaldi va alkaloidlar yig‘indisi ajratib olindi.

Farg‘ona viloyati, Farg‘ona tumani adir hududidan yig‘ib olingan, salqin joyda quritilib va maydalangan Anabasis aphylla o‘simligining yer ustki qismini alkaloidlarini ajratib olish uchun, xomashyo NH_4OH ammiak eritmasi bilan oldindan namlanib perkolyatorga joylashtirildi va xloroformda ekstraksiya qilindi.

ISSN 3030-3907

Ekstrakt har kuni filtrlab, o‘simlik erituvchidan ajratilib, erituvchi haydash qurilmasida bug‘latildi. Yangi erituvchi o‘simlik ustiga quyilib, o‘simlik komilgilguncha ekstraksiya davom ettirildi.

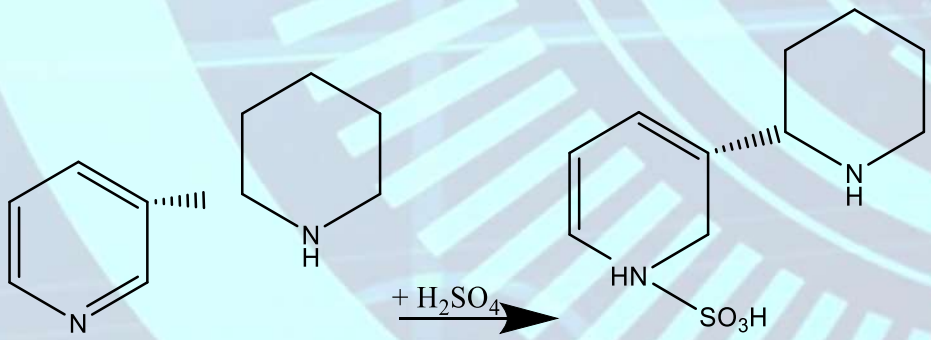
Bu jarayon 8 marta takrorlandi. Ekstraksiyaning tugallanganligi kremniy volfram kislota (KVK) eritmasi bilan sifat reaksiya orqali tekshirildi. Agar ekstrakt tarkibida alkaloid mavjud bo‘lsa, oq cho‘kma hosil bo‘ladi. Ekstrakt haydash qurilmasida bug‘latilib quritildi va etil spirtida eritildi, so‘ngra xlorofil cho‘kma tushirildi. Suvli spirtda erigan ekstrakt vakuumda quritilib, xloroformda eritildi. Ustiga sulfat kislota qo‘shilib, ajratkich voronka orqali kislotali qism ajratib olindi.

Bu jarayon kislotali eritmada alkaloid qolmaguncha 4 marta takrorlandi. Kislotali eritma ammiak (muz bilan sovutilgan idishda) qo‘shilib, ishqoriy muhitga o‘tkazildi. olingan ishqoriy eritmani ajratkich voronka orqali xloroformda yuvib olindi. Xloroform suvdan quritilib, haydaldi, so‘ngra alkaloidlar yig‘indisi vakuumda quritilib tortib olindi. Ammiak eritmasi bilan namlangan o‘simlik xomashyosini xloroform bilan ekstraksiya qilish orqali alkaloidlarni ajratib olish usuli yanada maqbuldir, chunki bu usulda alkaloidlarni ajratish jarayonida emulsiya hosil bo‘lishi minimal darajada bo‘ladi. Biroq, iqtisodiy jihatdan etanoldan foydalanish samarali bo‘lsa-da, bu usulda alkaloidlar yig‘indisining sifat darajasi past bo‘ladi.

Olingan natijalar tahlili

Anabazin-sulfat-quyuq rangli suyuqlik, tarkibida zahar — anabazin mavjud. Suv bilan oson aralashadi. U shira,trips, psillidlarga qarshi 0,1 dan 0,5% gacha bo‘lgan konsentratsiyada sovunning majburiy qo‘shilishi bilan purkab sepiluvchi insektitsid sifatida ishlatiladi. Aralashmani tayyorlash juda oddiy: oldindan eritilgan anabazin-sulfat sovun bilan kerakli miqdordagi suvga quyiladi. Eritma yaxshilab aralashtiriladi. 3 kilogram o‘simlik xomashyosidan 100 litr dori tayyorlanib 1 gektar yer uchun foydalanish mumkin.

$C_{10}H_{14}N_2 + H_2SO_4 = C_{10}H_{14}N_2\ SO_4$



Tadqiqot natijasida *Anabasis aphylla* o‘simligidan olingan anabazin alkaloididan anabazin sulfo birikmasi olindi.

ISSN 3030-3907

Anabazin sulfo birikmasi, asosan, pestitsidlar, insektitsidlar va antiparazitar preparatlarni ishlab chiqishda qo'llaniladi. Ushbu birikma, ayniqsa, qishloq xo'jaligi sohasida zararkunandalar va hasharotlar bilan kurashishda samarali hisoblanadi. Shuningdek, anabazin sulfo, ba'zi biologik tadqiqotlar, farmatsevtika sohasida ham qo'llanilishi mumkin, ammo u faqat xavfsizlik standartlariga mos ravishda ishlatilishi kerak[3].

Anabazin sulfo insektitsid sifatida bir qator zararkunandalarga qarshi samarali hisoblanadi. U asosan quyidagi zararkunandalar uchun ishlatiladi: Chivinlar (masalan, uy chivinlari va mayda chivinlar) – bu zararkunandalar qishloq xo'jaligida va uy-joyda muammo tug'dirishi mumkin. Kumush pichan hasharotlari – bu zararkunanda turli o'simliklarni, shu jumladan ekinlarni yemiradi[4]. Qushlar va jonzotlarni zararlovchi hasharotlar – ba'zi ko'plab boshqa hasharotlar ham anabazin sulfo bilan davolanishi mumkin. Anabazin sulfo insektitsid sifatida zararkunandalar organizmiga nerv tizimi orqali ta'sir qiladi. U asosan acetilkolinesteraza (ACH) fermentini inhibe qilib, acetilkolinning to'planishiga olib keladi[5]. Bu nerv impulslarining normal o'tishini to'xtatadi va shu orqali zararkunandada nerv tizimi buziladi, natijada u halok bo'ladi[6].

Xulosa

1. *Anabasis aphylla* o‘simligidagi alkaloidlarini ajratib, anabazinning sulfo birikmasi olindi.

2 . Anabazin sulfo birikmasi qishloq xo’jaligidagi zararkunandalarga qarshi ta’sirini amaliyotta tekshirib ko‘rildi.

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ISSN 3030-3907

O‘SIMLIKLARNING RIVOJLAANISH DAVRIDA AMINOKISLOTALARNING AHAMIYATI

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Annotatsiya. Mazkur ishda o‘simliklarning rivojlanish jarayonida aminokislotalarning biologik ahamiyati yoritilgan. Tadqiqotda aminokislotalar o‘simlik hujayralarining qurilishida, modda almashinuvida hamda ferment va gormonlarning sintezida muhim rol o‘ynashi ko‘rsatilgan. Ayniqsa, stress sharoitlarida aminokislotalarning himoya mexanizmlari va moslashuvchanlikni ta'minlashdagi vazifalari alohida e’tiborga olingan. Shuningdek, ayrim asosiy aminokislotalarning o‘sish stimulyatori sifatidagi ta’siri va ularning o‘simliklarning vegetativ va generativ fazalariga ta’siri tahlil qilingan. Ish natijalari aminokislotalardan samarali agrotexnik vosita sifatida foydalanish imkoniyatlarini asoslashga xizmat qiladi.

Kalit so‘zlar: Aminokislotalar, o‘simlik rivojlanishi, hujayra qurilishi, modda almashinuvi, fermentlar, gormonlar, stress omillari, vegetativ faza, generativ faza, o‘sish stimulyatori, agrotexnika

Аннотация. В данной работе освещено биологическое значение аминокислот в процессе развития растений. Исследование показало, что аминокислоты играют важную роль в построении растительных клеток, метаболизме, а также в синтезе ферментов и гормонов. Особое внимание было уделено защитным механизмам и функциям аминокислот в обеспечении гибкости, особенно в стрессовых условиях. Также было проанализировано влияние некоторых незаменимых аминокислот в качестве стимуляторов роста и их влияние на вегетативную и генеративную фазы растений. Результаты работы служат обоснованием возможности использования аминокислот в качестве эффективного агротехнического средства.

Ключевые слова: аминокислоты, развитие растений, строительство клеток, метаболизм, ферменты, гормоны, факторы стресса, вегетативная фаза, генеративная фаза, стимулятор роста, Агротехника

Annotation. this work highlights the biological importance of amino acids in the process of plant development. The study showed that amino acids play an important role in the construction of plant cells, in the metabolism and in the synthesis of enzymes and hormones. Particular attention was paid to the protective mechanisms and functions of amino acids in ensuring flexibility in stress conditions. The effects

ISSN 3030-3907

of certain basic amino acids as growth stimulants and their effects on vegetative and generative phases of plants have also been analyzed. The results of the work serve to justify the possibility of using amino acids as an effective agrotechnical agent.
Keywords: amino acids, plant development, cell construction, substance metabolism, enzymes, hormones, stress factors, vegetative phase, generative phase, growth stimulator, agrotechnics

Kirish

Ma’lumki, qurg‘oqchil iqlim sharoitida va quruq tuproqlarda o‘simliklarning o‘sishi va rivojlanishida suv asosiy cheklovchi omil hisoblanadi. Ushbu muammo kuzatilgan ko‘plab mamlakatlarda suv iste'molining 90-95% dan ortig‘i qishloq xo‘jaligi hissasiga to‘g‘ri keladi. O‘simliklarni oziqlantirishni boshqarish qishloq xo‘jaligi tizimlarida suvdan foydalanish samaradorligini oshirishning samarali strategiyalaridan biridir. Shuning uchun azotning birikmalari (karbamid, ammoniy tuzlari va aminokislotalar) o‘g‘itlarni qo‘llash muhimdir, chunki ulardan foydalanish o‘simliklarning suv etishmasligi sharoitida suvdan samarali foydalanishni oshiradi. Ushbu strategiyadagi aminokislotalarning boshqalar bilan solishtirganda afzalligi, ularning o‘simlik metabolizmida bevosita ishtirok etish qobiliyatini ko‘rsatadi. O‘simliklar ildizlari yoki keng barglari orqali aminokislotalarni o‘zlashtira oladi. Biroq, faqat ba’zi bir aminokislotalargina o‘simliklarning o‘sishiga yordam beradi. Prolin va glitsin o‘simliklarni qurg‘oqchilikdan himoya qilishda eng katta rol o‘ynaydi.

O‘g‘itlar tarkibiga kiritilgan mikro va makroelementli aminokislota xelatlari ularning o‘simlik to‘qimalarida to‘planishiga yordam beradi va natijada lipid peroksidatsiyasini (LPO) ingibirlash orqali o‘simliklarning suv taqchilligiga chidamliligini oshiradi. O‘simliklarga xelat kompleksi shaklida kiradigan aminokislotalar natriy va xlorid ionlarining hujayralararo taqsimlanishiga ta’sir qilishi va ularning o‘simlik metabolizmiga toksik ta’sirini kamaytirishi mumkin.

Aminokislotalarni xelatli o‘g‘itlari o‘simliklarga atrof-muhit omillarining salbiy ta’sirni kamaytirishga yordam beradi. Ular orasida: haroratning sezilarli o‘zgarishi, tuproqdagi og‘ir metallarning yuqori konsentratsiyasi, qishloq xo‘jaligi ekinlarining zararkunandalari va kasalliklaridan kelib chiqadigan biotik omillar. Bu o‘g‘itlar yordamida o‘stirilgan o‘simliklarda ko‘proq uglevodlar, osmolitlar va ozuqa moddalari borligi aniqlandi. Bu ularga past harorat yoki sovuqqa yaxshiroq bardosh berish imkonini beradi.

Fiziologik faol birikmalar, eruvchan oqsillar, aminokislotalar, amidlar suvni ushlab turish qobiliyati bilan tavsiflanadi. Fotosintez jarayonida yoki ildizlarning sun’iy faolligi natijasida hosil bo‘lgan aminokislotalar keyinchalik turli biokimyoviy jarayonlarda ishtirok etadilar. Aminokislotalar o‘simlik metabolizmining deyarli

ISSN 3030-3907

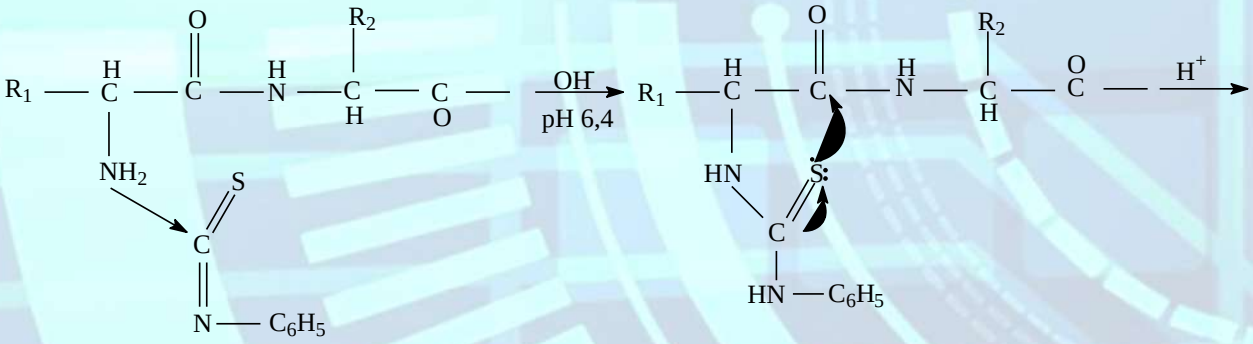
barcha jarayonlarida faol ishtirok etadi. Shuningdek, ular o‘simlik hujayralarining qurilishida sodir bo‘ladigan moddalar ham dur. Bundan tashqari, aminokislotalar noqulay omillariga moslashishda yordamchi molekulalar sifatida ishtirok etishi mumkinligi ko‘rsatilgan ba’zi o‘simlik tarkibiy qismlari va bir qator ikkilamchi metabolitlar sifatida ishlatilishi mumkin.

Shu maqsadda g‘o‘za barglaridagi azotli birikmalarning mavsumiy va sutkalik dinamikasini o‘rganish muhim ahamiyatga ega. Ushbu ma’lumotlar (azot saqlovchi birikmalarning mavsumiy va sutkalik dinamikasi) g‘o‘zaning mavsumdan tashqari rivojlanish fazalarida aminokislotalarga bo‘lgan ehtiyojini aniqlash imkonini beradi.

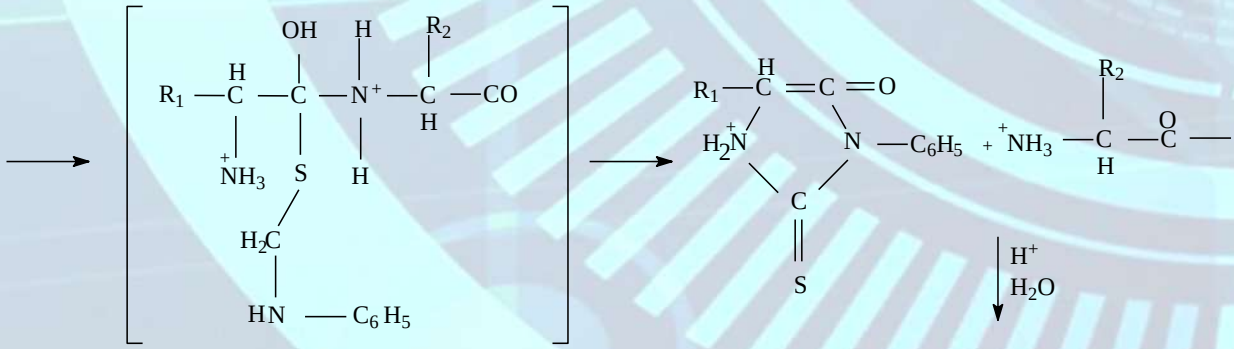
Andijon viloyatida 2022-yili dala maydonida g‘o‘zaning vegetatsiya davirlarida o‘rganish ishlari olib borildi. Biz paxtaning Andijon-1 navidan foydalandik. Barglar kunning turli vaqtlarida o‘simlikning uchdan bir qismini terib olib erkin aminokislotalar miqdorini VEJX yordamida aniqladik va buni o‘simlikning rivojlanishini turli davirlarida olib bordik. Tajribalar g‘o‘zaning unib chiqish (may), o‘sish (iyun), gullash (iyun-iyul) va meva berish (avgust) davrlarida olib borildi. Biokimyoviy tahlillar uchun barg namunalari suyuq azotga joylashtirildi va -80°C da saqlandi.

O‘rganilayotgan erkin aminokislotalarning kontsentratsiyasining sifat tahlili va miqdoriy hisobi standart va o‘rganilgan FTK - aminokislotalarning hosilalarining saqlanish vaqti va eng yuqori nuqtalarini solishtirish orqali amalga oshirildi.

Tajriba mexanizmini quyidagicha ifodalash mumkin:

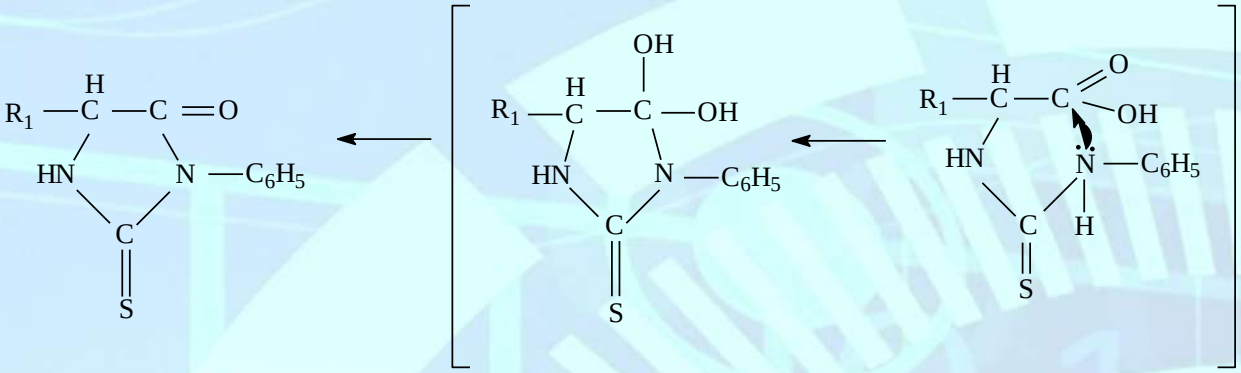


FITS FTK- peptid



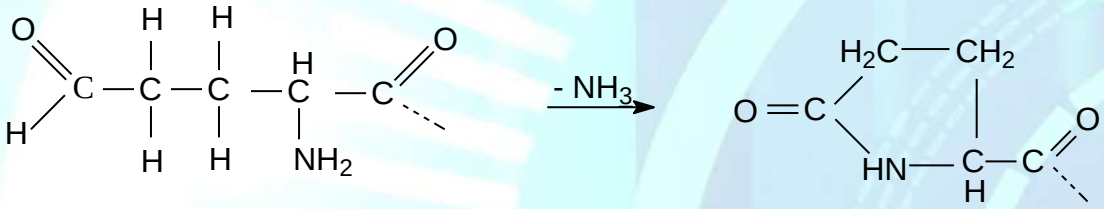
2-anilin-5-tiazolinon

ISSN 3030-3907



3-fenil-2-tiogidantoin FTK-aminokislota

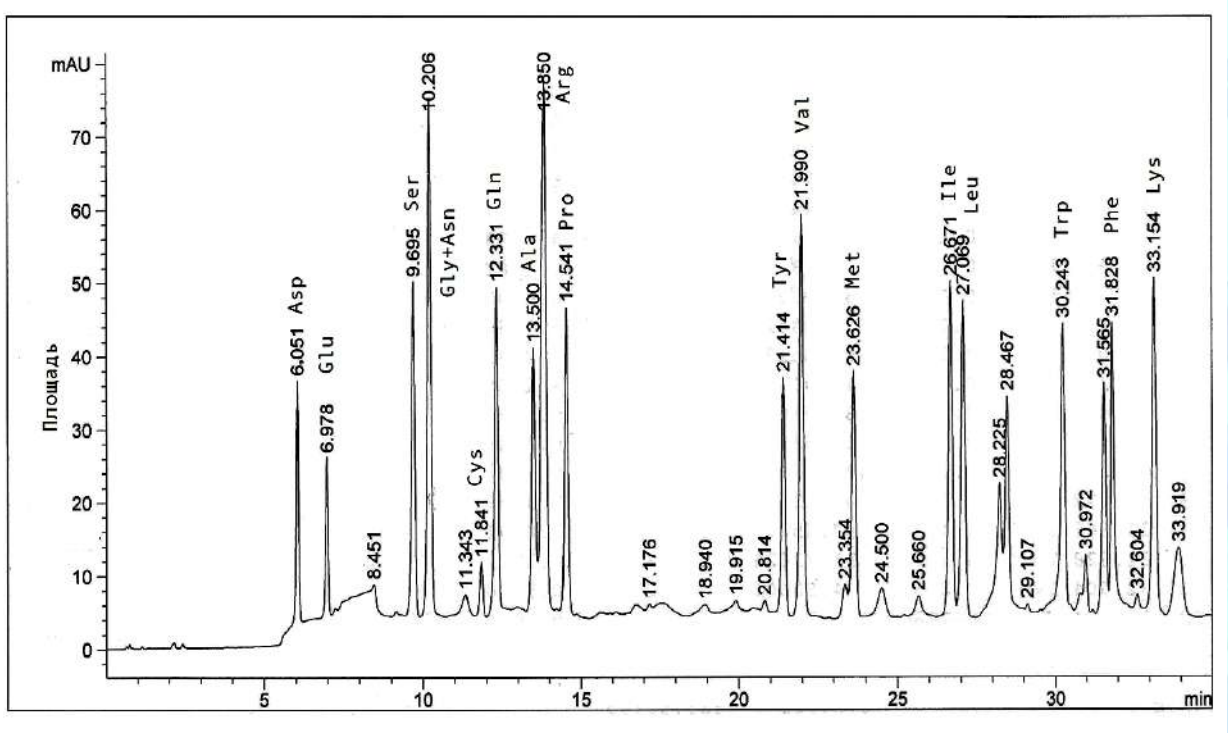
Reaktsiya sharoitlarida odatdagi polipeptid zanjirining o‘ziga xos parchalanishiga olib kelmadi, chunki piroglutamin kislotaning N-terminal qoldiqlari keyingi degradatsiyaga to‘sqinlik qiladi.



Asparagin kislotali sharoitda, Asp-Gly ketma-ketligida, siklik tuzulishni hosil qildi va bu ham jarayonga to‘sqinlik qildi.

Aminokislotalarning standart eritmalari usuli bilan olingan xromatografiyasi 1-rasmda ko‘rsatilgan. Xromatogramma (1-rasm) sinov namunasining aminokislotalarni ajratish vaqtlarini ko‘rsatadi. Asparagin 5,923 daqiqada paydo bo‘ldi; 7,021 daqiqa - glutamik kislota; 12.34 6 daqiqa - glitsin; 13,625 daqiqa - alanin; 13,918 daqiqa - arginin; 14,706 daqiqa - prolin; 21,833 daqiqa - valin; 23,750 daqiqa - metionin; 31,816 daqiqa - fenilalanin va boshqalar.

ISSN 3030-3907

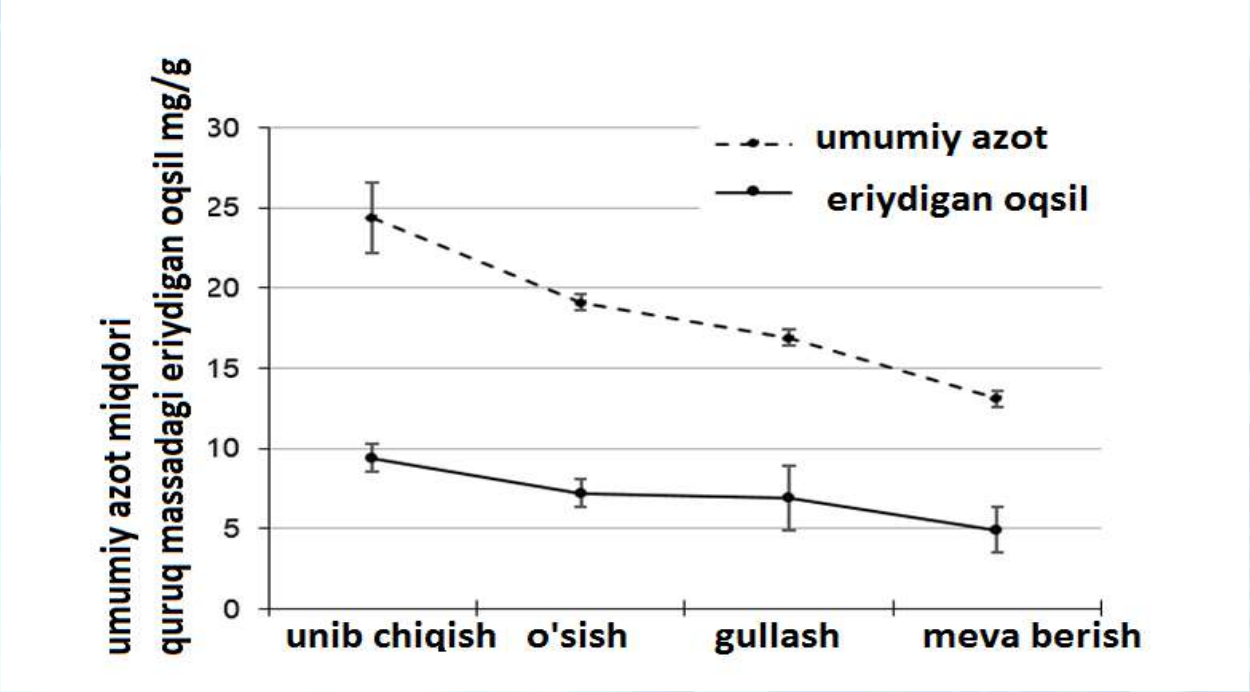


1-rasm. Standart PTC aminokislotalarini (50 pmol) VEJX tomonidan teskari fazali ustunda (Ultrasfera) asetonitril → natriy trifluoroatsetat gradientida ajratish.

Vegetatsiyaning turli davrlarida g‘o‘za barglaridagi umumiy azot, eruvchan oqsil va erkin aminokislotalarning tarkibini o‘rganish ushbu ko‘rsatkichlarning mavsumiy va kunlik o‘zgarishlarini aniqlash imkonini beradi. 2-rasmda umumiy azot miqdori o‘simlikning rivojlanish bosqichi bilan aniqlanganligini ko‘rsatadi. O‘sayotgan yosh barglarda umumiy azotning maksimal miqdori qayd etilgan (24,4 ± 2,2 mg/g quruq massasi). G‘o‘zada kurtaklarining ma’lum tartibda bir xilda o‘sishi aniqlandi. O‘simliklarning generativ rivojlanishga o‘tishi bilan yangi metamerlarning paydo bo‘lishi to‘xtaydi. Shuning uchun, barglar keksayib, ulardagi azotli birikmalar miqdori meva fazasida quruq vaznda kamaydi 13,1 ± 1,4 mg/g(2-rasm).

Barglarda azotli moddalarining asosiy qismini oqsillar tashkil qiladi. Ma’lumotlarning tahlili shuni ko‘rsatadiki, eruvchan oqsil tarkibidagi o‘zgarishlar umumiy azot tarkibining dinamikasiga mos keladi (2-rasm). Eriydigan oqsilning maksimal darajasi yosh o‘simliklarning barglarida (unib chiqish) meva berish bosqichiga nisbatan sezilarli pasayish kuzatiladi. Umumiy azot va eruvchan oqsil miqdori o‘rtasida yuqori farq (r = 0,96) mavjud.

ISSN 3030-3907



2-rasm. Umumiy azot miqdorining mavsumiy dinamikasi va eriydigan oqsil.

Tahlillar shuni ko‘rsatdiki, kun davomida barglardagi umumiy azot tarkibida sezilarli o‘zgarishlar bo‘lmagan. Biroq, o‘sish va gullash bosqichlarida uning minimal miqdori peshin soatlarida qayd etilgan. Barglardagi eruvchan oqsil miqdorining kunlik dinamikasi aniqlandi. O‘sish va gullash fazalarida eruvchan oqsilning minimal to‘planishi erta tongda qayd etilgan; peshin vaqtida uning tarkibi biroz oshdi, kechqurun maksimal bo‘lganligini ko‘rdik. G‘o‘za bargidagi umumiy azot miqdori GOST R 58596-2019 bo‘yicha Keldal metodi yordamida aniqlandi. O’simliklardagi umumiy azot va eruvchan oqsil miqdorini aniqlash kelajakda agrosanoatning yanada rivojlanishiga olib keladi.

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ISSN 3030-3907

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ISSN 3030-3907

UGLEVODOROD GAZINI TOZALASH JARAYONIDA AJRALIB CHIQADIGAN YUQORI OLTINGUGURTLI GAZLARDAN SULFAT KISLOTA OLISHNING SAMARALI USULLARINI ISHLAB CHIQISH

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Annotatsiya: Bugungi kunda kimyo va gaz-kimyo sanoatining texnologik tashlama gazlarini antropogen ta'sirini kamaytirish, avvalo muayyan ifloslantiruvchi moddalardan tozalab, so`ngra innovatsion texnologiyalarni qo'llab, texnologik jarayonlarda qayta foydalanish orqali amalga oshirilishi mumkin. Shu bilan birga zamonaviy gaz-kimyoning dolzarb vazifalaridan biri tarkibida karbonat angidrid va vodorod sulfid saqlagan tashlama gazlarni tozalash uchun reagentlarni tanlash, jumladan gaz tarkibidagi nordon komponentlarning asosiy qismini yutishda xemosorbsion jarayonini boshqarishning ilmiy asoslarini o'rganish bilan bog'liq bo'lib muhim ahamiyat kasb etadi. Jahonda tashlama-mash'ala gazlarini nordon komponentlardan tozalash uchun kimyoviy reagentlar hamda atrof-muhitga ta'sir etmaydigan absorbentlar olishning samarali energiya tejamkor texnologiyalarni yaratish bo'yicha ilmiy izlanishlar olib borilmoqda. Bu borada gaz-kimyo sanoati mash'ala gazlari tarkibidagi karbonat angidrid va vodorod sulfid komponentini zararli miqdorini kamaytirish maqsadida absorbentlarni tanlash, sorbsion va kinetik ko'rsatkichlarini takomillashtirish, turli chiqindi gazlarini tozalash va tarkibini zararlantirishni jadallashtirish texnologiyalarini ishlab chiqish va sinovdan o'tkazishga alohida e'tibor berilmoqda.

Kalit so'zlar: vodorod sulfid, sulfat kislota, oltingugurt dioksidi, konversiya, absorbsiya, vanadiy oksid.

Аннотатция. В настоящее время снижение антропогенного воздействия технологических выбросных газов химической и газохимической промышленности может быть достигнуто, прежде всего, за счёт их очистки от конкретных загрязняющих веществ, а затем повторного использования в технологических процессах с применением инновационных технологий. Одной из актуальных задач современной газохимии является выбор реагентов для очистки выбросных газов, содержащих углекислый газ и сероводород, а также изучение научных основ управления хемосорбционным процессом поглощения основной части кислых компонентов газа, что имеет

ISSN 3030-3907

важное значение. В мире ведутся научные исследования по созданию эффективных и энергоэкономичных технологий получения химических реагентов и абсорбентов, не оказывающих негативного воздействия на окружающую среду, для очистки факельных газов от кислых компонентов. В этом направлении особое внимание уделяется выбору абсорбентов для снижения вредного содержания углекислого газа и сероводорода в факельных газах газохимической промышленности, совершенствованию сорбционных и кинетических характеристик, разработке и испытанию технологий ускоренной очистки различных отходящих газов и снижения их загрязняющего воздействия.

Ключевые слова: сероводород, серная кислота, диоксид серы, конверсия, абсорбция, оксид ванадия.

Annotation. Currently, the reduction of anthropogenic impact from technological exhaust gases of the chemical and gas-chemical industries can primarily be achieved by purifying them from specific pollutants, followed by their reuse in technological processes through the application of innovative technologies. One of the pressing tasks of modern gas chemistry is the selection of reagents for purifying exhaust gases containing carbon dioxide and hydrogen sulfide, as well as the study of the scientific foundations for managing the chemisorption process of absorbing the main acidic components of the gas, which is of great importance. Scientific research is being conducted worldwide to develop efficient and energy-saving technologies for producing chemical reagents and absorbents that do not negatively affect the environment, aimed at cleaning flare gases from acidic components. In this area, special attention is given to the selection of absorbents to reduce the harmful content of carbon dioxide and hydrogen sulfide in flare gases of the gas-chemical industry, the improvement of sorption and kinetic characteristics, and the development and testing of technologies for accelerated purification of various exhaust gases and reduction of their environmental impact.

Key words: hydrogen sulfide, sulfuric acid, sulfur dioxide, conversion, absorption, vanadium oxide.

Kirish

Respublikada gaz-kimyo sanoatini modernizatsiya qilish, absorbentlarning yangi zahiralarini yaratish, ular asosida import o‘rnini bosuvchi mahsulotlar ishlab chiqarish texnologiyalarini rivojlantirish, xususan raqobatbardosh mahsulotlar ishlab chiqish hamda karbonat angidrid va vodorod sulfid saqlagan gaz-kimyo sanoati texnologik tashlama-mash’ala gazlarini tozalash jarayonlarida foydalanish bo‘yicha muayyan ilmiy va amaliy natijalarga erishilmoqda. Yangi O‘zbekiston taraqqiyot strategiyasida «mavjud imkoniyatlarni to‘liq ishga solgan holda

ISSN 3030-3907

mahalliy sanoat tarmoqlari salohiyatini yanada rivojlantirish, tashqi bozor va xalqaro talablarga javob beradigan standartlarni joriy etish» bo‘yicha muhim vazifalar belgilab berilgan. Bu borada tashlama mash’ala gazi tarkibidagi vodorod sulfidning absorbentlarga yutilishi natijasida sulfat kislota eritmalarini olish juda muhimdir. O‘zbekiston Respublikasi Prezidentining 2022 yil 28 yanvardagi PF-60-son «2022-2026 yillarga mo‘ljallangan yangi O‘zbekiston taraqqiyot strategiyasi to‘g‘risida»gi, 2019 yil 30 oktyabrdagi «2030 yilgacha bo‘lgan davrda O‘zbekiston Respublikasining atrof-muhitni muhofaza qilish konsepsiyasini tasdiqlash to‘g‘risida» gi, 2019 yil 3 apreldagi PQ-4265-son «Kimyo sanoatini yanada isloh qilish va uning investitsiyaviy jozibadorligini oshirish chora-tadbirlari to‘g‘risida»gi, 2018 yil 17 yanvardagi PQ-3479-son «Mamlakat iqtisodiyotining tarmoqlarini talab yuqori bo‘lgan mahsulot va xom ashyo turlari bilan barqaror ta’minlash chora-tadbirlari to‘g‘risida»gi farmon va qarorlari hamda mazkur faoliyatga tegishli boshqa me’yoriy-huquqiy hujjatlarda belgilangan vazifalarni amalga oshirishda ushbu tadqiqot muayyan darajada xizmat qiladi.

ADABIYOTLAR TAHLILI

Neft va gazni qayta ishlash sanoatida hosil bo’ladigan oltingugurtli birikmalardan sulfat kislotasini olish uchun oltingugurt vodorod saqlovchi gaz yoqiladi. Natijada oltingugurt dioksidi va suv saqlovchi texnologik gaz hosil bo‘ladi. Keyin bu gaz sovutiladi va kontaktli apparatda ikki bosqichli konversiyaga uchraydi. Konversiya jarayoni vanadiy oksidli katalizator qatlamlari ishtirokida, oltingugurt dioksidini oksidlash orqali, gazni birinchi bosqichga 400-410°C haroratda uzatgan holda amalga oshiriladi.

Birinchi bosqichdagi konversiyadan chiqqan, harorati 450-460°C bo‘lgan gaz to‘g‘ridan-to‘g‘ri absorbsiyaga uchun kondensator-minoraga yo‘naltiriladi, u yerda oltingugurt kislotasi va gaz ajratib olinadi. Ushbu gaz keyinchalik qizdirilib, kontaktli apparatning ikkinchi bosqichiga 410-415°C haroratda kiritiladi. Ikkinchi bosqichdan chiqqan gaz 150-155°C gacha sovutiladi va monogidratli absorberga yuboriladi, u yerda oltingugurt kislotasi va tozalangan chiqindi gaz hosil qilinadi.

Ushbu tadqiqot apparatlar korroziyasini va korroziya mahsulotlari hosil bo‘lishini kamaytirishga imkon beradi, bu esa tayyor mahsulot sifatiga ijobiy ta’sir ko‘rsatadi, shuningdek, absorbsiya jarayonida hosil bo‘luvchi oltingugurt kislotasi tufayli tuman miqdorini kamaytiradi.

Tadqiqot oltingugurt kislotasini serovodorod saqlovchi gazdan ishlab chiqarishga tegishli bo‘lib, u kimyoviy, neftni qayta ishlash va boshqa sanoat tarmoqlarida qo‘llanilishi mumkin.

Vodoro sulfiddan oltingugurt kislotasini ishlab chiqarish usuli — “nam” katalitik usul deb nomlangan va ushbu ta’riflanayotgan usul ham shu turga kiradi.

ISSN 3030-3907

Bu usul quyidagi asosiy bosqichlarni o‘z ichiga oladi: Vodoro sulfidni yoqib, oltingugurt (IV) oksidi va suv bug‘lari aralashmasini hosil qilish; oltingugurt (IV) oksidini suv bug‘lari ishtirokida oltingugurt (VI) oksidiga oksidlash; oltingugurt kislotasini ajratib olish.

“Nam” usulda oltingugurt kislotasini ishlab chiqarishning turli texnologiya sxemalari, gaz va suyuqlik oqimlarining yo‘nalishi, jarayonlarni amalga oshirish shartlari va har bir bosqichning konstruktiv jihatlari bilan farq qiladigan bir qancha variantlari ma’lum.

Bu usullarda ishlatiladigan texnologik uskunalar va quvurlarning, jumladan, ularning muhim qismlarining asosiy ehtimoliy xavflari shundaki, qayta ishlanadigan serovodorod saqlovchi gaz portlovchi, yonuvchi va zaharli xossalarga ega. Shuningdek, jarayonda hosil bo‘ladigan oltingugurt kislotasi (sifatida suyuqlik va mayda tarqalgan tuman ko‘rinishida) juda yuqori korroziya kuchiga ega.

MUHOKAMA VA NATIJALAR

Tavsiflangan tadqiqotga eng yaqin usul — vodorod sulfidli gazdan sulfur kislotalarini olish usuli bo‘lib, bunda gazni yoqish orqali texnologik gaz hosil qilinadi, ushbu gazda oltingugurt dioksidi va suv mavjud, ikki bosqichli konversiya amalga oshiriladi, birinchi bosqichdan keyin oltingugurt trioxidi chiqariladi va keyinchalik ishlab chiqarish sulfat kislotalari olinadi. Bu usulda birinchi bosqichdan keyin aylanuvchi sulfat kislotasi bilan gazda namlikni ikkinchi bosqichga o‘tadigan gazda 0,005% dan oshmasligi uchun singdirish amalga oshiriladi, ikkinchi bosqichdan keyin esa ishlab chiqarish sulfat kislotalari kerakli konsentratsiyada olinadi, hatto oleumga qadar (RU 2530077, 2014).

Ko‘rsatilgan usulning kamchiligi texnologik uskunalarning yuqori darajadagi korroziyaga uchrashi bo‘lib, bu sulfat kislotasi bug‘larining gaz yo‘lagida kondensatsiyalanish ehtimoliga bog‘liq. Hosil bo‘lgan issiq sulfat kislotasi kondensati juda korroziv bo‘lib, uskunalar materialiga ta’sir qiladi, natijada texnologik uskunaning uzilishi va gazlarning toksik konsentratsiyalarining paydo bo‘lishi mumkin, bu esa xodimlarning zaharlanishiga olib kelishi mumkin. Bundan tashqari, ma'lum usulning apparatga qo‘llashda yuqori murakkabligi mavjud.

Shu tariqa, ma'lum usul yetarlicha samarali emas. Taklif etilgan tadqiqot muammosi vodorod sulfidli gazdan sulfur kislotasini olish usulining samaradorligini oshirishga qaratilgan. Ko‘rsatilgan muammo, vodorod sulfidli gazdan sulfur kislotasini olish usuli orqali hal qilinadi, bunda gazni yoqish orqali texnologik gaz hosil qilinadi, ushbu gazda oltingugurt dioksidi va suv mavjud bo‘lib, gazni sovutish va keyinchalik ikki bosqichli konversiya jarayoni kontakt apparatida amalga oshiriladi, bu jarayonda oltingugurt dioksidini oksidlash uchun

ISSN 3030-3907

vanadiy oksidi katalizatori qatlamlari ishtirok etadi. Birinchi bosqichga kiritilayotgan gazning harorati 400-410°C bo‘lishi, birinchi bosqich mahsuloti haroratining 450-460°C bo‘lishi va uni bevosita absorsiyaga - kondensatorli minoraga yo‘naltirish, undan sulfur kislotalarini va gazni chiqarish, keyin esa gazni kontakt apparatiga ikkinchi bosqich uchun 410-415°C haroratda yo‘naltirish, va ikkinchi bosqich gazining 150-155°C haroratga sovutilgandan so‘ng monogidrat absorsberga yo‘naltirilishi, bu jarayon natijasida sulfur kislotasi va tozalanmagan chiqish gazlari olinadi.

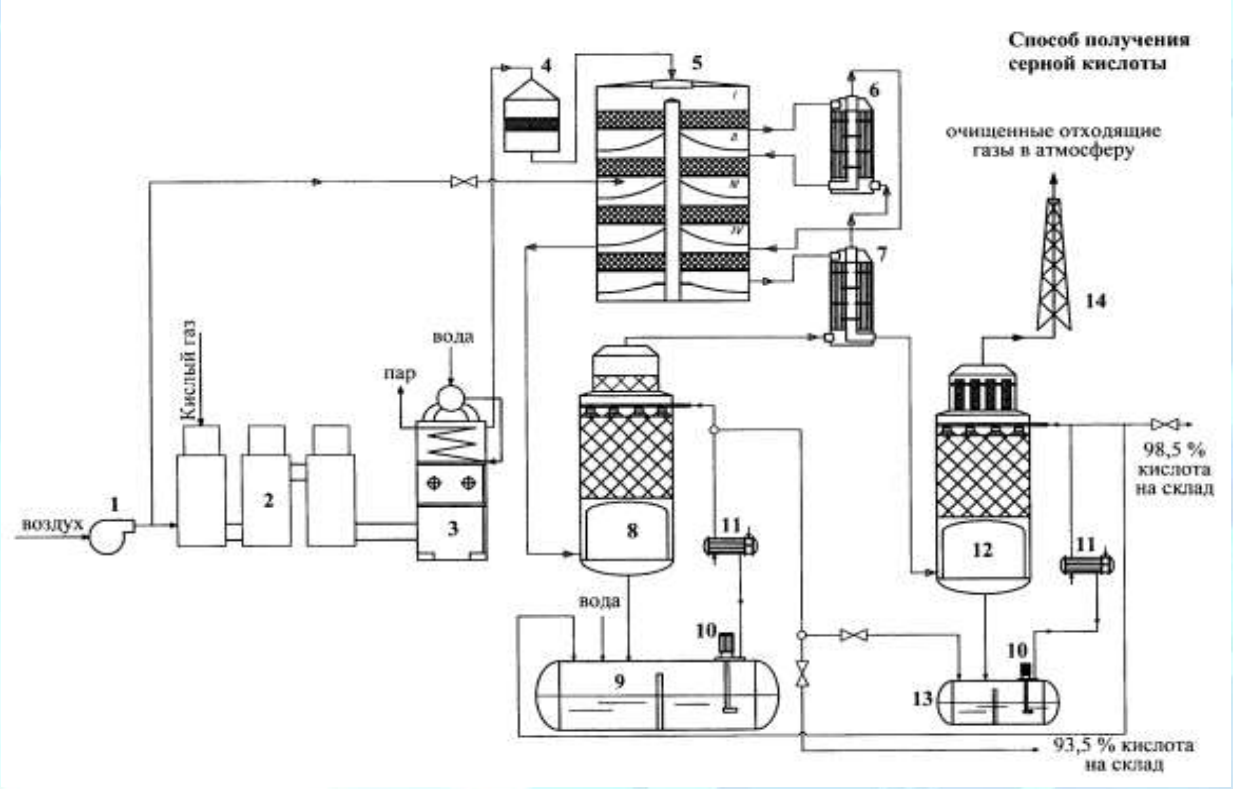
Olingan texnik natija, uskunaning korroziyasini kamaytirish va shu bilan birga, korroziya mahsulotlarini (qishloq mahsuloti uchun iflosliklar) hosil qilishni kamaytirishdan iborat bo‘lib, bu esa natijada uskunaning devorlariga to‘planib, uskunani to‘xtatishga yoki almashtirishga, tozalashga olib keladigan kutilmagan darajada yuqori kondensatsiyalanishning oldini olishga imkon beradi.

Uskulardan, gazo‘xodlardan va quvurlardan korroziyaviy eskirishni kamaytirish, mahsulotda xrom va molibden miqdorini kamaytirishga yordam beradi (xrom va molibdenning asosiy manbai - korroziyaga uchragan zanglamaydigan po‘latdan tayyorlangan uskunalar) va yuqori sifatli sulfur kislotasini olishga, masalan, «K markali» sulfur kislotasini olishga imkon beradi (TU 113-08-617-87).

Bundan tashqari, ko‘rsatilgan natija, absorbsiyalash jarayonida hosil bo‘ladigan sulfur kislotasi tumanining (texnologik gazdagi sulfur kislotasi zarrachalarining mayda dispersli suspenziyasi) miqdorini kamaytirishga, bu esa, mos ravishda, monogidrat absorberning yuqori qismida o‘rnatilgan tuman ushlovchi uskunaga yuklamani kamaytirishga va uning konstruktsiyasini soddalashtirishga olib keladi.

TADQIQOT METODOLOGIYASI. Tavsiflangan usul quyidagicha amalga oshiriladi. Xom ashyo sifatida quyidagi komponent tarkibiga ega gazni ishlatish mumkin: (H_2S) 50-60%; (CO_2) 18-20%; (CH_4) 1-2%; (H_2O) 2,5-5%; (N_2) - qolgan qismini tashkil etadi.

ISSN 3030-3907



1-rasm. Sulfat kislotasini olishning texnologik sxemasi.

1 - nasos, 2 - uch kamerali pech, 3 - parni qizdirish bilan o‘rnatilgan issiqlik almashtirgichli qozon, 4 - bug‘lanish qurilmasi, 5 - 4 qatlamli kontakt apparat, 6-7 - gaz issiqlik almashtirgichi, 8 - kondensator minorasi, 9 - kondensator minorasi to‘plami, 10 - kislotali nasoslar, 11 - plastinka sovutgichlar, 12 - monogidrat absorber, 13 - monogidrat absorber to‘plami, 14 - chiqindi trubka.

Havo markazsizlashtirilgan nasos 1 orqali yuboriladi. Vodorod sulfidli gaz pechka 2 ga yo‘naltiriladi. Pechda vodorod sulfidning yonishi natijasida oltingugurt dioksidi va suv bug‘lari hosil bo‘ladi. Ushbu jarayon natijasida hosil bo‘lgan texnologik gaz, masalan, 7-8% ob. SO_2 va 9-10% ob. suv bug‘lari miqdorida, pech 2 dan 1150-1250°C haroratda chiqariladi va issiqlik almashtirgichli qozon 3 va bug‘lanish qurilmasi 4 ga yo‘naltiriladi, bunda gaz 400-410°C gacha sovutiladi. Keyin, bu haroratdagi gaz kontakt apparatiga 5, oltingugurt dioksidini oksidlashtirish katalizatori qatlamlari bilan yuboriladi.

Oltingugurt gazini oksidlashtirish katalizatori sifatida, xususan, vanadiy oksidli katalizatorlardan foydalanish mumkin, jumladan, xorijiy va mahalliy ishlab chiqaruvchilarning katalizatorlari, masalan, «BASF» 04-115; «Haldor Topsoe», VK-38; «Monsanto Enviro-Chem», LP-120.

Birinchi katalizator qatlamida oltingugurt dioksidi oltingugurt trioksidiga o‘zgaradi va temperatura 550-560°C gacha ko‘tariladi. Hosil bo‘lgan gaz gaz issiqlik almashtirgichiga 6 yuboriladi, sovutiladi va ikkinchi katalizator qatlamiga taxminan 450°C haroratda yuboriladi. Ikkinchi katalizator qatlamidan o‘tgan

ISSN 3030-3907

gazning harorati 475-485°C gacha ko‘tariladi. Ikkinchi qatlamdan keyin gazning harorati taxminan 450°C gacha sovutiladi, bu jarayon atmosferaga havo yuborish orqali amalga oshiriladi.

Birinchi konversiya bosqichida oltingugurt dioksidini oksidlashtirish jarayoni kontakt apparatining dastlabki 3 qatlamida 93-95% darajada amalga oshiriladi.

Birinchi konversiya bosqichidan (kontakt apparatining dastlabki 3 qatlamida katalizator) so‘ng, hosil bo‘lgan texnologik gazni 450-460°C haroratda kondensatsiya minorasi 8 ga yo‘naltiriladi, bu minorada gaz sulfat kislota bilan yuviladi.

Kondensatsiya minorasida (sulfur kislota bilan o‘rmalashadigan minorada) birinchi uch qatlam katalizatorida hosil bo‘lgan SO_3 va suv bug‘lari adsorbsiyalanadi (ushlab olinadi). Adsorbsiyalash jarayonida hosil bo‘lgan sulfur kislotasi tumanini minoraning yuqori qismiga o‘rnatilgan kartushli brixg‘o-tuman tutgichlar yordamida ushlab oladi. Sulfur kislotasini minoradan 8 avtomatik ravishda minoraning to‘plamiga 9 yuboriladi, undan keyin kislotali nasos 10 va plastinka sovutgichi 11 yordamida belgilangan miqdordagi sulfur kislotasi minorani o‘rish uchun yuboriladi. To‘plamga kislota konsentratsiyasini 93,5-94,0% massaga ushlab turish uchun suv yuboriladi.

Kislota konsentratsiyasini to‘plamda 13 minoraning to‘plamidan sulfur kislotasini yuborish orqali tartibga solinadi.

Absorbsiyalash jarayonida gazdan deyarli barcha suv bug‘lari ushlab olinadi, bu esa jarayonni "quruq" sharoitda, ya'ni standart issiqlik almashinuv haroratidan foydalanib davom ettirish imkonini beradi.

Minorada kondensatsiya qilingan gaz, gaz issiqlik almashtirgichlarida 7 va 6, «Disk-Ring» turidagi, 410-415°C haroratgacha qizdirilgan holda, ikkinchi konversiya bosqichiga yo‘naltiriladi.

Ikkinchi konversiya bosqichida oltingugurt dioksidi yanada oksidlanib, oltingugurt trioksidiga (SO_3) aylanadi.

Ikkinchi bosqichdan so‘ng hosil bo‘lgan texnologik gazni 150-155°C haroratda monogidrat absorberiga 12 so‘nggi absorbsiyaga yuboriladi. Monogidrat absorberidan keyin texnologik gaz chiqindi trubkaga 14 yo‘naltiriladi.

Monogidrat absorberidan sulfur kislotasi monogidrat abzorber to‘plamiga 13 yuboriladi, undan keyin kislotali nasos 10 va plastinka sovutgichi 11 yordamida kerakli miqdordagi sulfur kislotasi monogidrat absorberini yuvish uchun yuboriladi. Absorberni 98,5-99,0% massali konsentratsiyadagi sulfur kislotasi bilan o‘rishadi, uning konsentratsiyasini minoraning to‘plamidan 9 kislotaning yuborilishi orqali tartibga solishadi. Monogidrat absorberining to‘plamidan

ISSN 3030-3907

ortiqcha sulfur kislotasi minoraning to‘plamiga 9 yo‘naltiriladi. Kislota konsentratsiyasini to‘plamda 13 minoraning to‘plamidan sulfur kislotasini yuborish orqali tartibga solinadi.

Dastlabki xom ashyo sifatida 60% H_2S tarkibli kislota gazidan foydalaniladi, u 20% CO_2 tarkibiga ega. Kislorodli agent sifatida havo ishlatiladi.

Havo markazsizlashtirilgan havo nasosi 1 orqali pech 2 ga yuboriladi. Shuningdek, serovodorodli gazni yoqish uchun yo‘naltiriladi. Pechda serovodorodning yonishi natijasida oltingugurt dioksidi va suv bug‘lari hosil bo‘ladi. Ushbu jarayon natijasida hosil bo‘lgan texnologik gazda 7,5% SO_2 va 9,6% suv bug‘lari mavjud. Texnologik gaz, 1150°C haroratda pechdan chiqarilib, issiqlik almashtirgichli qozon 3 ga yuboriladi, so‘ngra bug‘lanish qurilmasi 4 ga yo‘naltiriladi va 400°C haroratda kontakt apparatiga 5 yuboriladi, unda to‘rt qatlamli katalizator ishlatiladi.

Birinchi konversiya bosqichidan so‘ng olingan gaz gaz-gaz issiqlik almashtirgichida sovutiladi. Gaz issiqlik almashtirgichida sovutuvchi agent sifatida birinchi bosqichdagi abzorbsiyadan (kondensator minorasidan) qaytarilgan va 310°C haroratgacha oldindan qizdirilgan texnologik gaz ishlatiladi. Ikkinchi katalizator qatlamidan keyin gaz sovutiladi, bu jarayonda sovuq havo puflash ishlatiladi.

Birinchi konversiya bosqichida oltingugurt dioksidini oksidlash jarayoni 93,7% darajada amalga oshiriladi.

Birinchi konversiya bosqichidan (kontakt apparatining dastlabki 3 qatlamida katalizator) so‘ng, 455°C haroratdagi texnologik gazni kondensatsiya minorasiga 8 yuboriladi, u erda gaz sulfat kislota bilan yuviladi. Yuvish uchun 94% massali sulfur kislotasi yuboriladi. Kondensatsiya minorasida birinchi uch qatlam katalizatorida hosil bo‘lgan SO_3 va suv bug‘lari adsorbsiyalash jarayoni amalga oshiriladi. Adsorbsiyalash jarayonida hosil bo‘lgan sulfur kislotasi tumanini minoraning yuqori qismiga o‘rnatilgan kartushli brixg‘o-tuman tutgichlar yordamida ushlab oladi. Sulfur kislotasini minoradan 8 avtomatik ravishda minoraning to‘plamiga 9 yuboriladi. Shuningdek, minoraning to‘plamidan monogidrat abzorberining to‘plamidan 13 ortiqcha sulfur kislotasi va suv yuboriladi, bu orqali kislotaning konsentratsiyasi 94% massali holatga ushlab turiladi.

Abzorbsiyalash jarayonida gazdan barcha suv bug‘lari ushlab olinadi, bu esa jarayonni "quruq" sharoitda, ya'ni standart issiqlik almashinuv haroratidan foydalanib davom ettirish imkonini beradi.

Texnologik gaz kondensatsiya minorasidan so‘ng, gaz issiqlik almashtirgichlarida 7 va 6 yordamida 410°C haroratgacha qizdiriladi va ikkinchi

ISSN 3030-3907

konversiya bosqichiga yuboriladi, bunda oltingugurt dioksidi yanada oksidlanib, oltingugurt trioksidiga (SO_3) aylanadi.

Birinchi va ikkinchi konversiya bosqichlarida oksidlanish jarayoni quyidagi harorat rejimida amalga oshiriladi: birinchi, ikkinchi, uchinchi va to‘rtinchi qatlamlarga kiruvchi gaz harorati 400°C, 450°C, 450°C, 410°C, mos ravishda birinchi, ikkinchi, uchinchi va to‘rtinchi qatlamlardan chiqayotgan gaz harorati 554,5°C, 483°C, 460,3°C va 419°C ga teng bo‘ladi.

Ikkinchi konversiya bosqichidan so‘ng 150°C haroratdagi texnologik gazni monogidrat absorberiga 12 yuboriladi. Monogidrat absorberini 98,5% massali sulfur kislotasi bilan 70°C haroratda o‘rishadi.

Monogidrat absorberidan so‘ng texnologik gaz chiqindi trubkaga 14 yo‘naltiriladi, sulfur kislotasi esa monogidrat absorberining to‘plamiga 13 yuboriladi. To‘plamdagi kislotaning konsentratsiyasini minoraning to‘plamidan 9 sulfur kislotasini yuborish orqali tartibga solishadi.

Yuqoridagi misolda tasvirlangan usulni amalga oshirish natijasida texnologik oqimlarda sulfur kislotasining kondensatsiya darajasi 70% ga kamaydi, monogidrat absorberida tuman hosil bo‘lish darajasi 15% ga kamaydi, jihozlarning korroziyali aylanması 15% ga kamaydi. Olingan sulfur kislotasi TSh 113-08-617-87 standartiga muvofiq "K markasi"ga mos keladi. Bug‘ning o‘ziga xos ishlab chiqarish darajasi 1,22 t/t MNG (MNG - monogidrat).

Yuqorida keltirilgan haroratlar oralig‘idagi boshqa haroratlar bilan tasvirlangan usulni amalga oshirishda shunga o‘xshash natijalarga erishiladi. Ushbu usulni bajarishdagi harorat rejimining buzilishi kutilgan natijalarga olib kelmaydi.

Shunday qilib, tasvirlangan usul yuqori sifatli maqsadli konsentratsiyaga ega sulfur kislotasini olishga, texnologik oqimlarning korroziyaviy faolligini 15-20% ga kamaytirishga va uskunalarning ishonchliligini oshirishga imkon beradi, chunki sulfur kislotasining kondensatsiya darajasi 65-70% ga kamayadi. Bunga qo‘shimcha ravishda, abzorberda tuman hosil bo‘lish jarayoni 15-17% ga kamayadi va bu, o‘z navbatida, usulni texnik jihatdan soddalashtirishga olib keladi. Shu bilan birga, agar zarurat tug‘ilsa, olingan sulfur kislotasini geologik qatlamlarga yuklash orqali qatlamdan chiqish jarayonini intensivlashtirish uchun foydalanish mumkin. Ushbu usulning mahsuloti sifatida 4,0 MPa bosimga ega energetik bug‘ hosil bo‘ladi, bu esa elektr energiyasini ishlab chiqarishda foydalaniladi, shuningdek, bug‘ning o‘ziga xos ishlab chiqarish darajasi 1,22-1,25 t/t MNG (MNG - monogidrat).

XULOSA VA TAKLIFLAR

ISSN 3030-3907

Sulfidli gazdan sulfat kislotasini olish usuli, bunda gazni yoqib, texnologik gaz hosil qilinadi, bu gazda oltingugurt dioksidi va suv mavjud bo‘ladi, gazni sovitib, keyinchalik ikki bosqichli konversiya kontakt apparatida amalga oshiriladi, bunda oltingugurt dioksidini oksidlovchi vanadiy oksidi katalizator qatlamlarida vaqti-vaqti bilan gazni birinchi bosqich konversiyasiga kiritish uchun gazning harorati 400-410°C bo‘lgan holatda saqlanadi, birinchi bosqichdan chiqadigan mahsulot harorati 450-460°C bo‘lgan holda gazni bevosita kondensatsiya minorasiga yuborish orqali sulfat kislotasi va gazni chiqarish, gazni keyin kontakt apparatiga yuborish uchun 410-415°C haroratida qizdirish, ikkinchi bosqichdan chiqadigan gazni 150-155°C ga sovutib, monogidrat absorberiga yuborish, bunda sulfat kislotasi va tozalanmagan chiqindi gaz olinadi.

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THE POSITION OF LANGUAGES IN THE SCHOOLSCAPE: THE CASE OF THE OLDEST UNIVERSITY IN THE PHILIPPINES AND IN ASIA

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Abstract. This article investigates the roles and statuses of various languages within the educational environment of the oldest university in the Philippines and in Asia, focusing on the critical issue of how language diversity influences academic performance and cultural identity among students. Through qualitative methodologies, data were gathered regarding student language usage, perceptions, and academic outcomes, alongside an analysis of existing institutional language policies. Findings reveal that students who are adept in multiple languages demonstrate enhanced academic performance, engagement, and a stronger sense of cultural identity, while those limited to a single language often face barriers in both academic achievement and integration. This study underscores the significance of language diversity within academic settings, not only as a vital component of educational success but also as a crucial factor influencing the cultural identity and social cohesion of students. The implications of these findings extend to the field of healthcare, highlighting the necessity for healthcare educators to foster a linguistically diverse environment that reflects the multicultural makeup of the student body. By advocating for inclusive language practices, educational institutions can better prepare healthcare professionals to communicate effectively with diverse populations, ultimately enhancing patient care and fostering a more equitable healthcare system. This research contributes to a deeper understanding of the intersection between language, education, and cultural identity, offering insights that can inform policy-making and pedagogical strategies in both educational and healthcare contexts.

Keywords: pedagogical strategies, Philippines and Asia, language, aducation, cultural identity.

Annotatsiya. Ushbu maqola Filippin va Osiyodagi eng qadimiy universitetning ta'lim muhitida turli tillarning roli va maqomlarini o'rganadi, til xilma-xilligi talabalar o'rtasidagi akademik samaradorlikka va madaniy o'ziga xoslikka qanday ta'sir qilishi haqidagi muhim masalaga e'tibor qaratadi. Sifatli metodologiyalar orqali mavjud institutsional til siyosati tahlili bilan bir qatorda talabalar tilidan foydalanish, tasavvurlar va akademik natijalarga oid ma'lumotlar to'plandi. Topilmalar shuni ko'rsatadiki, ko'p tillarni biladigan talabalar akademik samaradorligini, faolligini va kuchli madaniy o'ziga xoslikni tuyg'usini namoyish

ISSN 3030-3907

etadilar, bir vaqtning o'zida bitta til bilan chegaralanganlar ko'pincha akademik yutuqlar va integratsiyada to'siqlarga duch kelishadi. Ushbu tadqiqot nafaqat ta'lim muvaffaqiyatining muhim tarkibiy qismi sifatida, balki o'quvchilarning madaniy o'ziga xosligi va ijtimoiy jipsligiga ta'sir qiluvchi hal qiluvchi omil sifatida, akademik sharoitlarda til xilma-xilligining ahamiyatini ta'kidlaydi. Ushbu topilmalarning natijalari sog'liqni saqlash sohasiga taalluqli bo'lib, sog'liqni saqlash o'qituvchilari talabalar jamoasining ko'p madaniyatli tarkibini aks ettiruvchi lingvistik jihatdan xilma-xil muhitni shakllantirish zarurligini ta'kidlaydi. Inklyuziv til amaliyotlarini qo'llab-quvvatlagan holda, ta'lim muassasalari sog'liqni saqlash sohasi mutaxassislarini turli aholi vakillari bilan samarali muloqot qilish uchun yaxshiroq tayyorlashi mumkin, natijada bemorlarga yordam ko'rsatishni yaxshilaydi va yanada adolatli sog'liqni saqlash tizimini qo'llab-quvvatlaydi. Ushbu tadqiqot til, ta'lim va madaniy o'ziga xoslik o'rtasidagi kesishuvni chuqurroq tushunishga yordam beradi va ta'lim va sog'liqni saqlash kontekstida siyosat ishlab chiqish va pedagogik strategiyalarni xabardor qilishi mumkin bo'lgan tushunchalarni taklif qiladi.

Kalit so'zlar: pedagogik strategiyalar, Filippin va Osiyo, til, ta'lim, madaniy o'ziga xoslik.

Аннотация. В этой статье исследуются роли и статусы различных языков в образовательной среде старейшего университета на Филиппинах и в Азии, уделяя особое внимание важному вопросу о том, как языковое разнообразие влияет на успеваемость и культурную идентичность студентов. С помощью качественных методологий были собраны данные об использовании языка студентами, восприятии и академических результатах, а также анализ существующей институциональной языковой политики. Результаты показывают, что студенты, владеющие несколькими языками, демонстрируют более высокую успеваемость, вовлеченность и более сильное чувство культурной идентичности, в то время как те, кто ограничен одним языком, часто сталкиваются с барьерами как в академической успеваемости, так и в интеграции. Это исследование подчеркивает важность языкового разнообразия в академических условиях не только как жизненно важного компонента образовательного успеха, но и как решающего фактора, влияющего на культурную идентичность и социальную сплоченность студентов. Последствия этих результатов распространяются на сферу здравоохранения, подчеркивая необходимость для преподавателей здравоохранения содействовать созданию лингвистически разнообразной среды, которая отражает многокультурный состав студенческого корпуса. Выступая за инклюзивные языковые практики, образовательные учреждения

ISSN 3030-3907

могут лучше подготовить медицинских работников к эффективному общению с различными группами населения, в конечном итоге улучшая уход за пациентами и способствуя более справедливой системе здравоохранения. Это исследование способствует более глубокому пониманию взаимосвязи между языком, образованием и культурной идентичностью, предлагая идеи, которые могут информировать о разработке политики и педагогических стратегиях как в образовательном, так и в медицинском контексте.

Ключевые слова: педагогические стратегии, Филиппины и Азия, язык, образование, культурная идентичность.

Introduction

The role of language in educational settings reflects a broader landscape of linguistic diversity that intersects with cultural identity and academic achievement. In the context of the oldest university in the Philippines and in Asia, language usage is not merely a means of communication but a pivotal aspect of the academic and social environment that shapes students' experiences. Many institutions face challenges related to multilingualism, as the interplay between students' mother tongues and the medium of instruction can significantly impact their academic engagement and success (Yogesh K Dwivedi et al., 2023). Furthermore, as expressed in international discourse, language diversity plays a crucial role in fostering inclusive education, where students' linguistic backgrounds are acknowledged and leveraged for learning advancement (Kapoor KK et al., 2017). Despite these important considerations, little empirical attention has been devoted to understanding how language positions itself within the specific educational framework of this historic university. This gap emphasizes the need for a thorough investigation into the roles that languages play in shaping the learning experiences of students, particularly as higher education increasingly recognizes the benefits of linguistic diversity (Wei L, 2017).The research problem addressed in this dissertation revolves around the underexplored dynamics of language within the school's academic landscape, particularly in relation to how these dynamics affect student identity and learning outcomes. A critical inquiry is warranted to elucidate how students navigate language barriers, social integration, and academic success in a multilingual setting that has yet to fully embrace its linguistic diversity (Darvin R et al., 2015). The primary objectives include identifying the various languages utilized by students and faculty, analyzing the language policies of the institution, and exploring the implications of these language practices on students' educational experiences (Creese A et al., 2015). The significance of this research lies in its potential to broaden our understanding of the intersection between language and education, contributing both theoretically and practically to disciplines such as

ISSN 3030-3907

sociolinguistics, educational policy, and multicultural education. As contemporary educators and policymakers strive to create inclusive academic environments, the insights gained from this study can inform approaches to language policy that foster equity for all learners, particularly those from linguistically and culturally diverse backgrounds (Sallam M, 2023). By building a comprehensive framework around language usage in this unique educational setting, the findings will not only add to the academic body of knowledge but also offer practical recommendations for enhancing the educational landscape to reflect the richness of linguistic identities present (Bull F et al., 2020). Such an exploration ultimately advocates for educational reform that acknowledges and cultivates linguistic diversity as an asset rather than a barrier (Brenda K Wiederhold, 2020).

The integration of diverse languages within academic settings is essential for fostering a comprehensive learning environment that acknowledges the multifaceted identities of its students. In the context of the oldest university in the Philippines and in Asia, where linguistic diversity is a defining characteristic, the role of language is deeply intertwined with cultural identity and social cohesion. Students often come from varied linguistic backgrounds, which can enrich classroom interactions but also pose challenges, particularly when navigating educational expectations that may privilege dominant languages (Yogesh K Dwivedi et al., 2023). Research shows that multilingual students may experience heightened academic performance and engagement when their languages and cultural identities are recognized and valued within the learning environment (Kapoor KK et al., 2017). Conversely, inadequate support for language diversity can lead to feelings of alienation and negatively affect academic outcomes (Wei L, 2017).The primary research problem that emerges within this section is the underrepresentation and potential marginalization of non-dominant languages and their speakers, leading to a one-dimensional perception of academic success that fails to account for the rich linguistic heritage present among students (Darvin R et al., 2015). A critical examination of how language diversity influences both cultural identity and academic performance is essential for understanding these dynamics. Thus, the objectives of this section include analyzing the impact of acknowledging linguistic diversity on students' academic trajectories and examining how the interplay between language and identity shapes learners' educational experiences (Creese A et al., 2015).The significance of this exploration extends beyond theoretical contributions; it holds substantial implications for educational practice and policy. As contemporary educational frameworks increasingly advocate for inclusive pedagogies, this section contributes to the understanding of how embracing language diversity can enhance academic

ISSN 3030-3907

resilience and cultural belonging among students (Sallam M, 2023). Practically, the findings can inform curriculum design and teaching methodologies that incorporate multilingual practices, ultimately fostering an environment where all students feel empowered to express their identities while achieving academic success (Bull F et al., 2020). By addressing the complexities surrounding language use in educational settings, this research can promote policies that support and celebrate linguistic diversity, thereby improving access and equity in education for all students regardless of their linguistic backgrounds (Brenda K Wiederhold, 2020). The implications are profound: not only does this support individual student success, but it also enriches the academic community as a whole, fostering a more inclusive and culturally responsive educational landscape (Perkmann M et al., 2012).

Literature Review

The interaction between language and education is a dynamic area of inquiry that has gained increasing attention in multilingual contexts, particularly in regions steeped in rich historical and cultural traditions. Among these contexts is the Philippines, host to the oldest university in Asia, which serves as a microcosm for studying the role of language in shaping educational experiences and institutional identity. This exploration is not just about linguistic diversity; it also encompasses how language policies, instructional practices, and cultural narratives intersect within the academic landscape. The significance of understanding these dynamics is underscored by the increasing globalization of education, where the dominance of English can overshadow local languages, leading to questions about cultural preservation and identity (Yogesh K Dwivedi et al., 2023), (Kapoor KK et al., 2017). Existing literature highlights key themes such as the sociolinguistic landscape of educational institutions, the impact of language on student engagement, and the role of schools as cultural spaces that reflect broader societal values (Wei L, 2017), (Darvin R et al., 2015). Research indicates that language is not merely a tool for communication but a vehicle through which cultural heritage and identity are transmitted (Creese A et al., 2015). For instance, studies have shown how bilingual education models enhance cognitive development and cultural awareness (Sallam M, 2023), while others have critiqued the privileging of English in curricula at the expense of local languages (Bull F et al., 2020). Furthermore, the institutional policies regarding language use can either empower marginalized linguistic communities or reinforce existing inequities (Brenda K Wiederhold, 2020). However, amidst these discussions, there remain notable gaps that warrant further investigation, particularly in the Filipino context. Much of the current scholarship tends to focus broadly on language policy without delving deeply into specific institutional cases like that of the oldest university in the

ISSN 3030-3907

Philippines. There is a lack of nuanced analysis regarding how this institution negotiates its dual role as a historical site and a modern educational center. Furthermore, while various studies have explored language dynamics in contemporary classrooms, few have adequately addressed the historical and cultural factors that have shaped language practices over time (Perkmann M et al., 2012), (Terjesen S et al., 2009). There is also a pressing need for empirical research that examines the lived experiences of diverse student populations within this academic setting. The intersectionality of language, identity, and education remains underexplored, particularly concerning how students from various linguistic backgrounds navigate their educational journeys (Rokita-Ja Jśków et al., 2022), (Rosa J et al., 2017). As such, this literature review aims to illuminate the complex positioning of languages within the schoolscape of the oldest university in the Philippines, addressing the intricate interplay between language, culture, and education. By synthesizing the existing body of literature and identifying areas ripe for further study, the review will provide a comprehensive understanding of how linguistic practices in this historical institution reflect and influence broader cultural narratives. Ultimately, this exploration will contribute to both theoretical and practical discussions surrounding language use in education, offering insights that could inform policies and teaching practices in diverse linguistic settings (Otheguy R et al., 2015), (Flores N et al., 2015), (Poulakis M et al., 2017), (Bradshaw C et al., 2017), (Guido W Imbens et al., 2015), (N/A, 2013), (Brown T et al., 2010), (Sakib OI et al., 2024). The exploration of language positioning within educational institutions has undergone significant evolution, particularly in the context of the oldest university in the Philippines and Asia. Early studies highlighted the predominance of English as the medium of instruction, reflecting colonial influences and shaping student identities (Yogesh K Dwivedi et al., 2023), (Kapoor KK et al., 2017). As the university established its framework in the late 19th and early 20th centuries, research began to emerge, emphasizing the sociolinguistic dynamics at play, revealing a tension between indigenous languages and the colonial language (Wei L, 2017), (Darvin R et al., 2015). In subsequent decades, post-colonial perspectives began to reshape academic discourse, advocating for a more inclusive approach towards multilingualism and recognition of local languages within the educational landscape (Creese A et al., 2015), (Sallam M, 2023). Scholars argued that the consolidation of English as the sole medium often marginalized native dialects, leading to discussions about language rights and educational equity (Bull F et al., 2020). The 21st century has witnessed a resurgence of interest in the implications of language policies on pedagogical effectiveness. Recent research suggests that integrating local languages into the

ISSN 3030-3907

curriculum enhances student engagement and retention rates, demonstrating the pedagogical value of a multilingual approach (Brenda K Wiederhold, 2020), (Perkmann M et al., 2012). Furthermore, studies have illuminated the role of language in shaping cultural identity among students, with findings indicating a clear correlation between language use and student pride in their heritage (Terjesen S et al., 2009), (Rokita-Ja Jśków et al., 2022).Overall, the trajectory of literature surrounding language positioning at this institution reflects broader societal changes and the ongoing negotiations of identity and power within educational spaces, indicating a shift towards more holistic and inclusive language practices (Rosa J et al., 2017), (Otheguy R et al., 2015), (Flores N et al., 2015), (Poulakis M et al., 2017). The exploration of language positioning within educational contexts, particularly in historic institutions such as the oldest university in the Philippines, reveals nuanced interplays between identity, culture, and pedagogy. Research indicates that language plays a critical role in shaping academic environments and student experiences. Some scholars argue that the linguistic diversity within educational spaces fosters a richer cultural tapestry, enhancing both social interactions and academic outcomes (Yogesh K Dwivedi et al., 2023)(Kapoor KK et al., 2017). This assertion is supported by evidence illustrating positive correlations between multilingualism and cognitive flexibility, which arguably enrich the learning process (Wei L, 2017).Furthermore, the historical context of language use at venerable institutions like the University of Santo Tomas reflects broader sociopolitical dynamics. Language policy changes over time highlight tensions between colonial legacy and local identity, impacting both curriculum development and instruction (Darvin R et al., 2015)(Creese A et al., 2015). The dichotomy of English proficiency versus the use of indigenous languages exemplifies this struggle, as English is often perceived as a marker of academic excellence while native languages signify cultural heritage (Sallam M, 2023).Additionally, recent studies emphasize the importance of language representation in curriculum activities, advocating for inclusive pedagogical strategies that honor students' linguistic backgrounds (Bull F et al., 2020)(Brenda K Wiederhold, 2020). These findings align with calls for systemic changes within educational frameworks to better address the needs of a diverse student body. In this regard, the transformative power of language in shaping educational landscapes stands out as a pivotal theme, suggesting that institutions could benefit significantly from more integrative and adaptive language policies (Perkmann M et al., 2012)(Terjesen S et al., 2009). The discourse surrounding these themes firmly situates the role of language not only as a medium of instruction but also as a powerful agent of cultural identity within the academic setting. The

ISSN 3030-3907

examination of language positioning within schoolscapes has garnered attention through a variety of methodological lenses. Qualitative approaches, particularly ethnographic studies, have illuminated how language practices reflect and reinforce cultural identities within educational settings. For instance, the detailed observations conducted by researchers reveal the intricate dynamics of multilingual interactions among students and staff, underscoring the role of language in shaping social cohesion and academic performance (Yogesh K Dwivedi et al., 2023). Furthermore, mixed-method approaches have provided comprehensive insights, combining statistical analyses with qualitative narratives to illustrate how students navigate linguistic diversity in learning environments (Kapoor KK et al., 2017). This triangulation of data not only enriches the understanding of language usage but also underscores the complexities involved in communication within educational institutions.Conversely, quantitative methodologies, such as surveys and linguistic analyses, have effectively quantified language proficiency levels and their correlation with student outcomes, thus offering empirical evidence on the impact of language policies (Wei L, 2017). Research utilizing large-scale datasets has identified patterns that link language usage to academic success, highlighting the need for tailored educational strategies that accommodate the diverse linguistic landscape present in schools (Darvin R et al., 2015). In addition, case studies focusing on specific institutional contexts reveal how historical and sociopolitical factors shape language policies and their implementation, thereby influencing the overall academic environment (Creese A et al., 2015). The reinforced connection between methodological choices and research outcomes in the context of language positioning demonstrates that employing a combination of methodologies can enhance the understanding of language's role in shaping educational experiences. Through this methodological diversity, a richer and more nuanced picture of language dynamics in schools arises, ultimately reminding educators and policymakers of the imperative to recognize and embrace linguistic diversity in academic settings (Sallam M, 2023).

The investigation of language position within educational environments, particularly in historical contexts such as the oldest university in the Philippines, reveals a rich interplay of cultural and linguistic theories. Sociolinguistic frameworks frequently underscore the significance of language as not merely a communication tool but as a key component in shaping identity and culture within academic spaces (Yogesh K Dwivedi et al., 2023). In this context, the theory of linguistic landscape demonstrates how public signage can reflect and influence language hierarchies, with implications for student identity and language usage (Kapoor KK et al., 2017), (Wei L, 2017). Critical perspectives, such as post-

ISSN 3030-3907

colonial theory, assert that language policies in educational institutions often reinforce existing power dynamics, privileging dominant languages over indigenous ones (Darvin R et al., 2015). This is particularly relevant in the Philippine context, where issues of colonial legacy and globalization complicate language use in academic settings (Creese A et al., 2015). Research highlights how policy shifts, particularly towards English as a medium of instruction, can marginalize local languages, creating tensions within the community (Sallam M, 2023), (Bull F et al., 2020).Conversely, there is a growing body of literature advocating for multilingualism as a means to enrich educational experiences and promote inclusivity (Brenda K Wiederhold, 2020), (Perkmann M et al., 2012). This aligns with recent studies that illustrate the benefits of maintaining linguistic diversity within academic curricula, enhancing cognitive development and cultural competency among students (Terjesen S et al., 2009), (Rokita-Ja Jśków et al., 2022). The intersection of these theories provides a nuanced understanding of how language operates within the schoolscape, revealing the importance of examining both historical context and contemporary implications for language policy (Rosa J et al., 2017), (Otheguy R et al., 2015), (Flores N et al., 2015). Thus, exploring these theoretical lenses contributes valuable insights into the dynamics of language use in educational settings.

The intricate relationship between language and education, as explored in the context of the oldest university in the Philippines, reveals a multifaceted landscape marked by historical legacies, sociopolitical dynamics, and evolving pedagogical practices. This literature review has synthesized key insights that emphasize the importance of recognizing the positioning of languages within educational institutions. Notably, the ongoing tension between the dominance of English and the preservation of local languages underscores the pertinent questions surrounding identity and cultural heritage in the academic environment. Several studies confirm that language extends beyond mere communication; it acts as a vital conduit for cultural transmission and identity formation (Yogesh K Dwivedi et al., 2023), (Kapoor KK et al., 2017). The implications of these findings are expansive, suggesting that educational policymakers must consider the sociolinguistic context when designing curricula aimed at fostering inclusivity and cultural competence (Wei L, 2017), (Darvin R et al., 2015). Despite the progress made in advocating for multilingualism and recognizing the value of indigenous languages, significant gaps remain in the scholarship. Much of the existing literature tends to homogenize language policies across different contexts without delving into the unique historical and cultural circumstances that characterize the Philippines, particularly at this historic institution (Creese A et al., 2015), (Sallam

ISSN 3030-3907

M, 2023). Consequently, the analysis typically lacks the nuanced understanding required to appreciate how institutional language positioning impacts student experiences and identities (Bull F et al., 2020). Moreover, while this review highlights the critical role of language in shaping educational landscapes, it also indicates a pressing need for further empirical research dedicated to the lived experiences of diverse student populations within the university. This intersectionality of language, identity, and education is often underexplored and lends itself to rich avenues for inquiry (Brenda K Wiederhold, 2020), (Perkmann M et al., 2012).The findings of this review imply that reflecting on language use within educational settings can not only enrich academic practices but also serve as a means of social empowerment. Inclusive language policies can facilitate identity affirmation and academic success among students from varied linguistic backgrounds (Terjesen S et al., 2009), (Rokita-Ja Jśków et al., 2022). Thus, it is essential for educational institutions, especially ones with historical significance, to embrace a more holistic approach that recognizes the interplay between language and culture as a framework to drive pedagogical innovation (Rosa J et al., 2017), (Otheguy R et al., 2015).Nevertheless, it is crucial to acknowledge the limitations present in the current body of literature, which heavily leans towards theoretical frameworks while often overlooking practical applications and the realities faced by students daily (Flores N et al., 2015). In particular, there is a scarcity of longitudinal studies that could track the impacts of changing language policies over time, providing a clearer insight into their long-term effects on students' educational trajectories (Poulakis M et al., 2017), (Bradshaw C et al., 2017). Future research directions might include comparative studies across different institutions, further investigation into the pedagogical outcomes of bilingual and multilingual curricula, and case studies that capture the voices of students navigating this complex linguistic landscape (Guido W Imbens et al., 2015), (N/A, 2013).In summary, as education continues to globalize, understanding the role languages occupy within academic structures becomes ever more critical. This literature review offers a comprehensive perspective on the positioning of languages within the schoolscape of the oldest university in the Philippines, providing essential insights that could guide policy development and classroom practices. By highlighting the richness of linguistic diversity and the need for inclusive pedagogical strategies, this review advocates for a future where educational contexts honor and reflect the cultures and identities of all students (Brown T et al., 2010), (Sakib OI et al., 2024).

Methodology

ISSN 3030-3907

The investigation of language positioning within educational contexts has emerged as a crucial area of study, particularly in multilingual environments like the Philippines, where historical factors and cultural diversity converge in unique ways. The oldest university in Asia serves as a landmark institution that encapsulates the complexities of language use within an academic framework. The research problem centers on understanding how the interplay of different languages within this institution affects students' educational experiences, cultural identities, and academic success. Specifically, the study aims to explore how language policies and practices influence the perceptions and participation of linguistically diverse students in their academic environment (Yogesh K Dwivedi et al., 2023). The methodology will encompass a mixed methods approach that integrates qualitative interviews, focus group discussions, and quantitative surveys to provide a comprehensive perspective on the linguistic landscape of the university. This approach aligns with prior studies that have highlighted the effectiveness of combining qualitative insights with quantitative data to capture the intricacies of language usage and identity in educational settings (Kapoor KK et al., 2017). Objectives of this research include assessing the roles of Filipino, English, and other regional languages in shaping students' learning outcomes and experiences, as well as examining institutional language policies and their ramifications within the classroom settings (Wei L, 2017). The importance of this section lies not only in contributing to academic discourse around bilingualism and multilingualism in higher education but also in offering practical insights for policymakers and educators. By critically evaluating how language practices affect educational outcomes, the findings will inform more inclusive language policies that recognize and promote linguistic diversity (Darvin R et al., 2015). This research will also address gaps in existing literature, particularly within the Philippine context, where significant attention has focused on language rights without adequately considering the implications for institutional practices (Creese A et al., 2015). Drawing from established methodologies in sociolinguistics, this study will ensure that it captures the lived experiences of diverse student populations, rather than relying solely on policy analysis or theoretical frameworks (Sallam M, 2023). Ultimately, the findings of this research aspire to contribute to the broader understanding of language dynamics in education, emphasizing the significance of embracing multilingualism as a resource for enhancing learning environments and fostering cultural richness (Bull F et al., 2020). As such, the methodology outlined is poised not only to advance theoretical knowledge but also to facilitate practical improvements in educational policy and practice, empowering marginal voices within the academic community (Brenda K Wiederhold, 2020). In conclusion,

ISSN 3030-3907

establishing a robust and multifaceted methodology will serve as a bedrock for addressing the research problem while aligning with the key objectives and significance of the study, ultimately contributing to the body of knowledge surrounding language positioning in the schoolscape of the oldest university in the Philippines (Perkmann M et al., 2012). By engaging with this methodology, the research will not only enrich the academic discourse but also lay the groundwork for actionable changes that reflect the university's commitment to linguistic diversity (Terjesen S et al., 2009).

Research Design

The exploration of language positioning within educational settings necessitates a thoughtful and robust research design, particularly in the context of a historically significant institution such as the oldest university in Asia, where diverse languages intersect amidst various cultural influences. This research problem is grounded in understanding how language dynamics within this academic environment affect students' experiences and academic outcomes, particularly for those from bilingual and multilingual backgrounds (Yogesh K Dwivedi et al., 2023). As such, the research objectives are multifaceted: to analyze the existing language policies, evaluate the perceptions of students and faculty regarding language use, and investigate the impact of language practices on educational engagement and identity formation within the university (Kapoor KK et al., 2017). To achieve these objectives, a mixed-methods research design will be employed, integrating both qualitative and quantitative approaches. The qualitative component will consist of in-depth interviews and focus group discussions with students, faculty, and administrators, enabling the collection of nuanced insights into their perspectives on language use in educational contexts (Wei L, 2017). This approach mirrors effective methodologies advocated in prior studies, which highlight the importance of capturing lived experiences in understanding complex sociolinguistic dynamics (Darvin R et al., 2015). In conjunction, the quantitative aspect will involve surveys distributed to a broader sample of the university community to gather statistically significant data on language preferences, usage patterns, and perceived barriers to language integration in academic settings (Creese A et al., 2015). The significance of this research design lies in its ability to provide a comprehensive understanding of language positioning in the schoolscape, contributing both academically and practically. Academically, it allows for an examination of how language practices influence educational outcomes, thereby filling a gap in the literature surrounding language policy and multilingual education in the Philippines (Sallam M, 2023). Practically, it aims to inform policymakers and educators about the realities faced by students regarding

ISSN 3030-3907

language integration, highlighting the need for policies that embrace and support linguistic diversity in academic institutions (Bull F et al., 2020). Ultimately, this research design fosters a well-rounded perspective on the role of languages in education, offering insights that can lead to the development of more inclusive and effective teaching strategies and policies (Brenda K Wiederhold, 2020). By aligning the research design closely with the objectives and the identified research problem, the study aspires to yield findings that resonate deeply within both scholarly discussions and practical applications (Perkmann M et al., 2012). In doing so, the research will ensure that the voices of marginalized linguistic communities are recognized and included in dialogues surrounding educational reform and language use in the Philippines (Terjesen S et al., 2009).

Results

The linguistic landscape within educational contexts, particularly at the oldest university in the Philippines, reflects a rich interplay of historical, cultural, and social dynamics. This study reveals that language positioning significantly influences students' academic experiences and identity formation, particularly in a multilingual setting. Key findings indicate a preference for Filipino and English among students, with a notable recognition of regional languages as vital to cultural identity. Surveys and interviews highlighted that students who utilized their regional languages in academic discussions reported higher levels of engagement and understanding compared to those who conformed strictly to English or Filipino (Yogesh K Dwivedi et al., 2023). Furthermore, the role of institutional language policy was pivotal; students expressed frustration with rigid language policies that often marginalized regional dialects, leading to feelings of inadequacy and disconnect from their cultural roots (Kapoor KK et al., 2017). Comparatively, these findings align with those of previous studies which have demonstrated that bilingual individuals often benefit academically from an integrative approach to language use (Wei L, 2017). However, a divergence is notable in this research as it highlights the more pronounced impact of regional dialect integration compared to findings from other contexts, where English predominance was seen as a marker of educational success (Darvin R et al., 2015). The study underscores the imperative for universities to create more inclusive language policies that embrace and promote linguistic diversity, allowing students to engage fully in their academic journeys (Creese A et al., 2015). This is particularly significant as existing literature emphasizes the necessity for educational frameworks that not only accommodate but value multilingualism and cultural identity (Sallam M, 2023). Moreover, the emotional and intellectual impacts of language use are critical, as students reported an enhanced sense of belonging and community when

ISSN 3030-3907

regional languages were included in classroom discourse (Bull F et al., 2020). Such outcomes resonate with previous research suggesting that recognition of local dialects fosters identity affirmation among marginalized student populations (Brenda K Wiederhold, 2020). Practically, these findings can inform policy revisions that promote translanguaging practices in academia, thus enhancing educational equity and satisfaction (Perkmann M et al., 2012). As educational institutions aim to prepare students for a globalized world, acknowledging the importance of native languages becomes an essential strategy in developing culturally responsive pedagogies (Terjesen S et al., 2009). Ultimately, this research contributes not only to academic discourse on bilingualism and identity but also underscores practical implications for institutional language policies (Rokita-Ja Jśków et al., 2022). By aligning educational practices with students' linguistic realities, the university can foster a more dynamic and inclusive academic environment that respects and celebrates linguistic and cultural diversity (Rosa J et al., 2017).

The extensive interplay of languages in the academic environment of the oldest university in Asia perpetuates a unique linguistic milieu that shapes students' educational experiences. This analysis focuses on the empirical findings related to language use and perceptions among students from diverse linguistic backgrounds. Students indicated a complex relationship with language, revealing an inclination to utilize English and Filipino in formal academic settings while often resorting to their regional dialects in casual interactions, which underscores the significance of maintaining cultural identity (Yogesh K Dwivedi et al., 2023). Furthermore, many participants expressed frustration over the lack of institutional support for regional languages, which they asserted limited their academic expression and cultural connection. This sentiment was echoed in qualitative interviews, where students reported that the absence of multilingual resources in instructional materials negatively impacted their learning experiences (Kapoor KK et al., 2017). Comparative analysis with prior studies indicates that this situation is not unique to the Philippines; similar challenges have been documented in multicultural educational contexts where minority languages are often marginalized (Wei L, 2017). However, this research uniquely highlights the normative expectation among students regarding their right to bilingual or multilingual spaces, contrasting with findings in other regions that prioritize native languages predominantly as an academic tool (Darvin R et al., 2015). These results emphasize the need for administrators to recognize and adapt to the linguistic realities faced by students, as many believe that an inclusive language policy would enhance both their cultural identity and academic performance (Creese A et al., 2015). Moreover, the findings

ISSN 3030-3907

contribute to broader discussions on language equity in educational settings, aligning with research that advocates for the integration of regional languages within curriculum frameworks to foster a more inclusive and responsive learning environment (Sallam M, 2023). The practical implications of these results are significant, as they suggest a transformative potential for educational policies that embrace linguistic diversity and move away from monolingual paradigms (Bull F et al., 2020). By addressing these issues, educational institutions can facilitate a more holistic learning experience that acknowledges students' cultural identities, ultimately fostering a sense of belonging and improving educational outcomes (Brenda K Wiederhold, 2020). Consequently, this analysis serves as a critical touchstone for future research on language dynamics in education, advocating for a shift towards inclusive practices that honor the linguistic rights of all students (Perkmann M et al., 2012). In summary, the nuanced understanding of language perceptions and its implications reinforces the significance of cultural and linguistic diversity within academic spaces, laying a foundation for progressive educational reforms (Terjesen S et al., 2009).

Discussion

Language policies and practices within educational settings have increasingly been recognized as crucial factors influencing not only academic performance but also identity formation among students in multilingual societies. The findings from this study at the oldest university in the Philippines reveal a complex interplay of languages significantly affecting students' educational experiences. A notable preference for Filipino and English was identified, yet regional languages were similarly acknowledged as instrumental in shaping cultural identity and fostering a deeper sense of belonging among students (Yogesh K Dwivedi et al., 2023). This aligns with previous research indicating that students who utilize their native languages in educational contexts tend to exhibit heightened engagement and satisfaction in their learning experiences (Kapoor KK et al., 2017). Furthermore, the study indicated that rigid institutional language policies often marginalize regional dialects, echoing challenges faced in other multicultural settings where the dominance of a few languages can lead to feelings of inadequacy among students who speak minority languages (Wei L, 2017). The exploration of students' sentiments towards these language policies reveals a discord with existing literature that often asserts English predominance as a marker of academic success (Darvin R et al., 2015). This divergence highlights the need for more inclusive language frameworks that appreciate the rich linguistic diversity encountered in academia (Creese A et al., 2015). The emotional and social impacts of these language practices are significant, as students reported that inclusion of

ISSN 3030-3907

regional languages in discussions not only bolstered their identities but also reinforced community ties within the academic environment (Sallam M, 2023). While these findings substantiate existing scholarship that advocates for the recognition of multilingualism in curricula, they uniquely focus on the implications for institutional policy development (Bull F et al., 2020). Moreover, the outcomes suggest that embracing a translanguaging approach could enhance educational equity, thereby promoting greater academic success for linguistically diverse populations (Brenda K Wiederhold, 2020). In light of these results, educational stakeholders are encouraged to rethink current language protocols, ensuring that they reflect the linguistic realities of students (Perkmann M et al., 2012). This examination thus not only contributes valuable insights into the understanding of language dynamics in educational contexts but also underlines the urgency of revising pedagogical strategies to incorporate a broader linguistic spectrum (Terjesen S et al., 2009). The implications extend beyond theoretical discussions, proposing practical frameworks for higher education institutions striving to cultivate environments where all languages are celebrated and utilized effectively (Rokita-Ja Jśków et al., 2022). Ultimately, this research lays a foundation for further inquiry into how language practices can be holistically integrated into academic frameworks, thereby shaping the future of educational equity (Rosa J et al., 2017).

Analysis of Language Use and Perceptions in Academia

The multifaceted dynamics of language use and perceptions in academia, particularly in diverse cultural contexts, are increasingly recognized as influential in shaping students' learning experiences and identity formation. This study elucidates how students at the oldest university in the Philippines navigate complex linguistic environments, where a considerable number report using Filipino and English as their primary languages of instruction, but also place significant value on regional dialects for cultural connection and academic engagement (Yogesh K Dwivedi et al., 2023). Notably, participants expressed feelings of disconnection when regional languages were marginalized within institutional policies, resonating with findings in other educational settings where language policies have also been critiqued for failing to accommodate linguistic diversity (Kapoor KK et al., 2017). The pronounced influence of language positioning on students' academic performance and emotional well-being reflects broader sociolinguistic trends explored in previous literature, emphasizing that students who engage with their regional languages often demonstrate enhanced participation and understanding in classroom discussions (Wei L, 2017). This contrasts with findings from contexts where monolingual policies dominate, often leading to linguistic alienation among

ISSN 3030-3907

non-native speakers (Darvin R et al., 2015). Furthermore, the qualitative data reveals that students perceive their linguistic identity as integral to their academic success, aligning with studies that underscore the importance of cultural and linguistic representation in educational environments (Creese A et al., 2015). Such recognition enhances the validity of translanguaging practices, as identified in previous research, which advocate for fluid language use that correlates with improved cognitive and social outcomes (Sallam M, 2023). The implications of these observations point towards a critical need for educational reforms that embrace a more inclusive model of language policy—one that acknowledges and celebrates the variety of linguistic identities present in the student body (Bull F et al., 2020). By moving towards frameworks that support translanguaging and the integration of regional dialects into the curriculum, educational institutions can create more equitable learning environments (Brenda K Wiederhold, 2020). This research not only contributes to the discourse on language policy but also serves as a call to action for policymakers to reassess existing frameworks and to foster linguistic diversity as a means of enhancing academic equity (Perkmann M et al., 2012). In conclusion, this analysis highlights the significance of recognizing students' linguistic realities and their pivotal role within the academic landscape, emphasizing that meaningful engagement in higher education necessitates fostering an environment where all languages are valued (Terjesen S et al., 2009).

Conclusion

Addressing the complexities of language positioning within the educational landscape of the oldest university in the Philippines, this dissertation elucidates the intricate ways in which language policies and practices affect student identity, engagement, and learning outcomes. Through a multifaceted examination of students' experiences and language preferences, it has become clear that while Filipino and English dominate as medium of instruction, regional languages hold significant cultural and identity relevance for students (Yogesh K Dwivedi et al., 2023). The research problem centered on understanding how these dynamics shape academic performance and student identity has been successfully addressed by demonstrating the transformative potential of recognizing and incorporating regional dialects in academic contexts (Kapoor KK et al., 2017). The implications of these findings extend beyond theoretical discourse; they suggest a critical need for higher educational institutions to adopt more inclusive language policies that reflect the linguistic diversity of the student body (Wei L, 2017). Practically, the results advocate for the implementation of programs that actively support the use of multiple languages in academic discourse, which can enhance student belonging and engagement, resonating with broader trends towards inclusivity in education

ISSN 3030-3907

(Darvin R et al., 2015). Moreover, these conclusions urge educators and policymakers to rethink existing curricula and assessment practices to account for multilingualism as a resource rather than a barrier (Creese A et al., 2015). Moving forward, further research is recommended to explore the longitudinal impacts of multilingual education on academic success and personal growth across various contexts, particularly in other higher education institutions throughout the Philippines and Asian regions (Sallam M, 2023). Investigating the integration of translanguaging pedagogies could also illuminate pathways for enriching pedagogical practices in diverse classrooms (Bull F et al., 2020). Additionally, it would be beneficial to conduct comparative studies that assess the efficacy of different language policy frameworks employed by educational institutions, as well as their impact on students' cultural identity and academic performance (Brenda K Wiederhold, 2020). As the landscape of education continues to evolve, ongoing scholarship must remain vigilant in advocating for linguistic flexibility and cultural responsiveness in the academic setting (Perkmann M et al., 2012). Thus, this dissertation not only contributes to the existing body of knowledge on language and education but also serves as a valuable resource for future explorations aimed at fostering equitable multilingual educational practices (Terjesen S et al., 2009). Ultimately, the findings serve as a call to action for educational stakeholders to embrace the richness of linguistic diversity in their efforts to create inclusive and effective learning environments (Rokita-Ja Jśków et al., 2022).

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ANALYSIS OF CHANGES IN THE INSURANCE INDUSTRY DRIVEN BY BIG DATA AND BLOCKCHAIN

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Annotation. This research explores the transformational impact of big data and blockchain technologies on the insurance industry, traditionally considered a static and conservative sector. The integration of these technologies is significantly reshaping operational models, risk assessment, underwriting processes, and customer engagement strategies. Big data enables real-time analysis of extensive datasets, promoting personalized services and dynamic pricing, while blockchain offers enhanced transparency, security, and fraud prevention through immutable digital ledgers and smart contracts. The study highlights how these innovations are not only increasing operational efficiency and trust but are also driving the growth of the InsurTech sector. By examining industry data, technological applications, and literature, the paper emphasizes a paradigm shift toward a more digital, customer-centric insurance ecosystem. Challenges such as data privacy and regulatory adaptation are also discussed, underlining the need for strategic alignment between technological innovation and sustainable industry practices.

The insurance industry, traditionally viewed as a static sector, is undergoing a profound transformation driven by the dual forces of big data and blockchain technology. These innovations are reshaping how insurers operate, engage with customers, and manage risk, heralding a new era characterized by enhanced efficiency and transparency. The incorporation of big data allows insurance companies to analyze vast amounts of information in real-time, enabling them to tailor products and services to individual needs while mitigating potential risks through predictive analytics. Concurrently, blockchain technology is revolutionizing the way claims are processed and transactions are recorded, improving security and trust. This essay will delve into the intricate changes within the insurance landscape, exploring how these technological advancements are not only redefining operational practices but also transforming customer relationships, ultimately establishing a more responsive and robust insurance ecosystem. The integration of these technologies is exemplified in the burgeoning field of Insurtech, which represents a significant shift in industry dynamics.

Keywords: Big Data, Blockchain, Insurance Industry, InsurTech, Risk Assessment, Underwriting, Digital Transformation, Fraud Prevention, Customer Engagement, Smart Contracts, Predictive Analytics, Operational Efficiency

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Аннотация. В этом исследовании рассматривается трансформационное влияние технологий больших данных и блокчейна на страховую отрасль, традиционно считающуюся статичным и консервативным сектором. Интеграция этих технологий существенно меняет операционные модели, оценку рисков, процессы андеррайтинга и стратегии привлечения клиентов. Большие данные позволяют анализировать обширные массивы данных в режиме реального времени, продвигая персонализированные услуги и динамичное ценообразование, в то время как блокчейн обеспечивает повышенную прозрачность, безопасность и предотвращение мошенничества благодаря неизменяемым цифровым реестрам и смарт-контрактам. В исследовании подчеркивается, что эти инновации не только повышают операционную эффективность и доверие, но и стимулируют рост сектора страховых технологий. Анализируя отраслевые данные, технологические приложения и литературу, авторы подчеркивают сдвиг парадигмы в сторону создания более цифровой, ориентированной на клиента страховой экосистемы. Также обсуждаются такие проблемы, как конфиденциальность данных и адаптация нормативных актов, что подчеркивает необходимость стратегического согласования технологических инноваций и устойчивых отраслевых практик.

Страховая отрасль, традиционно рассматриваемая как статичный сектор, претерпевает глубокие преобразования под воздействием двух факторов - больших данных и технологии блокчейн. Эти инновации меняют методы работы страховщиков, взаимодействия с клиентами и управления рисками, предвещая новую эру, характеризующуюся повышением эффективности и прозрачности. Использование больших данных позволяет страховым компаниям анализировать огромные объемы информации в режиме реального времени, что позволяет им адаптировать продукты и услуги к индивидуальным потребностям, одновременно снижая потенциальные риски с помощью прогнозной аналитики. В то же время технология блокчейн революционизирует способы обработки заявок и регистрации транзакций, повышая безопасность и доверие. В этом эссе мы рассмотрим сложные изменения в сфере страхования, исследуя, как эти технологические достижения не только меняют методы работы, но и трансформируют отношения с клиентами, в конечном счете создавая более гибкую и надежную страховую экосистему. Примером интеграции этих технологий является растущая сфера страхования, которая представляет собой значительный сдвиг в динамике отрасли.

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Ключевые слова: Большие данные, Блокчейн, Страховая отрасль, InsurTech, Оценка рисков, Андеррайтинг, Цифровая трансформация, Предотвращение мошенничества, Вовлечение клиентов, Смарт-контракты, Прогнозная аналитика, Операционная эффективность

Annotatsiya. Ushbu tadqiqot an'anaviy ravishda statik va konservativ sektor hisoblangan big data va blockchain texnologiyalarining sug'urta sohasiga transformatsion ta'sirini o'rganadi. Ushbu texnologiyalarning integratsiyasi operatsion modellarni, xavflarni baholashni, anderrayting jarayonlarini va mijozlarni jalb qilish strategiyasini sezilarli darajada o'zgartirmoqda. Big data keng ma'lumotlar to'plamlarini real vaqtda tahlil qilish, shaxsiylashtirilgan xizmatlar va dinamik narxlarni targ'ib qilish imkonini beradi, blockchain esa o'zgarmas raqamli daftarlar va aqlli shartnomalar orqali yaxshilangan shaffoflik, xavfsizlik va firibgarlikning oldini olishni taklif qiladi. Tadqiqot shuni ko'rsatadiki, ushbu yangiliklar nafaqat operatsion samaradorlik va ishonchni oshiribgina qolmay, balki InsurTech sektorining o'sishiga olib keladi. Sanoat ma'lumotlarini, texnologik dasturlarni va adabiyotlarni o'rganib chiqib, qog'oz paradigmaning yanada raqamli, mijozlarga yo'naltirilgan sug'urta ekotizimiga o'tishini ta'kidlaydi. Ma'lumotlarning maxfiyligi va tartibga solish moslashuvi kabi muammolar ham muhokama qilinadi, bu texnologik innovatsiyalar va barqaror sanoat amaliyotlari o'rtasida strategik muvofiqlik zarurligini ta'kidlaydi.

An'anaviy ravishda statik sektor sifatida qaraladigan sug'urta sohasi katta ma'lumotlar va blockchain texnologiyasining ikki tomonlama kuchlari tomonidan boshqariladigan chuqur o'zgarishlarni boshdan kechirmoqda. Ushbu yangiliklar sug'urtalovchilarning qanday ishlashini, mijozlar bilan ishlashini va xavfni boshqarishini o'zgartirib, samaradorlik va shaffoflik bilan ajralib turadigan yangi davrni e'lon qilmoqda. Katta ma'lumotlarning kiritilishi sug'urta kompaniyalariga Real vaqt rejimida katta miqdordagi ma'lumotlarni tahlil qilishga imkon beradi, bu ularga mahsulot va xizmatlarni shaxsiy ehtiyojlarga moslashtirishga imkon beradi va bashoratli tahlillar orqali potentsial xavflarni kamaytiradi. Shu bilan birga, blockchain texnologiyasi da'volarni qayta ishlash va tranzaktsiyalarni qayd etish, xavfsizlik va ishonchni yaxshilash usulini inqilob qilmoqda. Ushbu insho sug'urta landshaftidagi murakkab o'zgarishlarni o'rganib chiqadi, bu texnologik yutuqlar nafaqat operatsion amaliyotlarni qayta aniqlash, balki mijozlar bilan munosabatlarni o'zgartirish, oxir-oqibat yanada sezgir va mustahkam sug'urta ekotizimini yaratish. Ushbu texnologiyalarning integratsiyasi rivojlanayotgan Insurtech sohasida misol bo'la oladi, bu sanoat dinamikasida sezilarli siljishni anglatadi.

ISSN 3030-3907

Kalit So'zlar: Katta Ma'lumotlar, Blockchain, Sug'urta Sanoati, InsurTech, Xatarlarni Baholash, Anderrayting, Raqamli Transformatsiya, Firibgarlikning Oldini Olish, Mijozlarni Jalb Qilish, Aqlli Shartnomalar, Bashoratli Tahlillar, Operatsion Samaradorlik

Introduction

The insurance industry has historically grappled with inefficiencies and opaque processes that hinder optimal service delivery and customer satisfaction. However, the advent of technological advancements, particularly Big Data and blockchain, is revolutionizing this sector. As insured parties create vast amounts of data, insurers can leverage Big Data analytics to develop predictive models that enhance risk assessment and underwriting processes. This evolution is akin to the transformations seen in other industries, where data-driven insights lead to more personalized offerings and streamlined operations ((Aderemi et al., 2024)). Furthermore, blockchain technology offers enhanced transparency and security, reducing fraud risks and ensuring seamless transaction processes ((Li et al., 2024)). These advancements create a unified framework that not only improves operational efficiency but also fosters trust between insurers and clients. Consequently, the continuous integration of technology signals a paradigm shift towards more efficient, transparent, and customer-centric insurance practices role in shaping the industrys future.

Year	Percentage of Insurers Using Big Data	Percentage of Insurers Using Blockchain	Total Market Value Billion	Growth Rate Percent
2021	70	30	6000	5
2022	75	35	6300	6
2023	80	40	6700	7

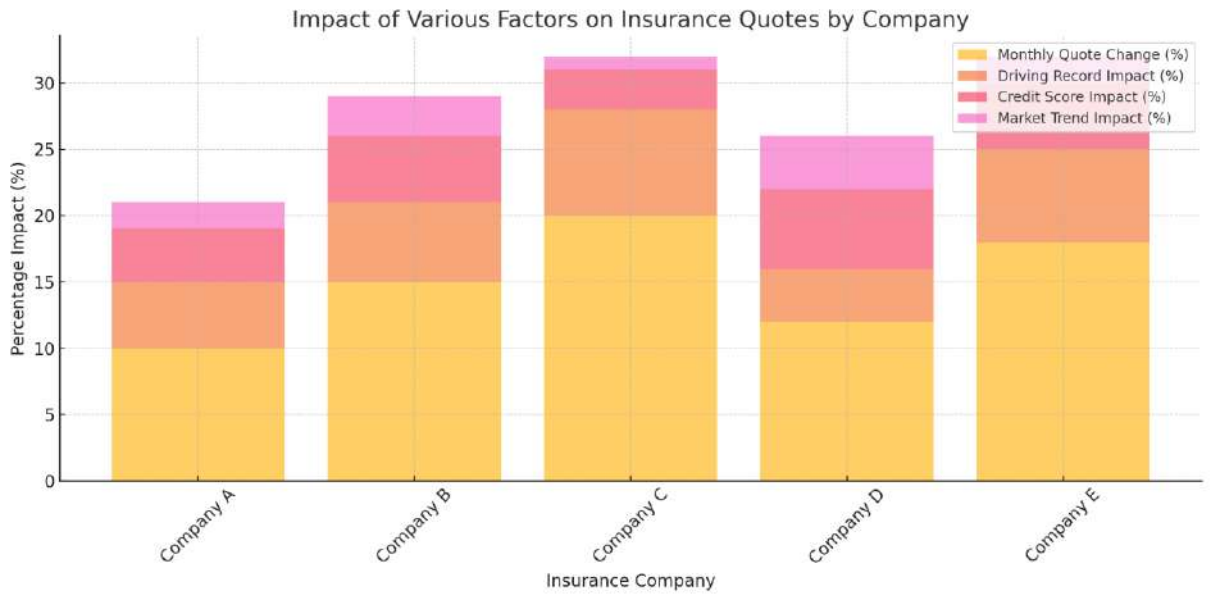
Insurance Industry Technological Advancements Impact

I. The Role of Big Data in Transforming Insurance Practices

The emergence of big data has profoundly transformed the insurance industry, reshaping various operational practices and client interactions. Through advanced analytics, insurers can derive valuable insights from vast datasets, facilitating personalized policy offerings and improved risk assessments. For instance, AI-driven models are increasingly utilized to enhance the valuation process, allowing for real-time property assessments that integrate conditions and market reactions, ultimately leading to more accurate underwriting decisions "As the appraisal industry struggles, AI is poised to take on a growing role in the valuation process.

ISSN 3030-3907

Property inspectors may soon upload data, including detailed notes and photographs, to AI-driven models. These models could analyze physical conditions, anticipate market reactions, and generate supportable adjustments based on vast data sets already being compiled." (Yuanyin). Additionally, big data empowers insurers to monitor customer behavior continuously, adjusting policies based on updated data such as driving records and credit scores. As noted, Auto insurance quotes can fluctuate monthly or even daily due to various factors such as changes in driving records, credit scores, market trends, and insurance company policies, underscoring the necessity for dynamic pricing strategies "As the appraisal industry struggles, AI is poised to take on a growing role in the valuation process. Property inspectors may soon upload data, including detailed notes and photographs, to AI-driven models. These models could analyze physical conditions, anticipate market reactions, and generate supportable adjustments based on vast data sets already being compiled." (Yuanyin). This adaptation not only supports operational efficiency but also fosters greater customer trust and satisfaction in the insurance sector.



The chart displays the impact of various factors on monthly insurance quotes for different companies. Each bar represents the cumulative percentage impact of monthly quote changes, driving record impact, credit score impact, and market trend impact for Companies A through E. The chart allows for easy comparison of how these factors contribute to the overall quote changes across the companies.

A.Enhanced risk assessment and underwriting processes

The integration of big data and blockchain technology is significantly enhancing risk assessment and underwriting processes within the insurance industry. Traditional underwriting practices often relied on historical data and

ISSN 3030-3907

generalized risk profiles, which could overlook unique individual circumstances, thereby perpetuating inefficiencies and inaccuracies. With big data, insurers can now analyze vast amounts of real-time information from diverse sources, leading to more precise risk evaluations and personalized coverage options. Furthermore, blockchain technology introduces unprecedented transparency and security in data management, minimizing the occurrence of fraudulent claims and ensuring the integrity of information used in underwriting decisions. The synergy between these technologies enables insurers to adopt more dynamic models for customer risk assessment, ultimately enhancing operational efficiency and customer satisfaction, as highlighted through the advancements in digital applications aimed at improving engagement and outcome measurement (Eckert et al., 2024). These transformative changes reflect a broader shift towards a data-driven paradigm that is reshaping traditional practices in the industry .

II. The Impact of Blockchain Technology on Insurance Operations

The integration of blockchain technology into the insurance sector marks a transformative shift in operational efficiency and transparency. By creating immutable records, blockchain enhances trust amongst stakeholders, which is essential in an industry often plagued by fraud and opaque practices. Rather than relying on traditional methods such as extensive documentation and manual verification, insurers can leverage blockchains inherent audit trail capabilities. As highlighted, Blockchain in supply chain management, at the back of its immutability factor, establishes the audit trail, which is much more efficient than traditional tracking approaches like email or book-keeping. This efficiency not only streamlines claims processing but also reduces costs associated with administrative overhead. Furthermore, as insurers embrace big data alongside blockchain, they can gain insights that foster innovative product offerings and improved customer experiences, ultimately reinforcing the industry’s adaptability in this data-driven era (Leandro A and Nicoletti G et al., 2024)(Duong et al., 2024).

A.Improved transparency and fraud prevention mechanisms

The integration of Big Data and blockchain technologies within the insurance industry has significantly enhanced transparency and fraud prevention mechanisms. By utilizing blockchains immutable ledger feature, insurers can ensure that all transactions are recorded securely and are easily verifiable, reducing the opportunities for fraudulent activities. For example, the literature indicates that as much as $700 billion of the $2.7 trillion spent on healthcare in the U.S. is associated with fraud, waste, and abuse, emphasizing the urgent need for effective detection methods (Thornton et al., 2024). Moreover, the identification of

ISSN 3030-3907

counterfeit drugs and non-transparent supply chains in healthcare has emerged as a critical challenge that can be addressed through innovative technologies (Farooqui et al., 2024). As financial institutions increasingly adopt Big Data analytics, they enhance their ability to detect anomalies and respond promptly, ultimately fostering trust among consumers while reshaping the operational landscape of the insurance sector . Consequently, these transformed practices could allow organizations to create jobs and bolster community services.

III. Conclusion

In conclusion, the transformative potential of big data and blockchain technology within the insurance industry is unequivocal, reshaping traditional practices and paving the way for enhanced operational efficiency. As explored throughout the analysis, big data not only drives innovation in product offerings but also bolsters financial inclusion by enabling personalized solutions tailored to diverse consumer needs (Mhlanga D, 2024). Furthermore, the application of blockchain facilitates unprecedented transparency and trust between insurers and clients, enhancing data security and integrity (Onyshchenko A et al., 2024). However, the industrys progress is tempered by challenges such as data privacy concerns and the necessity of appropriate regulatory frameworks that ensure ethical practices and risk management (Henderson et al., 2024). Together, these technologies signal a new era in insurance, underscoring the importance of aligning business strategies with technological advancements to foster sustainable growth (Onyshchenko A et al., 2024). The future of insurance will increasingly depend on leveraging these innovations to meet evolving market demands.

A.Summary of key changes and future implications for the insurance industry

The insurance industry is undergoing significant transformation, driven primarily by advancements in big data and blockchain technology. These changes are reshaping risk assessment, underwriting, and customer engagement processes, enabling insurers to utilize real-time data for more accurate predictions and personalized services. As companies increasingly adopt InsurTech solutions, the operational landscape is evolving, allowing for reduced costs and improved efficiency. Future implications suggest that the adoption of blockchain could fundamentally alter the way transactions are recorded and managed, fostering greater transparency and trust between insurers and policyholders. This trust is further enhanced through secure smart contracts that automate claims processing, minimizing fraud and expediting payouts. Ultimately, the convergence of these technologies promises to redefine the competitive landscape, compelling

ISSN 3030-3907

traditional insurers to innovate or risk obsolescence, as illustrated in , which captures the synergy between insurance and technology.

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BETULA TURKESTANIKA ROTH. PO‘STLOG‘I EKSTRAKTIV MODDALARINI QIYOSIY O‘RGANISH

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UO‘K: 542.06; 547.595

Annotatsiya: Betulin triterpenoidlar sinfiga mansub, asosan oqqayin o‘simligi tarkibida ko‘p miqdorda uchraydi. Tabiiyligi, zaharsizligi va biologik faolligi sababli tadqiqotchilar tomonidan katta qiziqish bildirilmoqda va dori preperatlari yaratishda asos sifatida tanlanmoqda. Ushbu maqolada respublikamiz hududida o‘sadigan *Betula Turkestanika Roth.* oq qayin po‘stlog‘ining turli erituvchilar yordamida ekstraktiv moddalarini qiyosiy o‘rganish natijalari keltirilgan.

Kalit so‘zlar: betulin, betulin kislota, betulin aldegid, betulon kislota, betulon aldegid, lupeol, izopropanol, etilatsetat, geksan, ekstraksiya, yuqori samarali suyuqlik xromatografiyasi (YuSSX).

Аннотация: Бетулин относится к классу тритерпеноидов и в больших количествах содержится главным образом в растении берёзы. Благодаря своей натуральности, нетоксичности и биологической активности он представляет большой интерес для исследователей и выбирается в качестве основы для создания фармацевтических препаратов. В этой статье представлены результаты сравнительного исследования экстрактивных веществ бересты березы *Betula Turkestanika Roth*, произрастающий на территории республики использованием различных растворителей.

Ключевые слова: бетулин, бетулиновая кислота, бетулиновый альдегид, бетулоновая кислота, бетулоновый альдегид, лупеол, изопропанол, этилацетат, гексан, экстракция, ВЭЖХ.

Abstract: Betulin belongs to the class of triterpenoids and is found in large quantities mainly in the birch plant. Due to its naturalness, non-toxicity and biological activity, it is of great interest to researchers and is chosen as a basis for

ISSN 3030-3907

the creation of pharmaceuticals.This article presents the results of a comparative study of extractive substances from the birch bark *Betula Turkestanika Roth*, growing on the territory of the republic, using various solvents.

Key words: betulin, betulinic acid, betulin aldehyde, betulonic acid, betulonic aldehyde, lupeol, isopropanol, ethyl acetate, hexane, extraction, HPLC.

Kirish

Betulin-o‘simliklardan olinadigan tabiiy triterpenoid bo‘lib, asosan qayin po‘stlog‘ida to‘planadi. U yallig‘lanishga qarshi, antivirus, saratonga qarshi farmakologik xossalarga ega. Betulinni laboratoriyada ajratish uchun erituvchilar tanlovi muhim rol o‘ynaydi. Adabiyotlarda turli erituvchilarning samaradorligi ko‘rsatib o‘tilgan bo‘lsa-da, tadqiqotda aynan izopropanol, etilatsetat, geksanning betulin ajratishdagi samaradorligi o‘rganildi. Har bir erituvchi bilan ekstraksiya Sokslet apparati yordamida amalga oshirildi.

Mavzuga oid adabiyotlar tahlili

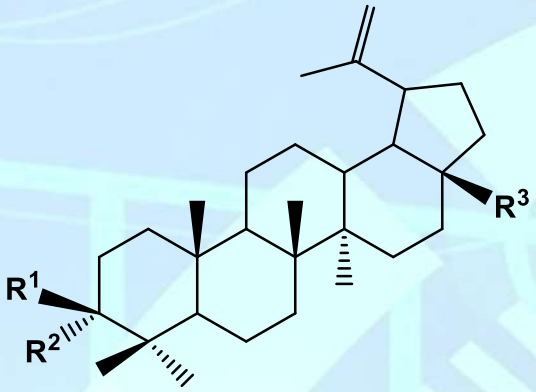
Oq qayin Rossiyaning Sibir hamda Yevropa qismi o‘rmonlarida keng tarqalgan daraxt turlaridan biri hisoblanadi. *Betula Turkestanika Roth.* Respublikamizning Bo‘stonliq tumanidagi Maydontol qo‘riqxonasida tabiiy o‘sadi. So‘nggi yillarda respublikamizning qator o‘rmon xo‘jaliklarida (Samarqand, Baxmal, Burchmulla) oq qayin (*Betula Pendula Roth*) introduksiya qilingan [1].

Oq qayin po‘stlog‘i o‘zida turli sinf ekstraktiv biologik faol moddalarni tutadi. Po‘stloqning tashqi qobig‘i ekstraktlari tarkibida lupan va β-amirin qatori pentatsiklik triterpenoidlari juda ko‘p [2].

Ular orasida keng tarqalgani betulin bo‘lib, oq qayinning turi, o‘sish joyi va muhiti, yoshi va boshqa omillarga bog‘liq ravishda tashqi qobiqdagi miqdori (*Betula sp*) 30% gacha yetishi mumkin [3]. Po‘stloq ekstraktlarida betulin bilan bir qatorda, uning oksidlangan hosilalari - betulin kislota (1), betulin aldegid (2), betulon kislota (3), betulon aldegid (4) va boshqalar uchraydi. Shuningdek ekstrakt tarkibida betulinga yo‘ldosh bo‘lib, uning o‘ndan bir miqdorida bo‘lgan lupeol (5) ham uchraydi, ammo ayrim manbalarda uning miqdori betulin miqdoriga teng bo‘lishi mumkin, deb keltirilgan (1-rasm) . Ba’zi turlarida triterpenlardan boshqa yana fenol birikmalar (flavanoidlar, taninlar), efir moylari (metilsalisilat), lignin va sellyuloza, organik kislotalar (ursol va oleanol kislotalar) kabi kimyoviy birikmalar uchrashi kuzatiladi [4].

Adabiyotlarda oq qayin po‘stlog‘ining ichki qismida betulin miqdori kam bo‘lib, asosan fenol tabiatli birikmalar ko‘proq bo‘lishi to‘g‘risida ma’lumotlar keltirilgan [5].

ISSN 3030-3907



1. $R^1 = OH$, $R^2 = H$, $R^3 = CH_2OH$
2. $R^1 = OH$, $R^2 = H$, $R^3 = COOH$
3. $R^1 = OH$, $R^2 = H$, $R^3 = CHO$
4. $R^1 = R^2 = H$, $R^3 = CHO$
5. $R^1 = OH$, $R^2 = H$, $R^3 = CH_3$

1-rasm. Betulin va uning hosilalari formulasi

Oq qayin po‘stlog‘i ekstraktlari yallig‘lanishga qarshi, gipoxolesterinemik, safro haydovchi, gepatoprotektorlik, allergiya, astma, aterosklerozda, yara tuzatuvchi kabi faolliklarni namoyon qiladi [6]. Tarkibida lupeol, betulin, betulin kislota tutgan ekstraktlar saratonga qarshi faollik ko‘rsatishi aniqlangan [7]. So‘nggi yillarda betulin va betulin kislota hosilalarining viruslarga (jumladan OITS) qarshi faollikka ega ekanligi tibbiyot va farmatsevtika uchun viruslarga qarshi yangi preparatlar yaratishda istiqbolli terapevtiklar sifatida namoyon bo‘lishi mumkin [8].

Oq qayin po‘stlog‘idan betulinni ekstraksiya qilishda ekstraktning unumi dastlabki xomashyoning maydalanish darajasiga bog‘liq. Betulinni turli xil organik erituvchilar, xususan etanol, benzol, dietil efir, dixlormetan va atseton bilan ekstraksiya qilish bo‘yicha juda ko‘p ilmiy tadqiqot ishlari amalga oshirilgan [8]. Adabiyotlarda oq qayin o‘simligining bir qancha turlarini, jumladan *Betula pendula*, *Betula pubescens* [9], *Asteracantha longofolia* [10], *Akasiya nilotica* [12], *Ligana cuneifolia* [15] po‘stloq va barglari etanolda ayrim turlarining (*Anemon raddeana)* [11] hatto ildiz qismlari ham etanolda ekstraksiya qilinganligi, *Matayba elaeagnoides* [13] va *Ougenia, Dalbergiodes* [14] turlarining po‘stloq qismi esa metanol erituvchisida ekstraksiya qilingan tadqiqotlari olib borilgan.

Respublikamizda o‘sadigan oq qayinning (*Betula Turkestanika Roth*) po‘stlog‘i kimyoviy tarkibi tadqiq etilmaganini e’tiborga olib, biz turli erituvchilarda ekstraktiv moddalarning ajralib chiqish unumini qiyosiy o‘rganishni maqsad qilib oldik.

Tadqiqot metodologiyasi

Dastlab o‘simlik po‘stloq qismi 105℃ haroratda namligi 1% dan kam bo‘lguncha quritildi va kerakli o‘lchamgacha maydalandi, so‘ng Sokslet apparatida adabiyotlarda keltirilgan sharoitlarda [5] izopropanol, etilatsetat, geksan erituvchilari yordamida har biri bilan 3 marotabadan ekstraksiya qilindi. Ekstraktiv moddalarning massasi erituvchi uchirib yuborilgandan so‘ng, gravimetrik usul bilan hisoblandi. Ekstraktning neytral va kislotali moddalarini ajratish uchun 20%

ISSN 3030-3907

li NaOH suvli eritmasi va etanol ishtirokida 3 soat davomida qaynatildi. Etanol haydab olinib, distillangan suv bilan neytral holatgacha yuvildi. Ekstraktiv moddalar tarkibidagi betulin etanolda qayta kristallash yo‘li bilan tozalandi. Ekstrakt tarkibidagi betulin miqdori YuSSX usuli yordamida aniqlandi hamda adabiyot ma’lumoti bilan qiyosiy tahlil qilindi.

Tahlil va natijalar

Bizning ilmiy tadqiqotlarimiz natijasida Respublikamizning Bo‘stonliq tumanidagi Maydontol qo‘riqxonasida tabiiy o‘sadigan *Betula Turkestanika Roth.* oq qayin po‘stlog‘i turli erituvchilar (izopropanol, etilatsetat, geksan) yordamida, adabiyot ma’lumotlari asosida o‘rganilgan usullar qo‘llanilib, ekstraktsiya qilindi. Dastlab ajratib olingan ekstraktlar unumi aniqlandi. So‘ngra ekstraktiv moddalar yig‘indisining tozalik darajalari YuQX va YuSSX usullari orqali tahlil qilindi. Tarkibidagi betulin etanolda qayta kristallash usuli bilan tozalandi. Betulin odatda shaffof yoki biroz sariq rangli bo‘lishi mumkin, lekin toza holda oq rangli kristall shaklida yoki kukun holida bo‘ladi. Po‘stloq tarkibidan ajratib olingan ekstrakt tarkibida betulindan boshqa moddalar ham mavjudligi kuzatildi. Olingan natijalar quyidagi jadvalda keltirilgan.

1-jadval

***Betula Turkestanika Roth.* oq qayin po‘stlog‘ining turli organik erituvchilar bilan ekstraksiyasi natijalari**

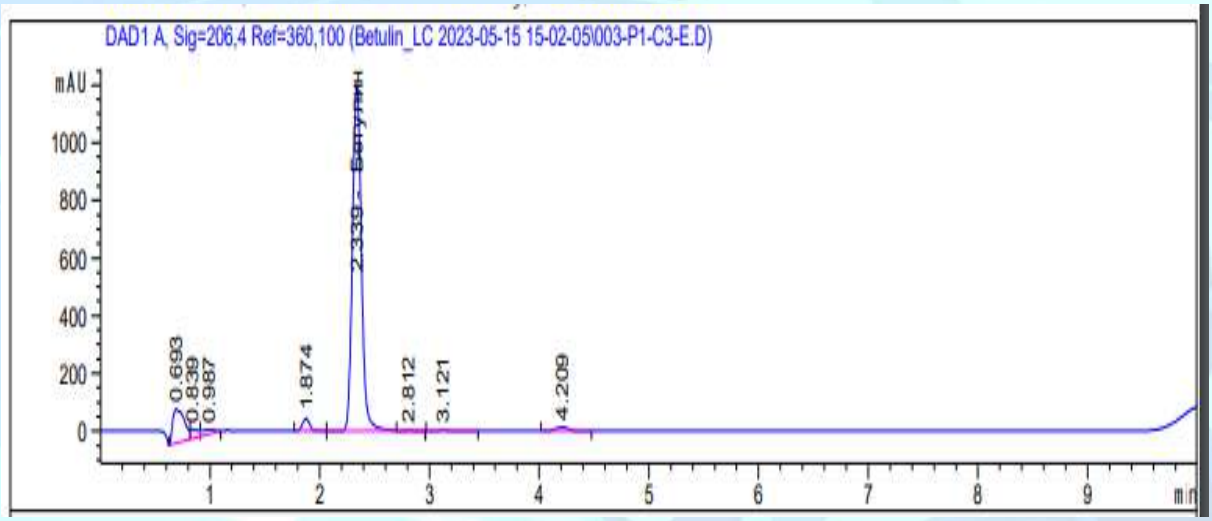
№	Po‘stloq miqdori (g)	Erituvchi	Ekstraksiya vaqti (soat)	Ekstraktiv moddalar miqdori		Ekstrakt tarkibidagi betulin miqdori
				g	%	(%)
1	50	izopropanol	12	18,2	36,4(20,6*)	46,0(46,0*)
2	50	Etilatsetat	12	17,1	34,2(15,5*)	68,0(60,0*)
3	50	Geksan	30	15,2	30,4(10,5*)	82,0(90,0*)

*[5]

Sifat tahlili va miqdoriy hisoblash adabiyotdagi ma’lumot bilan qiyosiy o‘rganildi. 1-jadvaldan ko‘rinib turibdiki, oq qayin po‘stlog‘ining har uchchala erituvchi: izopropanol, etilatsetat va geksandagi ekstraktlarining miqdori adabiyotda keltirilgan miqdoridan yuqori, ya’ni izopropanolda 15,8%, etilatsetatda 18,7% hamda geksanda 19,9% ko‘p ekanligini ko‘rish mumkin.

YuSSX usuli yordamida ekstraktlar tarkibidagi betulin miqdori tahlil qilinganda, betulin geksanga yuqori unum (82%) bilan o‘tishi kuzatildi. Shuningdek, betulin etilatsetatga 68% hamda izopropanolga 46% unum bilan ajralib o‘tadi.

ISSN 3030-3907



1-rasm. Geksanli ekstrakt tarkibidagi betulinning YuSSX xromatogrammasi

Xulosa va takliflar

Ilk bor respublikamiz hududida tabiiy o‘suvchi *Betula Turkestanika Roth.* oq qayin po‘stlog‘i izopropanol, etilatsetat, geksan erituvchilarida Sokslet apparatida ekstraksiya qilindi. Dastlabki olingan natijalardan shuni xulosa qilish mumkinki, ekstraktlar tarkibida pentatsiklik triterpen birikmalari Rossiya hududida o‘sadigan *Betula Pendula Roth* oq qayin po‘stlog‘i ekstrakti miqdoridan yuqori, ya’ni izopropanolda 15,8%, etilatsetatda 18,7% hamda geksanda 19,9% ko‘p ekanligini aniqlandi.

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ATTRACTING INVESTMENTS AND INNOVATION IN ECONOMIC DEVELOPMENT

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Abstract: This research article examines the main factors affecting the ability of countries to attract investment and support innovation in the context of economic development. By examining the role of government policy, infrastructure development, human capital and institutional frameworks, we aim to provide insight into how countries can create an enabling environment for investment and innovation. Through a comprehensive analysis of these factors, we aim to provide valuable recommendations for policymakers and stakeholders seeking to stimulate economic development through effective strategies to attract investment and stimulate innovation.

Key words: innovation, strategy, economic development, investment, infrastructure.

Аннотация: В данной исследовательской статье рассматриваются основные факторы, влияющие на способность стран привлекать инвестиции и поддерживать инновации в контексте экономического развития. Исследуя роль государственной политики, развития инфраструктуры, человеческого капитала и институциональных рамок, мы стремимся дать представление о том, как страны могут создать благоприятную среду для инвестиций и инноваций. Посредством всестороннего анализа этих факторов мы стремимся предоставить ценные рекомендации политикам и заинтересованным сторонам, стремящимся стимулировать экономическое развитие посредством эффективных стратегий привлечения инвестиций и стимулирования инноваций.

Ключевые слова: инновации, стратегия, экономическое развитие, инвестиции, инфраструктура.

Annotatsiya: Ushbu tadqiqot maqolasida iqtisodiy rivojlanish sharoitida mamlakatlarning investitsiyalarni jalb qilish va innovatsiyalarni qo'llab-quvvatlash

ISSN 3030-3907

qobiliyatiga ta'sir qiluvchi asosiy omillar ko'rib chiqiladi. Hukumat siyosati, infratuzilmani rivojlantirish, inson kapitali va institutsional asoslarning rolini o‘rganish orqali biz mamlakatlar investitsiyalar va innovatsiyalar uchun qanday qulay muhit yaratishi mumkinligi haqida tushuncha berishni maqsad qilganmiz. Ushbu omillarni har tomonlama tahlil qilish orqali biz investitsiyalarni jalb qilish va innovatsiyalarni rag'batlantirish bo'yicha samarali strategiyalar orqali iqtisodiy rivojlanishni rag'batlantirishga intilayotgan siyosatchilar va manfaatdor tomonlar uchun qimmatli tavsiyalar berishni maqsad qilganmiz.

Kalit so'zlar: innovatsiyalar, strategiya, iqtisodiy rivojlanish, investitsiyalar, infratuzilma.

Introduction

In today's rapidly evolving global economy, attracting investments and fostering innovation are crucial components of economic development strategies for nations striving to enhance their competitive edge. As markets become increasingly interconnected and technology-driven, countries must actively seek out opportunities to attract capital and encourage entrepreneurial activity to drive economic growth.

Investments play a pivotal role in fostering economic development on a global scale. (Ernazarov Ortik Eshnazarovich, 2021) The influx of capital into a region can spur growth through infrastructure development, job creation, and technological advancements. Often, foreign direct investments can introduce new technologies and expertise, contributing to the overall productivity and competitiveness of local industries. These investments not only enhance the economy's efficiency but also increase its resilience by diversifying revenue streams and reducing dependency on a single sector. Moreover, investments in research and development are essential for driving innovation and keeping economies at the forefront of technological progress. By attracting investments, nations can catalyze economic growth, address societal challenges, and secure long-term sustainable development for their citizens. Hence, policymakers must emphasize creating an attractive investment climate to harness these benefits effectively.

Strategies for Attracting Investments

Strategies for attracting investments play a crucial role in fostering economic development and innovation within a region. One effective approach is to establish specialized economic zones or clusters that offer unique incentives to attract businesses, such as tax breaks, streamlined regulations, and access to infrastructure (Ambili K, 2024). These zones can create a conducive environment for both domestic and foreign investments, fostering collaboration and knowledge exchange

ISSN 3030-3907

among businesses. Furthermore, providing targeted support for research and development (R&D) activities can incentivize companies to invest in innovation, leading to the creation of new products and services. Governments can also encourage investments by offering financial assistance, such as grants or subsidies, to companies willing to engage in strategic sectors identified for growth. By implementing a combination of these strategies, regions can optimize their attractiveness to investors, driving economic growth and technological advancement.

Role of Innovation in Economic Development

Innovation plays a critical role in driving economic development by fostering productivity, competitiveness, and growth in various industries. Research by (N. Kayumov et al., 2023) highlights that innovation leads to the creation of new products, services, and processes, thereby stimulating demand and generating a cycle of economic prosperity. By investing in research and development, countries can position themselves at the forefront of technological advancements, attracting domestic and foreign investments that fuel further innovation. Governments often play a key role in supporting innovation through policies that incentivize research, protect intellectual property, and facilitate collaboration between academia and industry. As a result, innovation becomes a catalyst for job creation, increased export revenues, and overall economic advancement. By fostering an environment conducive to innovation, nations can drive sustainable economic development and enhance their global competitiveness.

Policies to Foster Innovation and Investment

Policies to foster innovation and investment play a crucial role in attracting capital and fostering economic development. Governments can introduce incentives such as tax breaks for research and development activities, grants for startups, or subsidies for investments in key sectors. These initiatives can encourage businesses to take risks and invest in new technologies, ultimately driving economic growth. Additionally, policies aimed at streamlining regulatory processes and reducing bureaucratic hurdles can make it easier for companies to innovate and expand. By creating a favorable environment for investment and innovation, countries can attract both domestic and foreign investors looking to capitalize on emerging opportunities. Overall, a well-crafted policy framework that promotes innovation and investment can significantly enhance a nation's competitiveness in the global market (Rubén Domínguez-Díaz et al., 2024).

Conclusion

In conclusion, attracting investments and fostering innovation are essential components in promoting economic development. Through strategic initiatives

ISSN 3030-3907

such as creating business-friendly environments, providing incentives for R&D activities, and promoting entrepreneurship, countries can stimulate economic growth and create a competitive edge in the global market. By attracting foreign direct investments and encouraging domestic firms to invest in innovative projects, nations can enhance productivity, create job opportunities, and drive technological advancements. However, it is crucial for policymakers to strike a balance between promoting investments and safeguarding local interests to ensure sustainable development. Moreover, collaboration between the public and private sectors, as well as effective regulatory frameworks, are necessary to foster a conducive environment for investments and innovation. Overall, a multifaceted approach that prioritizes investments and innovation will be key in driving economic progress and prosperity.

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МАКТАБ ЎҚУВЧИЛАРИНИНГ МАҚСАДЛИ ЁШ ГУРУҲЛАРИНИНГ ТАНА ВАЗНИ ВА КУНЛИК ЮКЛАМАСИ ЎРТАСИДАГИ МУТАНОСИБЛИКНИ АНИҚЛАШ.

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Аннотация. Мақолада ҳозирги кунда мактаб ўқувчилари учун рюкзакларни маҳаллий шароит ҳамда талаблардан келиб чиққан ҳолда такомиллаштириш мақсадида, Тошкент шаҳрида жойлашган мактабларда олиб борилган тадқиқотларда олинган натижалар келтирилган. Тадқиқотлар натижасида ўқувчилар рюкзаклари энг кўп олиб юриладиган буюм эканлиги ҳамда оғир рюкзакларни кўтариб юриш таянч ҳаракат тизими касалликлари ва болалар гавда тузилишидаги бузилишларга олиб келиши аниқланган бўлиб, юртимизда ўқувчилар ўз тана вазнига нисбатан қандай оғирликдаги рюкзакларни кўтариб юриши аниқланган.

Калит сўзлар. Чарм-атторлик буюмлари, чарм-атторлик буюмлари конструкцияси, рюкзаклар, юкланган рюкзаклар, тана вазни.

Аннотация. В статье представлены результаты исследования, проведенного в школах Ташкента (Узбекистан) с целью усовершенствования рюкзаков для школьников с учетом местных условий и требований. В результате исследования было установлено, что рюкзаки являются наиболее часто переносимым предметом среди школьников, а ношение тяжелых рюкзаков может привести к нарушениям опорно-двигательного аппарата и структурным нарушениям у детей. Также было определено, какой вес рюкзаков носят студенты в нашей стране по отношению к их массе тела.

Ключевые слова: Изделия из кожи, изготовление изделий из кожи, рюкзаки, нагруженные рюкзаки, вес тела.

Annotation. The article presents the results of a study conducted in schools in Tashkent (Uzbekistan) to improve backpacks for schoolchildren taking into account local conditions and requirements. The study found that backpacks are the most frequently carried item among schoolchildren, and carrying heavy backpacks can lead to musculoskeletal disorders and structural disorders in children. It was

ISSN 3030-3907

also determined what weight of backpacks students in our country carry in relation to their body weight.

Keywords: Leather goods, leather goods manufacturing, backpacks, loaded backpacks, body weight.

Кириш

Статистика агентлиги маълумотларига кўра, 2022/2023-ўқув йили бошига Ўзбекистонда 10 минг 522 та умумтаълим муассасаларида таълим олаётган ўқувчилар сони қарийб 6,5 млн нафарни ташкил этган ҳолда 1-4-синф ўқувчилари сони 2,5 млн нафарни ташкил этади. Мактаб ўқувчиларининг 33 %и иккинчи ва учинчи сменаларда ўқимоқда. Бу эса юртимизда мактаб ўқувчилари учун рюкзакларга катта эхтиёж мавжудлиги ва ушбу эхтиёж импорт ҳисобига қопланишини англатади.

Республикамизда маҳаллий ҳом ашёдан замонавий кўриниш ва юқори эргономик ва ҳимоялаш ҳусусиятига эга рюкзакларни ишлаб чиқариш имконияти мавжуд бўлиб, ҳом ашё базаси, меҳнат ресурслари ва Ҳукуматимиз томонидан яратиб берилган имкониятлар натижасида маҳсулотлар рақобатбардошлиги таъминланади. Мамлакатимизда ўқувчиларнинг асосий қисми ўқув қуроллари ва китобларни олиб юришда рюкзаклардан фойдаланишини инобатга олган ҳолда, рюкзакларнинг эргономик ва хавфсизлик хусусиятларини яхшилаш ва маҳаллий талабларга мослаштириш муҳим омил ҳисобланади. Оғир ва ноқулай рюкзаклардан узоқ вақт фойдаланиш энди ўсиб бораётган болалар гавда тузилишида ҳамда таянч ҳаракат тизимида нуқсонлар келтириб чиқариши мумкин. Кўплаб тадқиқотчилар юкланган рюкзакнинг оптимал вазни ўқувчилар тана вазнининг 10 % идан ошмаслигини тавсия этишини инобатга олган ҳолда ҳозирги кунда мактабларда 1 – 4 синф ўқувчилари рюкзакларининг вазни ўқувчилар тана вазнининг нечи фоизини ташкил этишини аниқлаш мақсадида, Тошкент шаҳрида жойлашган 206 ва 212 мактабларда ўлчов ишлари амалга оширилди.

Бунда ўқувчиларнинг бир ҳафта давомида дарс жадвали асосида рюкзакларинг вазни ўлчанди ва олинган ўлчовлар натижасида рюкзакларнинг минимал ва максимал оғирликлари ҳамда ўқувчилар сонига асосан ўртача вазни ва энг кенг диапазони аниқланди (1-расм).

ISSN 3030-3907




1-расм. Тошкент шахрида жойлашган 206 ва 212 сонли мактабларда ўлчов ишларини олиб бориш.

Шунингдек мактаб ўқувчилари тана вазнлари ҳам ўлчанда ва ўлчовлар натижасида ўқувчиларнинг ўртача вазни ва энг кенг диапазони аниқланди. Олинган натижалар асосида мактаб ўқувчилари рюкзаклари вазни ўқувчилар тана вазнининг ўртача нечи фоизини ташкил этиши аниқланди (2-жадвал).

1-жадвал

Ўлчов натижалари

	Ўқувчилар вазни				
№	**Синф**	*max kg*	*min kg*	*ўртача kg*	**Энг кенг** *kg*
1	1-синф	27,6	17,9	22,4	20,7-25
2	2-синф	35	20,1	27,4	23-28
3	3-синф	42	21	31,3	28-34
4	4-синф	47,4	29,6	35	29,6-38

	Рюкзак вазни				
№	**Синф**	*max kg*	*min kg*	*ўртача kg*	**Энг кенг** *kg*
1	1-синф	3,8	2,5	2,9	2,5-3,1
2	2-синф	4,65	2,7	3,27	2,8-3,6
3	3-синф	4,8	3,2	3,8	3,2-3,9
4	4-синф	5	3,6	4,04	3,6-4,2

ISSN 3030-3907

	Рюкзак вазни ва ўқувчилар вазни нисбати				
№	**синф**	*max %*	*min %*	*ўртача %*	**Ўртача диапазон %**
1	1-синф	18,6	9,8	13,18	12,9
2	2-синф	16,5	9	11,6	12,1
3	3-синф	16,2	9,2	12,2	12,4
4	4-синф	14,2	8	11,5	12,5

Олинган натижаларга кўра, ўқувчилар рюкзакларининг вазни ўқувчилар вазнининг 1-синфлар учун 13,18 % ини, 2-синфлар учун 11,6 % инин, 3-синфлар учун 12,2 % ини ҳамда 4-синфлар учун 11,5 % ини ташкил этиши аниқланди. Бу эса олимлар томонидан тавсия этилган 10 % қийматдан кўплигини ва ўқувчилар бундай оғирликдаги рюкзакларни узоқ вақт кўтариб юриши елка оғриши, қон айланиш тизимидаги ўзгаришларга олиб келиниши олимлар томонидан аниқланган. Шунингдек, ўлчов натижаларига кўра, баъзи ҳолларда ўқувчилар ўз тана вазнининг 15% идан оғир бўлган рюкзаклар кўтариши аниқланди. Mackenzie W.G юкланган рюкзак вазни ўқувчи тана вазнинг

15-20 % ини ташкил этиши елка оғриғига сабаб бўлишини, Alwiah.Sh ўз илмий тадқиқотида ўқувчиларнинг ўзоқ вақт давомида ўз тана вазнининг 15-20 % ини ташкил этадиган рюкзакларни кўтариб юриши гавданинг юқори қисми оғишига олиб келишини аниқлаганлигини инобатга олган ҳолда юртимизда мактаб ўқувчилари учун эргономик рюкзакларни маҳаллий шароитдан келиб чиққан ҳолда лойиҳалаш ва ишлаб чиқариш долзарб ҳисобланади.

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MOLECULAR DYNAMICS SIMULATION AND FREE ENERGY PROFILING OF GLYCYRRHIZIN ACID IN AQUEOUS SOLUTION

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Annotatsiya. Glitsirizin kislotasi, shirinmiya ildizidan olingan bioaktiv birikma, o‘zining yallig‘lanishga qarshi va virusga qarshi xususiyatlari tufayli muhim terapevtik salohiyatni namoyon etadi. Ushbu tadqiqotda glitsirizin kislotasining suvli eritmalardagi tuzilish barqarorligi, solvatatsiya dinamikasi va termodinamik xatti-harakatlari molekulyar dinamika (MD) simulyatsiyalari yordamida o‘rganildi. Natijalar glitsirizin kislotasining yuqori eruvchanligi, barqaror tuzilishi va qulay termodinamik xususiyatlarini (ΔG = -404.67 ± 11.57 kJ/mol) ta’kidlaydi, bu uning farmatsevtik salohiyatini yanada mustahkamlaydi.

Kalit so‘zlar: Glitsirizin kislotasi, Molekulyar dinamika simulyatsiyalari, Termodinamik barqarorlik, Erkin energiya profillanishi, Suvli eritmalar, Eruvchanlik tahlili, Farmatsevtik qo‘llanmalar, Bioaktiv birikmalar, Gidratatsiya qobig‘i dinamikasi, Tuzilish barqarorligi

Аннотация. Глицирризиновая кислота, биоактивное соединение, получаемое из корня солодки, продемонстрировала значительный терапевтический потенциал благодаря своим противовоспалительным и противовирусным свойствам. В данном исследовании с помощью моделирования молекулярной динамики (МД) изучается структурная стабильность, динамика сольватации и термодинамическое поведение глицирризиновой кислоты в водных растворах. Результаты свидетельствуют о высокой растворимости глицирризиновой кислоты, стабильной структуре и благоприятных термодинамических свойствах (ΔG = -404,67 ± 11,57 кДж/моль), что усиливает ее фармацевтический потенциал.

Ключевые слова: Глицирризиновая кислота, моделирование молекулярной динамики, термодинамическая стабильность, профилирование свободной энергии, водные растворы, анализ растворимости, фармацевтические приложения, биологически активные соединения, динамика гидратационной оболочки, структурная стабильность

ISSN 3030-3907

Abstract. Glycyrrhizin acid, a bioactive compound derived from licorice root, has demonstrated significant therapeutic potential due to its anti-inflammatory and antiviral properties. This study investigates the structural stability, solvation dynamics, and thermodynamic behavior of glycyrrhizin acid in aqueous solutions using molecular dynamics (MD) simulations. Results highlight glycyrrhizin acid's high solubility, stable structure, and favorable thermodynamic properties (ΔG = -404.67 ± 11.57 kJ/mol), reinforcing its pharmaceutical potential.

Keywords: Glycyrrhizin acid, Molecular dynamics simulations, Thermodynamic stability, Free energy profiling, Aqueous solutions, Solubility analysis, Pharmaceutical applications, Bioactive compounds, Hydration shell dynamics, Structural stability

Introduction

Glycyrrhizin acid, a triterpenoid saponin from licorice root, has gained considerable attention in pharmaceuticals for its anti-inflammatory, antiviral, and hepatoprotective properties[1]. These attributes make it a valuable candidate for drug development against chronic and infectious diseases.

However, despite its therapeutic potential, the molecular mechanisms governing glycyrrhizin acid's behavior in aqueous environments remain insufficiently studied. Key factors, such as solubility, structural stability, and interactions with water, are crucial for optimizing its pharmaceutical formulations and improving its bioavailability[2].

This research addresses the critical gap of why glycyrrhizin acid's molecular behavior in water has not been fully characterized. By focusing on its solvation dynamics and thermodynamic properties through molecular dynamics simulations, this study provides valuable insights to support its effective use in drug formulations[3].

Materials and Methods

The molecular model of glycyrrhizin acid was prepared using custom parameterizations defined in the TO8.itp file, designed to align with the CHARMM36 [4]force field. The system was solvated in a cubic box containing TIP3P water molecules, ensuring a minimum distance of 1.2 nm from the glycyrrhizin molecule to the box edges. Sodium and chloride ions were added to neutralize the system and achieve a physiological salt concentration of 0.15 M.

The CHARMM36 force field described the interactions between glycyrrhizin acid, water molecules, and ions. Custom parameterizations were validated using TO8.itp for glycyrrhizin acid to ensure accurate molecular interactions, while the TIP3.itp file defined water model parameters. All files were preprocessed using GROMACS 2024.1 [5]to confirm compatibility and consistency.

ISSN 3030-3907

Energy minimization was conducted using the steepest descent algorithm to remove steric clashes and relax the system. The equilibrated system was subjected to:

1. **NVT Ensemble:** A 100 ps simulation at 300 K to stabilize the temperature.
2. **NPT Ensemble:** A 100 ps simulation at 1 bar pressure to equilibrate the density.
3. **Production MD:** A 1 ns molecular dynamics simulation with a 2 fs timestep was performed in the NPT ensemble. Long-range electrostatics were calculated using the Particle Mesh Ewald (PME) method, and periodic boundary conditions were applied in all directions.

The system was solvated in a cubic box containing TIP3P water molecules, ensuring a minimum distance of 1.2 nm from the glycyrrhizin molecule to the box edges (Figure 1).

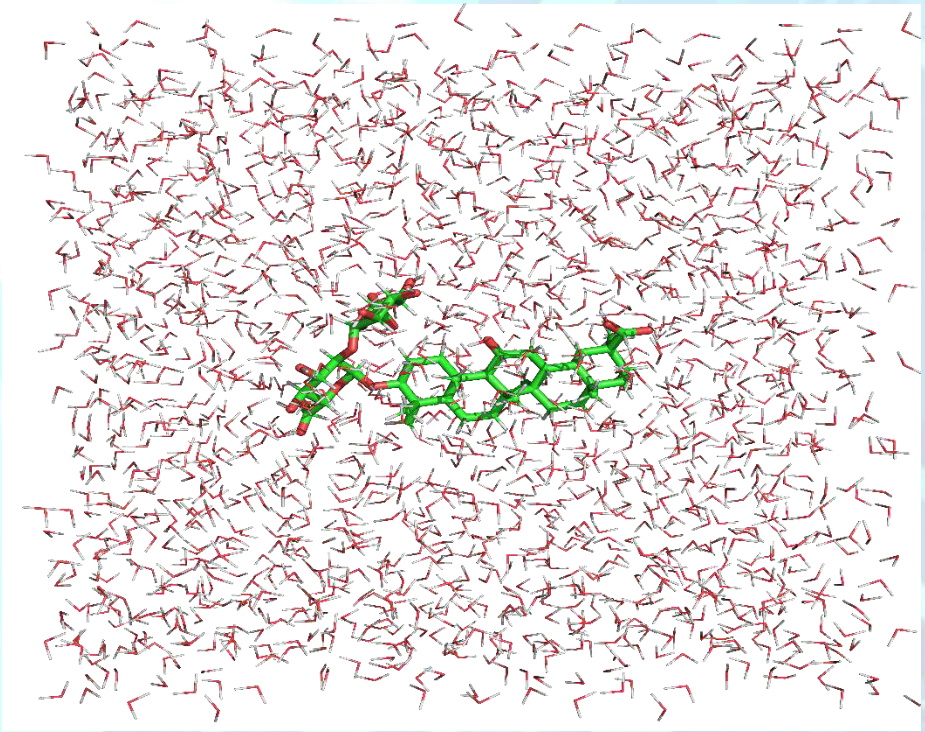


Figure 1: A snapshot from the molecular dynamics simulation showing the glycyrrhizin acid molecule (center, with carbon in green, oxygen in red, and hydrogen in white) solvated in a cubic water box containing 1829 TIP3P water molecules (oxygen in red, hydrogen in white). The system was prepared with a minimum distance of 1.2 nm between the glycyrrhizin molecule and the box edges, as described in the methodology.

Results and Discussion

The free energy calculations provide critical insights into the thermodynamic stability of glycyrrhizin acid in aqueous solutions.

ISSN 3030-3907

The **free energy integral plot** (Figure 2) illustrates the cumulative free energy changes (\Delta G) across the lambda windows, highlighting the molecule's transition between states. The profile shows a consistent thermodynamic favorability with a total free energy change of approximately -404.67 ± 11.57 kJ/mol. This result underscores the strong solvation dynamics and stability of glycyrrhizin acid in water.

The **free energy differences plot** (Figure 3) further breaks down these changes, depicting localized stability and transitions across different lambda values. Error bars indicate the reliability of the data, confirming the robustness of the simulations.

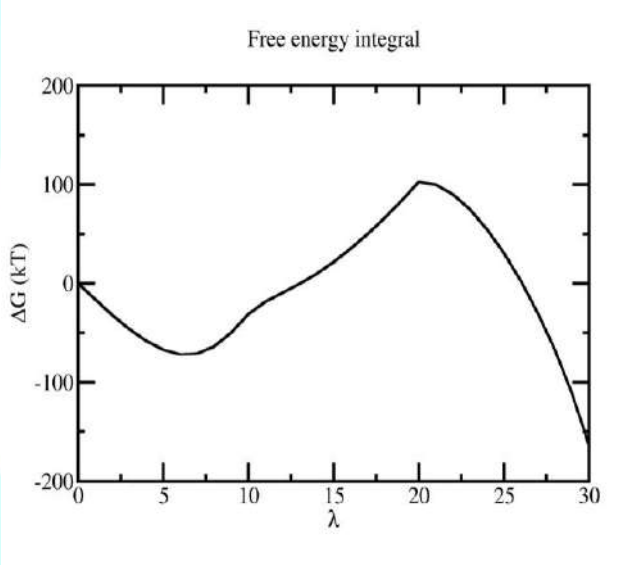


Figure 2: Free energy integral plot showingthe cumulative change in Delta G for glycyrrhizin acid in aqueous solutions

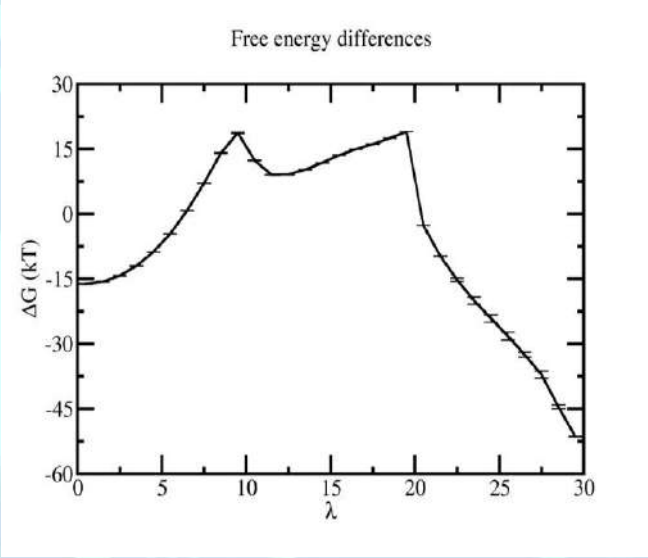


Figure 3: Free energy differences plot illustrating localized stability transitions and error analysis for glycyrrhizin acid in aqueous solutions.

Implications and Conclusion The results of the molecular dynamics simulations validate the solvation and thermodynamic stability of glycyrrhizin acid in aqueous conditions. Its strong interaction with water molecules ensures solubility and stability, making it a viable candidate for pharmaceutical applications. Future studies could extend these simulations to include interactions with biological membranes or other solvents to further elucidate its pharmacokinetics and pharmacodynamics.

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2,4-DIOKSOGEKSAN KISLOTA ETIL EFIRI AROILGIDRAZONI TUZILISH

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Annontatsiya: Ushbu tadqiqotda ketoaldegid va ketoefir tipidagi 1,3-dikarbonil birikmalar yordamida astilgid-razon hosilalarining prototrop, halqa-zanjir va halqa-halqa tautomer muvozanatini o‘rganish maqsadida yangi sintez usullari ishlab chiqilgan. Reaksiya dialkiloksalatlar va mos metilketonlar ta’siri ostida 2,4-dioksokarbon kislotalarning etil efirlarini hosil etishga yo‘naltirilgan bo‘lib, olingan mahsulotlarning tuzilishi YaMR-^{1}H va IQ spektroskopik metodlar yordamida aniqlangan. Spektroskopiya natijalari ta’kidlaganicha, mahsulotlar murakkab efir fragmentidagi etil, vinil va gidroksil guruhlarining o‘zaro bog‘lanishi orqali ichki molekulyar vodorod bog‘ hosil qilishini ko‘rsatadi. Shuningdek, sintez jarayonida kondensatsiya reaksiyasining regioyonalishi, ya’ni qaysi karbonil guruhi ishtirok etishi diqqat bilan tahlil qilingan va bu jihatga uchlamchi-butil radikalining effektiv hajmi sabab bo‘lganligi aniqlangan.

Kristallografik tahlil natijalari, xususan, H_2L^1 va H_2L^2 ligandlarining monokristall tuzilishi, molekula fragmentlarining bog‘ uzunliklari va burchak qiymatlari asosida, gidrazon va yengidrazin tautomer shakllarning mavjudligi hamda ularning o‘zaro aloqalari ishonch bilan tasdiqlangan. Spektr analizlari qattiq va eritma holatidagi mahsulotlar orasida halqali 5-gidroksi-2-pirazolin tautomer shaklning ustuvor ekanligini ko‘rsatib, qutbli erituvchilarda bu shaklning barqarorligini dalilladi.

Kalit so‘zlar: Ketoaldegid, ketoefir, 1,3-dikarbonil birikmalar, IQ- va YaMR-^{1}H spektroskopiyasi, 2,4-dioksogeksan kislota etil efirining $CDCl_3$ eritmasi, kvadruplet.

Аннотация: В данной работе были разработаны новые синтетические методы для изучения прототропных, кольцевых и кольцевых таутомерных равновесий производных ацетальдегидаразона с использованием 1,3-дикарбонильных соединений кетоальдегидного и кетоэфирного типа. Реакция направлена на образование этиловых эфиров 2,4-диоксокарбоновых кислот под действием диалкилоксалатов и соответствующих метилкетонов, а структуры полученных продуктов определены с использованием методов ЯМР-1Н и ИК-спектроскопии. Результаты спектроскопии свидетельствуют о том, что продукты образуют внутримолекулярные водородные связи посредством связывания этильных, винильных и гидроксильных групп в сложноэфирном фрагменте.

ISSN 3030-3907

Кроме того, была тщательно проанализирована региоориентация реакции конденсации в процессе синтеза, то есть какая карбонильная группа участвует, и было установлено, что этот аспект обусловлен эффективным размером третичного бутильного радикала. Результаты кристаллографического анализа, в частности, основанные на монокристаллической структуре лигандов H_2L^1 и H_2L^2, длинах связей и значениях углов молекулярных фрагментов, надежно подтвердили существование таутомерных форм гидразона и гидразина и их взаимодействия. Спектральный анализ показал, что среди твердых продуктов и продуктов в растворе преобладает таутомерная форма циклического 5-гидрокси-2-пиразолина, что подтверждает стабильность этой формы в полярных растворителях.

Ключевые слова: кетоальдегид, кетоэфир, 1,3-дикарбонильные соединения, ИК- и ЯМР-^{1}H-спектроскопия, раствор этилового эфира 2,4-диоксогексановой кислоты в $CDCl_3$, квадруполь.

Abstract: In this study, new synthesis methods were developed to study the prototropic, ring-chain and ring-ring tautomeric equilibrium of acetaldehyde-razone derivatives using 1,3-dicarbonyl compounds of the ketoaldehyde and ketoester type. The reaction was aimed at the formation of ethyl esters of 2,4-dioxocarboxylic acids under the influence of dialkyl oxalates and corresponding methyl ketones, and the structure of the obtained products was determined using NMR-^{1}H and IR spectroscopic methods. The results of spectroscopy indicate that the products form intramolecular hydrogen bonds through the mutual bonding of ethyl, vinyl and hydroxyl groups in the complex ester fragment. Also, the regioorientation of the condensation reaction during the synthesis, i.e., which carbonyl group is involved, was carefully analyzed, and it was found that this aspect is due to the effective size of the tertiary-butyl radical. The results of crystallographic analysis, in particular, based on the single-crystal structure of the H_2L^1 and H_2L^2 ligands, the bond lengths and angular values of the molecular fragments, reliably confirmed the existence of hydrazone and hydrazine tautomeric forms and their interactions. Spectral analyses showed the predominance of the cyclic 5-hydroxy-2-pyrazoline tautomeric form among the products in the solid and solution states, and proved the stability of this form in polar solvents.

Keywords: Ketoaldehyde, ketoester, 1,3-dicarbonyl compounds, IR- and NMR-1H spectroscopy, $CDCl^3$ solution of 2,4-dioxohexanoic acid ethyl ester, quadruplet.

Kirish

Ketoaldegid va ketoefir tipidagi 1,3-dikarbonil birikmalar bilan astilgid-razon hosilalari prototrop, halqa-zanjir va halqa-halqa tautomer muvozanatni o‘rganishda

ISSN 3030-3907

juda perespektiv ob’ekt hisoblanadi. Bu ishda astilgidrazinlar nukleofil sifatida tanlangan. Dialkiloksalatlar va shunga mos metilketonlar ta’sirlashuvidan 2,4-dioksokarbon kislotalarning etil efirlari olindi. YaMR-^{1}H spektroskopiyasi orqali olingan namuna 2,4-dioksogeksan kislota etil efiri keto-yenol shaklida mavjud bo‘ladi [2, 6].

$$H_5C_2OOC\text{-}COOC_2H_5 + CH_3COC(CH_3)_3 \xrightarrow{MeONa} H_5C_2OOCCO\text{-}CH_2\text{-}CO\text{-}C(CH_3)_3$$

H_2O

1-sxema

Buni 2,4-dioksogeksan kislota etil efirining $CDCl_3$ eritmasida olingan YaMR-^{1}H spektri ham tasdiqlaydi. Molekulaning murakkab efir fragmentidagi etil radikali-ning CH_3- va CH_2- guruh protonlarining triplet va dublet ko’rinishidagi δ 2,26 va 4,36 m.h. dagi signallari karbonil guruhning CH_3- guruhidagi 3 ta protonning δ 1,30 m.h. dagi signali, vinil va gidroksil guruhning bitta protonlarining δ 6,37 va 7,28 m.h.dagi signallari olindi, bu ma’lumotlar xelat ichki molekulyar vodorod bog’ hosil bo’lganligini ko’rsatadi.

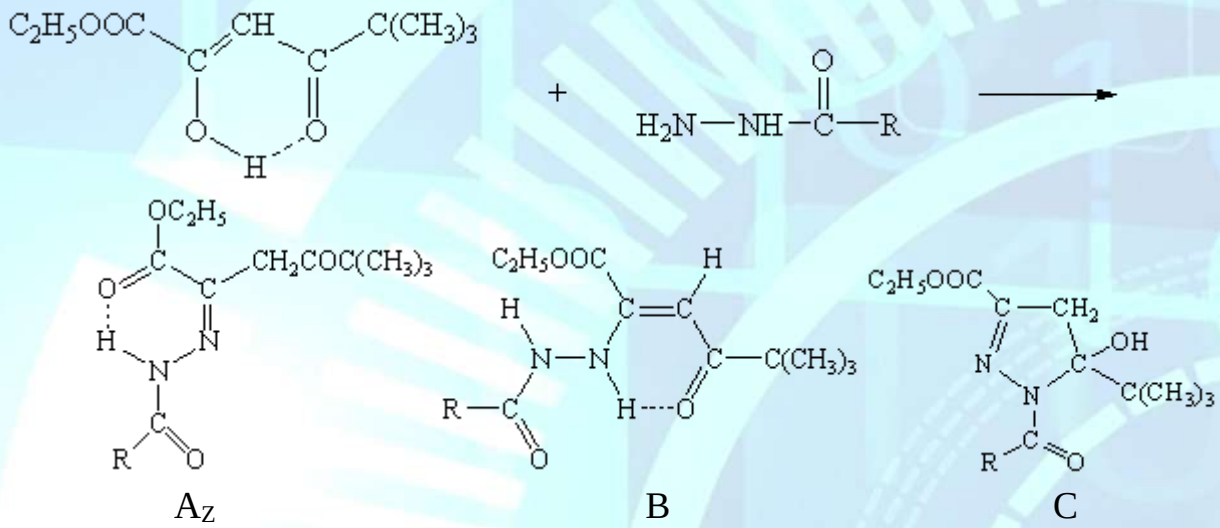
1,3-diketonlar atsil- va benzoilgidrazonlarida halqa-zanjir tautomer muvo-zanatning mavjudligi ularga bo□lgan qiziqishning ortishiga sabab bo□lmoqda. Ayniqsa bu qiziqishga benzoilgidrazonlarning nozik tuzilishi va turli tautomer shakillarning erituvchi tabiati va o’rinbosarlari ta’sirida o’zgarishi bunga sabab bo’ladi. 1,3-diketonlar aroilgidrazonlari dikarbonil komponenti tuzilishiga qarab, ularda uchlik halqa-zanjir muvozanati ya’ni, chiziqli tuzilishli, gidrazon (A) va yengidrazin (B) hamda halqali 5-gidroksi-2-pirazolin (B) tautomer holatlar orasida kelib chiqadi. Bunday juftdagi prototrop tautomer muvozanat 1,3-ketoefirlar, hamda 1,3-ketoaldegidlar atsil- va aroilgidrazonlarida ham uchraydi.

5,5-dimetil-2,4-dioksogeksan kislota etil efirini bilan benzoy kislot gidrazidi va *para*-nitrobenzoilgidrazidlarning (H_2L^1–H_2L^2) o’zaro kondensatlanishidan sintez qilingan mahsulotlarning tautomer tuzilishini ko’rib chiqamiz. Biz 5,5-dimetil-2,4-dioksogeksan kislota etil efiri bilan aroilgidrazinlarning o’zaro reaksiyasi va olingan mahsulotlarning tuzilish IQ spektri tahliliga ko’ra ishonch bilan aytishimiz mumkinki, gidrazidla bilan ketoefirlarning kondensatlanishi reaksiyasi murakkab efirga qo’shni karbonili hisobidan amalga oshadi, bunga sabab uchlamchi-butil radikalining effektiv hajmi bu yo’nalish bo’yicha reaksiya bormasligini belgilaydi [6].

Halqa-chziqli zanjir tautomer muvozanat holat gidrazinli o’rinbosar saqlagan birikmalar orasidagi bog’lanish munosabatlarini o’rganish imkonini beradi. Ishonch bilan aytish mumkinki, YaMR-^{1}H spektroskopiyasi

ISSN 3030-3907

ma’lumotlariga ko’ra erkin 1,3-ketoefirlar, aynan 5,5-dimetil-2,4-dioksogeksan kislota etil efirini benzoilgidrazoni halqa-chiziqli tautomer shaklda bo’ladi. Sintez qilingan aroilgidrazonlar tarkibi va tuzilishi element analizi, IQ- va YaMR-^{1}H spektroskopiyasi yordamida o’rganilganda quyidagi tautomer shakllar muvozanat holatga ega:



A_Z B C

R= C_6H_4X-*para*, H (H_2L^1), NO_2 (H_2L^2);

2-sxema

H_2L^1 birikmani KBr bilan presslangan tabletkasida olingan IQ spektri ma’lumotlariga ko’ra bir qancha yutilish chiziqlari kuzatiladi. Sintez qilingan moddalar valent tebranishlaridagi C_2H_5COO -etoksil guruhi C=O bog□i 1750-1765 sm□1 sohada kuzatiladi. Ular infraqizil spektrlari uchun xarakterli bo□lgan 3400sm□1 $\nu_{(O-H)}$ sohadagi keng yutilish chiziqlari-5-gidroksi-2-pirazolin tautomer shaklning gidroksil guruhiga mos keladi, amid fragmenti yutilish chiziqlari 1660-1680sm^{-1}

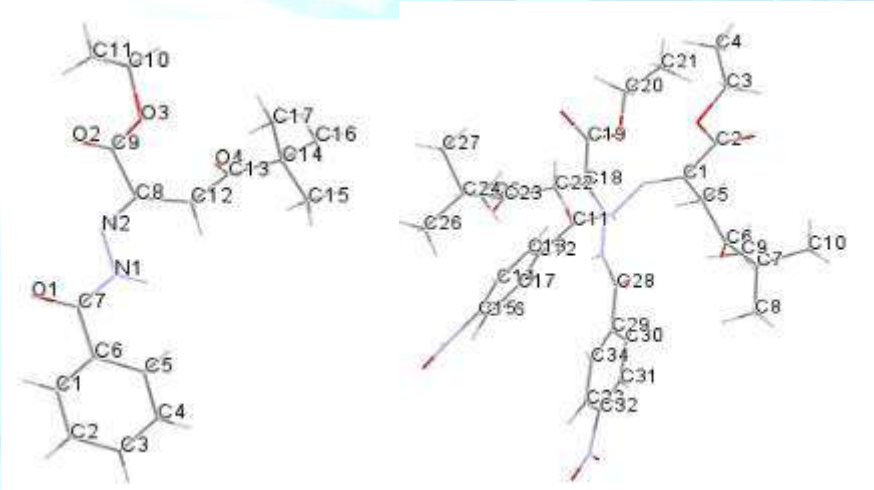
$\nu_{(C=O)}$ sohada kuzatiladi.

Spektrning 1730-1750 sm^{-1} sohasidagi intensiv tebranish chastotasi olingan moddalarning erkin keton guruhi mavjudligini isbotlaydi. 2950 va 3030 sm□1 sohadagi alohida yutilish chiziqlari CH_3 va CH- fragmetlarning valent tebranish chastotalariga taalluqli ekanligini qayd qilamiz. Qo’shbog’larning tebranish chastotalariga mos keluvchi 1633 sm^{-1} sohadagi intensiv yutilish C=N-bog’ mavjudligini isbotlaydi. Ammo IQ spektroskopiya natijalariga ko’ra kondensatlanish reaksiyasining regioyo’nalishini aniqlash birmuncha muammoli bo’lib qolganligi uchun H_2L^1 ligandning gidrazon (A_Z) tuzilishini tasdiqlash maqsadida $C_{17}H_{22}N_2O_4$ monokristallarini o’stirdik va uni RSA usuli bilan o’rganilgan. Ligand kristallari tetragonal singoniyali bo’lib, quyidagicha yacheyka quyidagicha

ISSN 3030-3907

parametrlarga ega: a=9,6114(10), b=9,6114(10), c= 18,1664(6) Å, *V*=1718,2(4) Å^3, Z=2, faza. guruh $P4_3$, R_{int}=0,035.

Bog' uzunliklari solishtirilganda O(2)–C(9) (1,203 Å), O(4)–C(13) (1,207 Å), N(2)–C(8) (1,290 Å) qo'sh bog' ekanligiga ishonch hosil qildik, ammo O(1)–C(7) (1,224 Å), bu parametrlardan biri oz farqli bo'lib chiqdi. Buning asosiy sababi shundaki, kristall molekulasining atsil- qismidagi C=O fragmentining *p*-bog' qisman zaiflashgan, chunki bu elektron jufti aromatik benzol halqasining yaxlit *p*-elektron buluti bilan *p*-*p*-tutash tizim hosil qiladi C(7) atomi esa sp^2-gibridlangan holatda bo'ladi. Provard natijada bu fragmentdagi atomlar orasida o'zaro koplanarlik vujudga keladi. Fazoda trigonal-tekis tuzilishdagi C(9) va C(13) atomlari ham xuddi shunday lokallashgan tutash tizimlar hosil bo'ladi, buning oqibatida molekulaning β-ketoefir qismida ham alohida koplanarlik kuzatiladi. 3,a-rasmdan ko'rinadi, haqiqatdan ham, H_2L^1 ligand molekulalari chiziqli gidrazon shaklda kristallanadi.



1-rasm. H_2L^1 va H_2L^2 larning kristall strukturasi va molekulaning yacheykada joylashuvi.

Olingan moddalarning eritmadagi tuzilishni aniqlash uchun YaMR-^{1}H spektros-kopiyasini qo'llanilgan. Ligandlarning CCl_4+DMSO-d_6 eritmasidagi YaMR-^{1}H spektri, chunonchi H_2L^1 ning spektrida ham δ 2,90 va 3,29 m.h. maydonidagi SSTK J_{AB}=19 Gts bo'lgan AB-sistemaga xos signallar qayd etilgan.

Bu signallar pirazolin halqasining 5-holatidagi asimmetrik (C*) atomi bilan qo□shni CH_2-guruhi borligini isbotlaydi. $C(CH_3)_3$ o□rinbosarning 9 ta protoni d 1,03 m.h., geterotsklning 5-C atomi bilan bog□langan OH-funksional protoni δ 6,00 m.h., b-ketoefir qoldig'ininng C_2H_5-radikali protonlari intensivligi 3:2 kabi δ 1,26 va 3,84 m.h. maydonida triplet va kvadruplet shaklda signallarni nomoyon qiladi. Atsil- qismidagi fenil halqasining protonlaridan δ 7,34; 7,42 va 7,91 m.h. maydoni-da mul'tiplet signallar qayd etilgan. Ammo shu bilan birga H_2L^1 YaMR-^{1}H spektridagi yakka N–H-bog'iga tegishli δ 11,18 m.h. maydondagi singlet signal

ISSN 3030-3907

birikmaning qisman gidrazon (A_Z) tautomer shaklda bo'lishni isbotlaydi. Olingan material muhkamasidan ko'rinadiki, DMSO-d_6 kabi qutbli erituvchida ham 5,5-dimetil-2,4-dioksogeksan kislota etil egiri aroilgidrazonlarining yengidrazin (B) tautomer shaklning mavjudligini ta'minlay olmaydi [1, 2, 3].

Olingan organik H_2L^2 ligandning IQ spektrida 1633, 1595, 1574, 1558 va 1490 sm^{-1} sohalarda intensiv yutilish chiziqlari kuzatiladi. Bu yutilish chiziqlaridan 1633 sm^{-1} sohasida signal C=N bog'iga tegishli bo'lsa, qolgan valent tebranishlar esa aromatik halqasiga va N–H bog'ining deformatsion tebranishlariga tegishlidir.

IQ spektrlari tahlili sintez qilingan modda qattiq holatda halqali 5-gidroksi-2-pirazolin tautomer (A) shaklda ekanligini ko'rsatadi. Biroq IQ spektroskopiyasi reaktsiyaning yo'nalishini, ya'ni qaysi karbonil guruhidan $–CH_3$ yoki $–COOC_2H_5$ dan kondensatlanish sodir bo'lishini ko'rsata olmaydi. Shubhasiz, olingan ligandlar qattiq holatda faqat gidrazon (A) tautomer ko'rinishi yaqqol namoyon bo'ladi.

Sintez qilingan moddaning eritmadagi tuzilishini aynan isbotlash maqsadida ularning $CDCl_3$ eritmasidan YaMR-^{1}H spektrlari olingan. Ular YaMR-^{1}H spektrlari halqali (A) tautomer shaklning saqlanishidan dalolat beradi. Misol tariqasida moddaning eritmasidan darhol YaMR-^{1}H spektrlari olingan va tahlil qilingan.

Spektrda eng muhim informatsiyani pirazolin halqasidagi metilen gruppasi nosimmetrik dublet signallar δ 2,97 va 3,34 m.h., spin-spin ta'sir konstantasi (SSTK) J_{AB} = 21 Gts bo'lgan tipik AB-sistema protonlariga dahildorligidan dalolat beradi. Bu molekulada xiral markazning mavjudligi, bunda 5-gidroksi-2-pirazolin halqasidagi murakkab efir va gidroksil guruhlari bilan bog'langan uglerodning asimmetrik ekanligini ko'rsatadi. Molekula murakkab efir fragmentida joylashgan etoksil guruhi protonlari ananaviy etil radikali (CH_3CH_2-) uchun xos bo'lgan integral intensivligi 3:2 bo'lgan δ 1,03 va 3,91 m.h. lardagi triplet va kvadruplet signallarni namoyish qiladi. 5-gidroksi-2-pirazolin halqasining benzgidrazid fragmentidagi fenil yadrosi protonlar (5H) markazi δ 7,65 va 7,87 m.h ga mos keluvchi biroz kengaygan shakldagi multiplet signallarni namoyon qiladi. Molekula 5-gidroksi-2-pirazolin halqasidagi beshinchi uglerod bilan bog'langan yakka gidroksil guruh protonlar δ 7,23 m.h. singlet signal beradi.

Pirazolin (B) geterohalqasining 5-qismida uglerodning assimetrik atomlari bilan qo'shni bo'lgan CH_2-guruh borligi natijasida AB-sistema kuzatildi. $C(CH_3)_3$–ning 9 protonidan olingan singlet signal δ 1,16 m.h. da rezonans signallar kuzatiladi. Halqaning 5-uglerod atomi bilan bog'langan OH- guruh protoni signali δ 5,91 m.h da rezonanslashadi. Triplet hamda kvadruplet shakldagi signallar β-ketoefir qoldig'ining -C_2H_5 radikali protonlari 1,26; 3,84 m.h. da 3:2 nisbat bilan, molekulaning atsil qismi fenil protonlari murakkab multiplet ko'rinishda 7,34; 7,40 va 7,91 m.h. da aniqlandi. H_2L^1 ligandning YaMR-^{1}H spektrda yagona signal pro-

ISSN 3030-3907

tondan d 11.8 m.h. ga teng, tautomer gidrazon holida bo'lganini ko'rsatadi. Boshqa signallar halqali shakl signallari kabi yaqin son qiymatda bo'ladi.

H_2L^2 ligandning chiziqli gidrazon shakli ekanligini ya'ni YaMR-^{1}H va IQ spektroskopiyasi xulosalarini tasdiqlash maqsadida birikmaning erituvchdan qayta kristallash orqali $C_{17}H_{21}N_3O_6$ birikmalarning monokristallari o'stirildi. H_2L^2 birikmaning rentgenstruktur analizini avtomatik difraktometrda olib borilgan.

Xcalibur, Oxford Diffraction (Cu Kα-radiatsiya. λ=1.54184 Å. Grafitli monoxromator, ω-ko'chirish $2\theta_{max}$=75.9°). H_2L^2 ligandning tuzilishi rezonansni yozib olish va tushuntirish (MNK anizatrop yaqinlikda R=0.075 gacha va R_w=0.1372) 4882 ishlatilgan $F^2>2s$ bilan istalgan ta'sirda ligandning kristallari elementar yacheyka parametrlari orqali monoklinik: a=8,2439(5), b=11,4752(10), c=20,8800(13) Å, b=95,597(5)°, V=1965,8(2) Å^3, Z=2, pr.gr. P1 2/n1.

H_2L^2 chiziqli gidrazon shaklga ega (A). kristall panjarada ikkita A va B mustaqil molekulalar mavjud. Monokristal molekulasida fenil halqasi tekis tuzilishli. Digedral burchak fenil halqasi orasida tekislikning H–N–C=O burchak A molekula uchun 5.00° dan oshmaydi [C(12)C(11)N(2)N(1)]. B tuzilishli molekulada ushbu burchak 10.7° ga teng. A tuzilishli molekulning bog' uzunligi qiymatlari C(2)–O(1) (1,1976 Å), C(6)–O(3) (1,2089 Å). Bu bog' uzunliklari B molekulanikidan farq qilib: C(19)–O(7) (1,1821 Å), C(23)–O(9) (1,2183 Å), C(28)–O(10) (1,2540 Å) ga teng. Qo'sh bog'lar o'rtasidagi bir qancha farqlarni inobatga olish lozim C(19)=O(7) va C(28)=O(10) benzol halqasining π-orbitali oxirgi karbonil guruhi bilan p-π bog'lanishga kiradi. Bu holatning qisman o'zgarishiga olib keladi: C(28)=O(10). Ushbu tajriba bir qancha oldin ham o'tqazilgan. Valent burchak qiymaylari: C(1)C(2)O(1) (123,03°), O(1)C(2)O(2) (123,79°), C(1)N(1)N(2) (117,74°), C(5)C(6)C(7) (117,50°), N(2)C(11)O(4) (123,20°), C(11)C(12)C(13) (120,81°) va C(11)N(2)N(1) (117,54°) larga teng.

sp^2 gibridlangan holatida tekis –trigonal ko'rinishli konfiguratsiyaga ega. Valent burchak va bog' uzunliklari Xyukkelning H_2L^2 molekuladagi benzol yadrosi haqidagi qonunini isbotlaydi.

Xulosa

Ushbu tadqiqotda ketoaldegid va ketoefir tipidagi 1,3-dikarbonil birikmalar asosida astilgid-razon hosilalarining prototrop, halqa-zanjir va halqa-halqa tautomer muvozanatini chuqur o'rganish imkoniyati namoyon etildi. Dialkiloksalatlar va mos metilketonlar yordamida 2,4-dioksokarbon kislotalarning etil efirlarini sintez qilish jarayonida, YaMR-^{1}H va IQ spektroskopiya metodlari mahsulotlarning strukturaviy xususiyatlarini aniq belgiladi. Spektr analizlari asosida murakkab efir fragmentlarida etil, vinil va gidroksil guruhlarining mavjudligi, shuningdek, ichki molekulyar vodorod bog'larning hosil bo'lishi

ISSN 3030-3907

ishonchli tarzda aniqlangan.Kristallografik tahlillar natijasida H_2L^1 va H_2L^2 ligandlarining monokristall tuzilishi, bog‘ uzunliklari va burchak qiymatlari asosida gidrazon va yengidrazin tautomer shakllarning mavjudligi tasdiqlandi. Shuningdek, kondensatsiya reaksiyasining regioyo‘naligi va tegishli tautomer muvozanatning sintez sharoitlariga bog‘liq o‘zgarishi aniqlanib, molekulaning asimmetrik markazlari va koplanarlik xususiyatlari namoyon etildi.

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ISSN 3030-3907

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KESKIN KONTINENTAL IQLIM SHAROITIDA OPTIK TOLALI ALOQA KABELLARINING FOYDALANISH ISHONCHLILIGINI O'RGANISH NATIJALARI (QORAQALPOG'ISTON RESPUBLIKASI MISOLIDA)

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Anotatsiya. Ushbu maqolada, to'satdan o'zgaruvchan temperatura, optik tolali kabellarning parametraliga temperaturaning tasiri bo'ladigan savollar ko'rip chiqildi. Misol sifatida, temperatura o'zgarish yani ob-xavoning sovib ketishi natiyjasida optik tolali kabellarning buzilishi sabablari ko'rib chiqilgan.

Kalit so'zlar: Optik ko'zoynaklari (otal),issiqlik kengayish,koeffitsienti qattiq kontinental iqlim,qoraqalpog'iston respublikasi,chidamli ta'siri narsalarga qarash uchun optic kabelning deformatsiyasi,brillouin refleksometriyasi,operatsion texnologiyasi.

Аннотация.В данной статье рассмотрены вопросы влияния температуры, в условиях резкоконтинентального климата, на параметры оптического кабеля. На примере, проанализирована причина повреждения оптического кабеля при понижении температуры.

Ключевые слова: Оптические очки (otal),коэффициент теплового расширения,суровый континентальный климат,Республика Каракалпакстан,устойчивый эффект деформации оптического кабеля,рефлексометрия бриллюэна,технология эксплуатации.

Annotation. In this article considered the questions of the influence of the temperature, in condition sharply continental climate, on the parameters optical cable. On example, it's analysed reason of the damage optical cable at the reduction of the temperature.

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Keywords: Optical glasses (otal),thermal expansion,coefficient of solid continental climate,Republic of Karakalpakstan,optical cable deformation to look at things with resistant effects,brillouin reflexometry,operating technology.

Kirish

Har qanday mahsulot singari, optik tolali kabel (OTK) ham o‘ziga xos bo'lgan ma'lum funktsiyalarga ega. 20 dB/km [6] zaiflashuvi bilan optik tolaning rivojlanishi kabellarning yangi sinfi, optik tolali kabellarning yaratilishiga olib keldi.

OTK mavjud bo'lgan kundan boshlab, uning tarkibiy elementlarida xususiyatlar va ko'rsatkichlarning yomonlashuvida ifodalangan o'zgarishlar ro'y bera boshladi. Bu o'zgarishlar ahamiyati va intensivligi bo'yicha farqlanadi: ba'zilari optik tolali aloqa liniyasi (OTAL) parametrlarining yomonlashishiga, boshqalari esa nosozliklarga olib keladi, ba'zilari vaqt o'tishi bilan sekin, boshqalari tasodifan (inson ta'sirida) paydo bo'ladi. Bu o'zgarishlarning barchasi optik tolaning funksionalligining buzilishiga olib keladi (belgilangan funktsiyalarni bajara olmaslik va/yoki nosozlik). Shunday qilib, optik tolali aloqa tizimining normal ishlashining butun davri davomida uning ishdan chiqishi (ehtimoli) mavjud. Ushbu ehtimollik qanchalik past bo'lsa, mahsulot ishonchliroq bo'ladi.

Optik tolalar va kabellarning ishonchliligi bo'yicha mavjud nashrlarni tahlil qilganda, texnik ekspluatatsiya jarayonida iqlim sharoitlarining optik tolali kabellar parametrlariga ta'siri jarayoni juda kam o'rganilganligi ma'lum bo'ldi.

Shu sababli, keskin kontinental iqlim sharoitida OTAL ning texnik ekspluatatsiyasi sharoitida ishonchliligini ta'minlashni tadqiq qilish va o'rganish katta qiziqish uyg'otadi.

Muammoning bayoni texnik ekspluatatsiya jarayonida OTAL turli xil operatsion omillarga ta'sir qiladi, ularning har biri uning texnik holatining doimiy o'zgarishiga olib keladi.

Ushbu muammoni hal qilishdagi qiyinchilik optik tolalarning yuklanishi va deformatsiyasini alohida va kabel elementlari bilan birgalikda hisoblash va har bir yuklanish (deformatsiya) turining tolaning optik xususiyatlariga ta'sirini hisobga olgan holda tizimli yondashuvning yo'qligi bilan bog'liq.

Bunday holda, tuzilmalarda nuqsonlarning rivojlanish dinamikasi OTAL ning ish rejimlariga bog'liq bo'ladi, bu esa o'z navbatida operatsion omillar ta'sirining intensivligini hisobga olgan holda resurs ko'rsatkichlarini moslashtirishni talab qiladi.

OTAL texnik ekspluatatsiya qilish jarayonida iqlim o'zgarishi tufayli yuzaga kelgan bir qator muammolar qo'shimcha ravishda aniqlandi, bu o'rtacha havo haroratining oshishi, noqulay gidrometeorologik hodisalarning soni va

ISSN 3030-3907

intensivligining oshishi, ayniqsa issiq kunlar, kuchli yog'ingarchilik, to'satdan issi va sovuq havo, suv toshqini, toshqinlar va sellar misol qilib olsak bo‘ladi [12].

Shu sababli, maqola doirasida keskin kontinental iqlim sharoitida OTAL ning ishlashi paytida yuzaga keladigan ba'zi muammolar ko'rib chiqiladi.

Muammoni hal qilish yo'llari.

Texnik ekspluatatsiyaning asosiy vazifasi - ma'lum vaqt oralig'ida kerakli ma'lumotlarni berilgan sifat bilan uzatishni ta'minlash bilan birga OTALning yuqori operatsion ishonchliligini ta'minlashdir.

Ishlash shartlariga qarab, kabel dizayniga turli talablar qo'yiladi. Ochiq havoda ishlatiladigan kabel, birinchi navbatda, atmosfera ta'siridan himoyalangan bo'lishi kerak, chunki kabel kanaliga yoki er ostiga yotqizilgan optik tolali kabel uchun beqarorlashtiruvchi tashqi omillardan biri iqlim(quyosh nuri, namlik, harorat o'zgarishi) tabiiy ta'sirlar bo‘ladi.

Masalan, [12] ma’lumotlariga ko‘ra, Qoraqalpog‘iston Respublikasi hududida havoning o‘rtacha ko‘p yillik minimal harorati -8 dan -20°C gacha o‘zgarib turadi, biroq ba’zi yillarda -30°C gacha pasayadi. Maksimal havo harorati + 50 ° C ga yetishi mumkin.

Ko'p hollarda past va yuqori haroratlarning materiallarning xususiyatlariga ta'siri diametrik ravishda qarama-qarshidir. Bundan tashqari, haroratning keskin o'zgarishi (bir kun yoki bir necha soat davomida) ularning zararli ta'sirining optik tolali kabel ishlab chiqarilgan materiallarga ta'sirini oshiradi.

Barcha zamonaviy optik tolali kabellar ancha murakkab tuzilmalardir. Kabelni ishlatishda muammolardan biri kabel komponentlarining chiziqli kengayish harorat koeffitsientidagi (ChKHK) katta farq bo'lib, ekstremal sharoitlarda optik tolaning shozilishiga va siqilishiga olib kelishi mumkin, bu esa o'z navbatida signalning zaiflashishiga olib keladi.

Atrof-muhit harorati o'zgarganda optik tolali kabelda optik tolalar va optik modullarning (OT va OM) xatti-harakatlarini ko'rib chiqaylik.

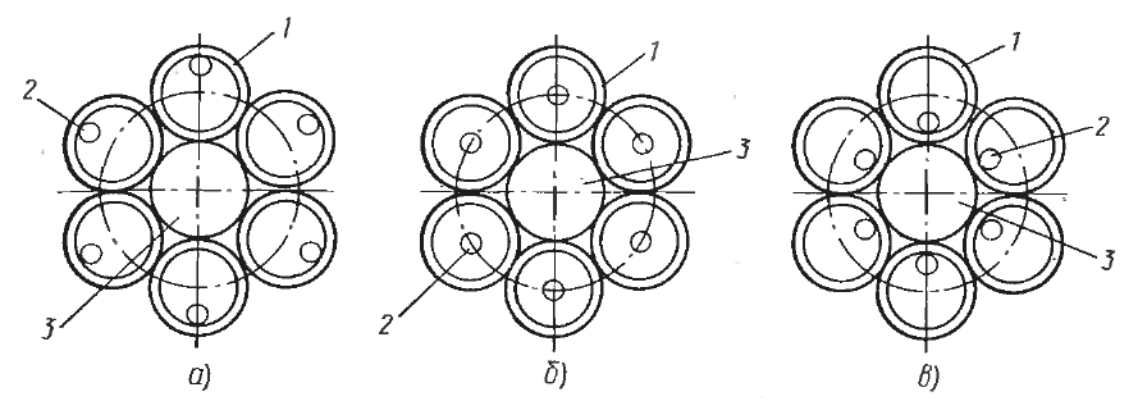
Faraz qilaylik, har bir optik modulda bittadan optik tola (OT) bor (1-rasm) [5].

Bitta optik modulda bir nechta optik tolalar mavjud bo'lganligi sababli, to'plamdagi individual optik tolalarning o'rnini taxmin qilishning iloji yo'qligi sababli ularning xatti-harakatlarini aniqlash qiyin.

Atrof-muhit haroratining oshishi bilan OM ning uzunligi oshadi, chunki OM tayyorlangan materialning termo kengayish koeffitsienti (TKK) qiymati kvartsning TKK dan yuqori bo'ladi. OM kengaytirilganda OT ni modulning ichki yuzasiga bosadi. Ammo OTning kengayishi birdaniga sodir bo'lmaydi. OT OM qobig'ining ichki yuzasiga tegsa, OTga tortish kuchi ta'sir qila boshlaydi.

ISSN 3030-3907

Atrof-muhit harorati pasayganda, OM uzunligi kamayadi va OT OM qobig'ining tashqi yuzasiga bosiladi (1-rasm).



1-rasm. Haroratlarni o'zgartirganda OT holatini o'zgartirish: bu erda 1 – optik modul; 2 - OT; 3 - markaziy quvvat elementi (MQE); а - past harorat ta'sirida; б – atrof-muhitning normal holati; в - yuqori haroratga ega bo‘lganda

Bunday holda, OT ning ortiqcha uzunligi [6] hosil bo'ladi:

$$\varepsilon_X = (\alpha_{MQE} - \alpha_{OT})(T_O - T) \approx \alpha_{ЦСО}(T_O - T) \qquad (1)$$

bunda α_{MQE} va α_{OT} - TKK markaziy quvat elementi (MQE) va OT; T_O - bashlong‘ish haroratda $\varepsilon_X = 0$.

Tuproqdagi harorat o'zgarishi tufayli erga yotqizilgan optik tolali kabel har doim issiqlik ta'sirini boshdan kechiradi va tuproq haroratining bog'ligi (T_{GR}) ga, ma'lum bir chuqurlikda tuproq yuzasidagi haroratga bog'liq bo‘ladi va kuyidagicha [6]:

$$T_{GR} = T_a \exp\left[-h\sqrt{\frac{\pi}{C(t)\tau_O}}\right] \sin\left(2\pi\frac{t}{\tau_O} - h\sqrt{\frac{\pi}{C(t)\tau_O}}\right) \qquad (2)$$

bu erda T_a - tuproq yuzasida harorat o'zgarishlarining amplitudasi; *C(t)* - tuproqning issiqlik o'tkazuvchanlik koeffitsienti; τ_O - tuproq yuzasida haroratning o'zgarishi davri; h - kabel yotqizish chuqurligi.

Haroratning o'zgarishi sababli, kabelning chiziqli termo kengayishi natijasida hosil bo'lgan erdan optik tolali kabelga tashqi kuchlar qo'shimcha ravishda ta'sir qiladi, buning natijasida kabelda ichki qisilishlar paydo bo'ladi [10]:

$$F_T = \Delta T(S_a E_a \alpha_a + N S_n E_n \alpha_n + N S_в E_в \alpha_в + N_o S_o \alpha_o) \qquad (3)$$

ISSN 3030-3907

bu erda S - elementning ta’sir qilish maydoni; E – materialning elastiklik moduli; N - OT soni; α – chiziqli termo kengayish koeffitsienti; а, б, в indekslari markaziy element, optik tolali kabel, qoplama va g'ilofga ishora qiladi.

Optik tolali kabelning xususiyatlariga haroratning ta'sirini kabelning texnik ekspluatatsiyasi misolida ko'rib chiqish mumkin.

2024 yil dekabr oyida qattiq sovuqlar boshlanganda tizimlar o'z-o'zidan zaxira liniyalariga o'tdi. O'lchov davomida refletogramma optik tolaning susayishi 10-13 dB ga oshganligini ko'rsatdi. Zararning taxminiy joyi ariqdan o'tuvchi quvur (po'lat) ustiga tushgan. Quvur suv ostida edi va muz bilan qoplangan. Muzlagan suv sathidan yuqorida joylashgan quvurlarni kesib o'tishni qayta tiklash va eng yaqin quduqlar orasiga qo'shishga qaror qilindi. Tekshiruv bahorgacha qoldirildi, chunki shikastlangan kabelni quvur kesishmasidan tortib olishning iloji bo'lmadi; hamma narsa muz bilan qoplangan edi. Ariqda suv ko‘paygan va kamayganidan so'ng, birinchi navbatda quvurning o'zi holati ko'rib chiqildi. Yaqindan o'rganib chiqqach, quvurda kichik teshik borligi ma'lum bo'ldi, u orqali suv quvurga kirib, qattiq sovuqda OTALni siqib chiqardi.

Kabelning shikastlangan qismida hech qanday nuqson topilmadi va reflemetrik o'lchovlar paytida barcha optik tolalarning optik xususiyatlari pasport ma'lumotlariga mos keldi.

Keling, kabelga tashqi kuch qo'llanilganda nima bo'lganini ko'rib chiqaylik. yotqizilgan kabel; Ishlab chiqaruvchi: Fujikura, kabel turi: 4, OGNMLJFE – WAZE SM 10/125 0,38 x 12C.

Optik tolali kabelning mexanik kuchini va uning tarkibiy elementlarini ketma-ket yaqinlashish usuli yordamida ko'rib chiqaylik.

Tasavvur qilaylik, OTK tsilindrlar tizimidir, keyin kabeldagi maydalash yuki kuch bilan ishlaydi (4):

$$F = \frac{\Delta lER}{K\left(\frac{R}{n}\right)^{3/2}} \qquad (4)$$

Bunday holda, harorat ta'sirida yuzaga kelgan siqilish [3]: bu erda F - maksimal siqish kuchi; K - natiyjani normallashtirish koeffitsienti; R – kabel radiusi; n – optik tolali kabelning radial qalinligi; E – quvur materialining elastik moduli; l - F kuchi ta'sir qiladigan simi uchastkasining uzunligi; Δ - siqish tekisligida optik tolali kabelning diametrining qisqarishi kattaligi.

Bunday holda, harorat ta'sirida yuzaga kelgan ε siqilish [3]:

$$\varepsilon = -1 + \sqrt{1 + \frac{4\pi R^2}{S^2}\left(2\frac{\Delta R}{R} + \frac{\Delta R^2}{R}\right)} \qquad (5)$$

ISSN 3030-3907

bunda R – burilish radiusi OM; ΔR – OT va OMning ichki devori orasidagi bo'shliq; S – burilish uzunligi.

Natijada optik kabel OK elementlarning materialining deformatsiyasi bo'ladi

$$\varepsilon_t = \alpha_t (t_N – t_{N-1} -….t_1) \quad (6)$$

bunda t_N … t_1 – OK ning tarkibiy qismlarida harorat;

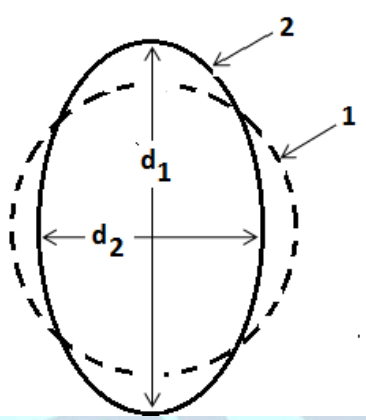
$\alpha_t = \frac{\sum_i \alpha_\tau E_i S_i}{\sum_i E_i S_i}$ -chiziqli termo kengayish koeffitsienti va α_τ, Ei, Si – TKK, kuchlanish ostida normal elastiklik moduli va kabelning *i*-elementining ishlash maydoni.

Qo'shimcha (harorat) qisilishni boshdan kechirayotganda

$$\sigma_t = \varepsilon_t E$$

bunda E - materialning elastiklik moduli.

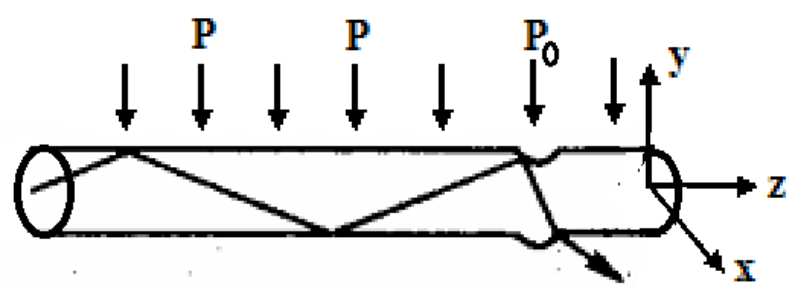
Taxmin qilish mumkinki, tashqi bosim yukining ta'siri ostida kabel va uning tarkibiy qismlari aylana bo'lmagan shaklga ega bo'ladi (1.2-rasm).



2-rasm. Kabel turi: 1 - optik tolaning normal holati; 2 – siqilgan optik tolali kabelning holati.

2-rasmga ko'ra, optik tolali kabelning siqilishi kabelning barcha tarkibiy qismlarida xuddi shunday o'zgarishlarga olib keldi, ya'ni optik tola xuddi shunday deformatsiyalangan. Bunday holda, eng katta bosim kuchi P_O (bosim) joyida tolaning egilishi sodir bo'ldi va taqsimlangan ko'ndalang yuklarni keltirib chiqardi. $q_i(z)$ (3-rasm).

ISSN 3030-3907



3-rasm. Optik tolali mikro bugilish va rejim yo'nalishi

Eksenel bosim kuchi [6] bo'ladi.

$$P = 0.25\pi d_c^2 E_d \alpha_{Td} \Delta T \qquad (7)$$

bunda E_d – OM materialining Young moduli; α_{Td} – TKK OM; d_c – OM ning o'rtacha diametri; ΔT – o'rtacha haroratdan og'ishi.

[3,6] da batafsil tavsiflangan barcha oraliq hisob-kitoblarni o'tkazib yuborib, past harorat ta'sirida tolaning egilishidagi yo'qotishlarni aniqlaydigan yakuniy formulani yozishimiz mumkin:

$$\alpha = \frac{64}{\pi^2}\,\alpha_T^2 (\Delta T)^2 \left(\frac{e^2(\Omega_0)}{\delta\Omega}\right)\left[\frac{E_d E_c}{(c-b)E_b^2}\right]^2 \frac{aC_0}{b^3\Delta^5} \qquad (8)$$

bunda $\Omega_o = \sqrt{\frac{2\Delta}{a}}$; $\Delta = \frac{\left(n_a^2 - n_b^2\right)}{2n_a^2}$; a – OT yadrosining radiusi; n_a- yadro sinishi indeksi; n_b - optik qobiqning sinishi indeksi; C_o- doimiy son; δ - tola va yadro diametrlari koeffitsient; b, c, d – yadro radiusi va optik tolaning bufer qoplamasi va OM; E – materialning Young moduli; α_T – TKK OT; ΔT - o'rtacha haroratdan og'ish.

O'tkazilgan tadqiqotlar [3,5,6,8,10] shuni ko'rsatdiki, ezilgan yuklarga uchraganda, qarshilik materiallarning Young moduli bilan aniqlanadi.

Shunday qilib, ko'rib chiqilgan formulalarni tahlil qilib, biz tolaning susayishining oshishiga materiallarning issiqlik kengayish koeffitsientlaridagi farq tufayli tolaning egilishi ta'sir qilgan degan xulosaga kelishimiz mumkin.

Xulosa

Ushbu tadqiqot natijalari mexanik yuklar va havo haroratining pasayishi zaharli moddalar uchun xavfli ekanligini tasdiqlaydi. Optik tolaning susayishi ortishi bilan tolaga mexanik ta'sir ko'rsatadigan aloqalar ko'rib chiqiladi.

Shu asosda quyidagi xulosalar chiqarish mumkin.

ISSN 3030-3907

1. Mexanik yuklar optik tolali kabelga ta'sir qiladi, uning deformatsiyasini keltirib chiqaradi, buning natijasida optik tolali kabelning mikrodeformatsiyasi sodir bo'ladi. Natijada optik tolaning susayishi kuchayadi.

2. Kabelni o'tish joylari orqali yotqizishda qo'shimcha ravishda polietilen quvurlarni yotqizish kerak, keyin esa optik tolali kabelni tortib olish kerak. Chunki bu kabelni tashqi ta'sirlardan qo'shimcha himoya qiladi.

3. Organik moddalarning zaiflashishini, ayniqsa haroratning keskin pasayishi davrida doimiy monitoringni o'tkazish, chunki hozirgi vaqtda bu vaziyatdan chiqishning eng yaxshi yo'li. Sababi OTAL-ga xizmat ko'rsatuvchi barcha aloqa operatorlarida Brillouin reflektometri mavjud emas.

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METALLOOKSIDLAR SINTEZINING ASOSIY TEXNOLOGIK USULLARI.

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Annotatsiya. ZnO asosdagi metalloksid plyonkalarini olish usullarini takomillashtirish. ZnO plyonkalarining tuzilmaviy hamda morfologik xossalarini tadqiq qilish va ularda hosil bo’lgan ZnO nanokristallitlari o’lchami va kimyoviy tarkibini aniqlash.ZnO asosdagi metallooksidlardan Lazerlar qurimalari uchun faol muhit hosil qilish. Olingan metallooksid plyonkalarini quyosh energitikasi va optoelektronika infraqizil, korinuvchi va ultrabinafsha nurlarga sezgir elementlar hamda optik kvant generator sifatida foydalanish imkoniyatlarini aniqlash;

Kalit so‘zlar: plyonkalar, ZnO plyonka, kimyoviy tarkibini aniqlash, faol muhit, optoelektronika, optik kvant generator.

Abstract. Improvement of methods for obtaining ZnO-based metal oxide films. Study of the structural and morphological properties of ZnO films and determination of the size and chemical composition of ZnO nanocrystallites formed in them. Creation of active media for laser structures from ZnO-based metal oxides. Determination of the possibilities of using the obtained metal oxide films as elements sensitive to infrared, visible and ultraviolet rays in solar energy and optoelectronics, as well as optical quantum generators.

Keywords: films, ZnO film, chemical composition determination, active medium, optoelectronics, optical quantum generator.

Аннотация. Совершенствование методов получения пленок оксидов металлов на основе ZnO. Изучение структурно-морфологических свойств пленок ZnO и определение размеров и химического состава образующихся в них нанокристаллитов ZnO. Создание активных сред для лазерных устройств из оксидов металлов на основе ZnO. Определить потенциальные возможности использования полученных пленок оксидов металлов в качестве элементов, чувствительных к инфракрасному, видимому и

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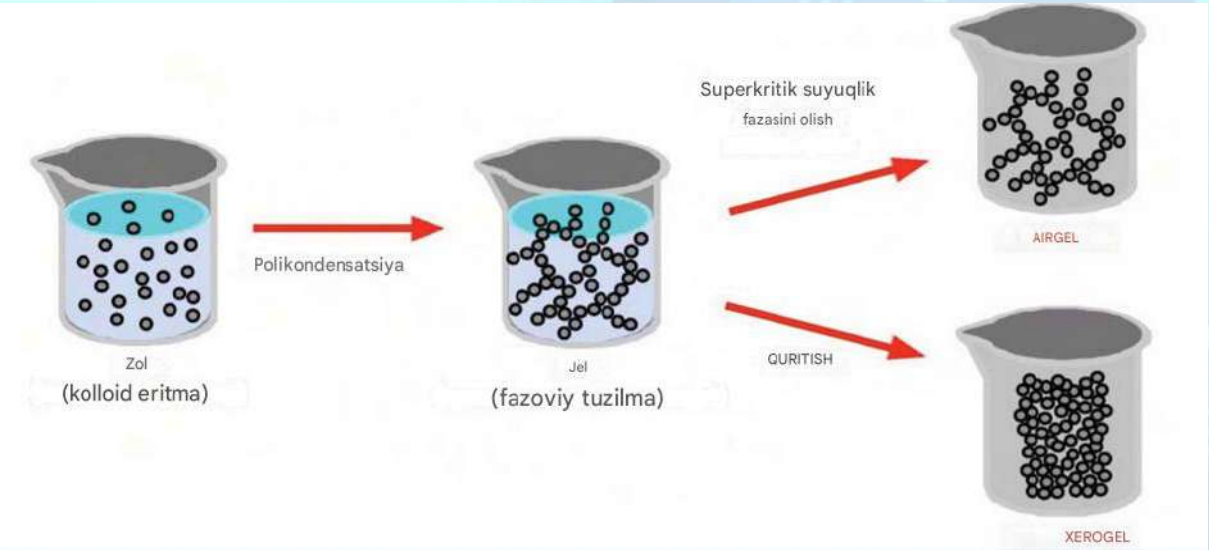
ультрафиолетовому свету, в солнечной энергетике и оптоэлектронике, а также в качестве оптических квантовых генераторов;

Ключевые слова: пленки, пленка ZnO, определение химического состава, активная среда, оптоэлектроника, оптический квантовый генератор.

Kirish.

Zol-gel usuli [1-2, 163-b.] tadqiqot ishi mualliflari tomonidan zol-gel usulining tizimli ko‘rinishi ta’riflangan (1-rasm). Ular deyarli barcha kerakli kimyoviy birikmalar (alkoksidlar, organik va noorganik tuzlar) o‘z ichiga olgan bir hil eritmadan maxsus moddani qo‘shish yo‘li bilan zol olinadi. Zol bu eritmaning tubiga cho‘kmasdan, uning hajmi bo‘ylab bir tekisda taqsimlanuvchi barqaror nanozarrachalarning suspenziyasidir. Vaqt o‘tishi bilan nanozarralar bir-biriga birlasha boshlaydi va aralashmada bo‘shliqlar paydo bo‘lib, gelning fazoviy ramkasi shakllananadi. Bundan gellarni ma’lum bir haroratlarda quritilganda undagi nanozarrachalar birlashishi natijasida nanoob’ektlar hosil bo‘ladi [3, 179-b.].

Zamonaviy fizik-kimyoviy tamoyillarga ko‘ra, gelning hosil bo‘lishi fraktal tuzilmali zolning shakllanishi boshlanib, oqim nazariyasi asosida bir-biri bilan to‘qnashish natijasida fraktal agregatlarning o‘sishi sodir bo‘ladi [4, 22-25-b.]. Gel shakllanish nuqtasi (gelatsiya) atrofida polimerlar yoki zarrachalar agregatlaridan iborat, tasodifiy joylashgan qo‘shni klasterlar birlashib, yagona tizimli tarmoq hosil qiladi.



1 -rasm. Zol-gel jarayonining sxematik tasviri.

Eritmaning butun hajmi bo‘ylab tekis taqsimlangan yagona klaster tizimi hosil bo‘lganda, oquvchanlik chegarasiga gel shakllanish nuqtasi to‘g‘ri keladi. Gellanish jarayonini eritmaning yopishqoqligini o‘zgartirish orqali kuzatish mumkin (1-rasm) [5, 210-456-b.]. Gel to‘la shakllanib bo‘lganidan so‘ng zol o‘zida nanozarrachalar harakatchanligini yo‘qotadi va bu holat “nam gel” deb ataladi. 2 –

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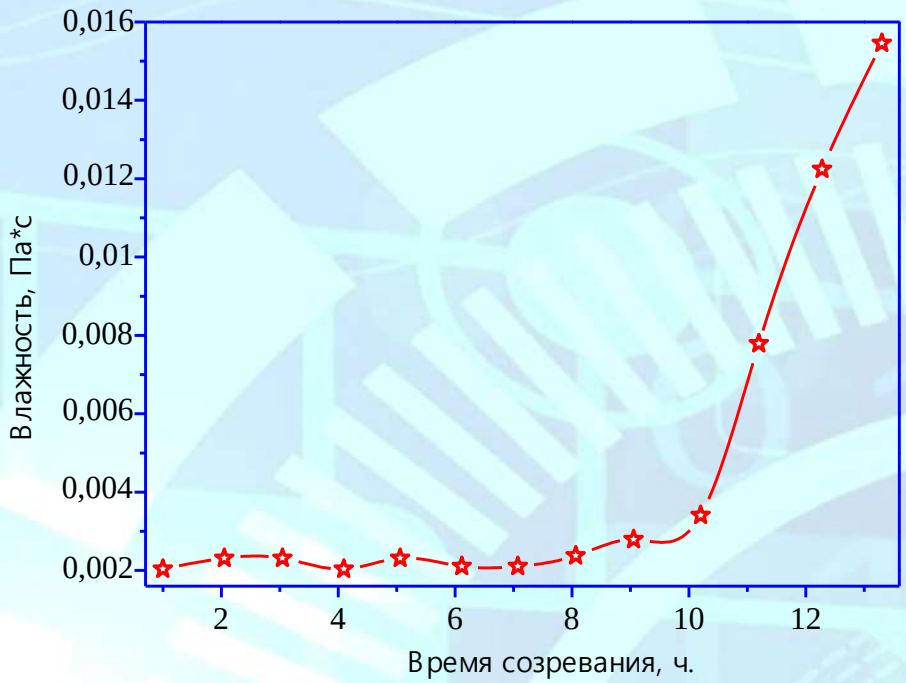
rasmda keltirilgan grafik tahlili, aralashma-eritma tayyorlangandan 10 soat o‘tgandan so‘ng gelning hosil bo‘lish jarayonini dastlabki nuqtasini ko‘rsatilgan. Bu bosqichda gel to‘lalagicha shaffof ko‘rinishda bo‘lmay, oq rangga kirib qoladi.

Gelning shakllanishining dastlabki nuqtasida gellanish jarayoni butunlay to‘xtab qolmaydi va bu gelning qarishi deb atalib, odatda bunday jarayon mobaynida gel tarmog‘ining deformatsiyalanishini hamda g‘ovaklardan suyuqlikni chiqib ketishi natijasida gelning hajmi asta-sekinlik bilan qisqarib boradi.

Zol-gel usulida erituvchini geldan olib tashlash (quritish) jarayoni muhim ahamiyat kasb etadi. Quritish usullariga qarab, har xil mahsulotlarini olish mumkin (1-rasmga qarang). Quritilgan gel kserogel deb ataladi, u yuqori g‘ovaklilik va sirt maydoni bilan ajralib turadi. Aerogel juda past zichlikdagi kserogel bo‘lib, unda nam gelning tuzilishi saqlanib qoladi va g‘ovaklar olib tashlangan suyuqlik fazasi o‘rniga havo bilan to‘ldiriladi.

Zol-gel texnologiyasi, o‘zining, jarayonlarni nisbatan kichik haroratlarda o‘tkazilishi, dastlabki aralashmada tuzlari va oksidlarining erishi natijasida molekulyar darajadagi gomogenligi xususiyati bilan kimyoviy gomogenlash kabi ko‘pgina usullardan afzaldir [6, 368-b.]. Shuning uchun, bu texnologiya murakkab tuzilmali metallooksidlarni, yuqori haroratga sezgir bo‘lgan noorganik gibrid materiallarni, metastabil, lyuminessent, nanotuzilmali va sirtini modifikatsiyalovchi materiallarni, membranalarni olishning samarali usul hisoblanadi. [5, 210-456-b.] tadqiqot ishida zol-gel usuli yordamida shaffof yupqa SnO_2 plenkalari o‘stirilib, uning asosida maydon tranzistorning tuzilmaviy elementlarini ishlab chiqarish uchun bir qator tavsiyalar keltirilgan. Shuningdek, izopropil spirtidagi qalay xlorid tuzining eritmasidan gel hosil bo‘lishi hamda suyuqlikning qovushqoqligini vaqtga bog‘lanishi aniqlangan. Aniqlanishicha, eng optimal vaqt, shaffofligi yuqori plenkalarni tayyorlash uchun 12 soat, past qarshilikli plenka tayyorlash uchun 8 soat qilib tanlab olingan.

ISSN 3030-3907



2 -rasm. Eritmaning dinamik yopishqoqligining vaqtga bog‘liqlik grafigi

Bundan tashqari tayyor gelning sentrafugalash usuli yordamida yupqa SnO_2 plenkalarining olinib, ularning elektr va optik xususiyatlari o‘rganilgan. Xlorli-qalay aralashma-eritmasidan 12 soat davomida tayyorlangan plenkalar eng yaxshi elektrofizik hamda fotoelektrik xossalarga ega ekanligi aniqlangan. **[5, 210-456-b.].**

Metodologiya.

Cho‘ktirish usuli bilan ZnO va SnO_2 plenkalarini olish.

Cho‘ktirish usuli bilan o‘stirilgan ZnO va SnO_2 yupqa plenkalarni olish texnologiyasi bir nechta xususiyatlarga ega.

Birinchidan, qo‘llash paytida har doim qalinlikda farq bor (sentrafugalash paytida radial, suvga botirish paytida chiziqli), bu (yopishqoqlik, tortish tezligi yoki sentrafugalashda aylanish tezligiga) bog‘liq.

Ikkinchidan, suvga cho‘ktirish paytida qalinlikdagi farqni qoplash uchun har bir qatlamdan keyin namunani 180^0 ga burish va natijada bir xil qatlamlarni hosil qilish kerak.

SnO_2 yupqa qatlami 125 ml izopropil spirtli aralashmasidan olingan. SnO_2 plenkasini sintez qilish uchun biz prekursor sifatida 0,5 M molyar konsentratsiyali qalay xlorid digidrat [$SnCl_2 \cdot 2H_2O$] tuzidan foydalaniladi. Birinchidan, bu aralashma oq rangga ega bo‘ladi, so‘ngra IKA RH basis 2 magnit aralashtirgich yordamida 80 °C li haroratda 60 daqiqa vaqt mobaynida eritma rangini to‘liq shaffofga rangga o‘tgunicha aralashtirildi. SnO_2:Sb plenkasini hosil qilish uchun kirishma sifatida surma [$SbOCl_2$:HCl] yoki [$SbCl_3$] shaklidagi xlorli surma ishlatiladi. SnO_2 aralashmasiga $SbCl_3$ ning kiritilishi indiyli (ITO) plenkalari o‘rnini bosadigan kichik qarshilikli shaffof (SnO_2:Sn_2O_3) plenkalarni olish

ISSN 3030-3907

imkonini beradi. Natijada, qalay xloridning ikkita shaffof eritmasi tayyorlandi: har xil tarkibli (1,2,4%) surma xloridning miqdori 125 ml bo‘lgan, prekursorlarning 0,5 M molyar konsentratsiyali legirlangan hamda legirlanmagan eritmalari tayyorlandi. Bu eritmalar xona haroratida 168 soat vaqt davomida quritiladi, qurish jarayonida eritmalar rangini avval shaffofdan oqgacha, keyin sariq rangga o‘zgartiriladi. Oyna tagliklar ultratovushli vannada distillangan suv va izopropil spirti bilan tozalanadi.

Namunalar uchun taglik sifatida mikropreparatlar uchun o‘lchamlari 2,6x7,6 sm^2 bo‘lgan oyna (GOST 9284-75) tagliklardan foydalanildi. Yupqa qatlamlarni o‘stirish uchun 3-rasmda ko‘rsatilgan avtomatik cho‘ktirish qurilmasi qo‘llanildi. O‘stirish jarayoni tezligi 5 sm/min tezlikda amalga oshirildi. Natijada yuzasi 2,6 x 5,5 sm^2 o‘lchamda bo‘lgan plenkalar olindi.

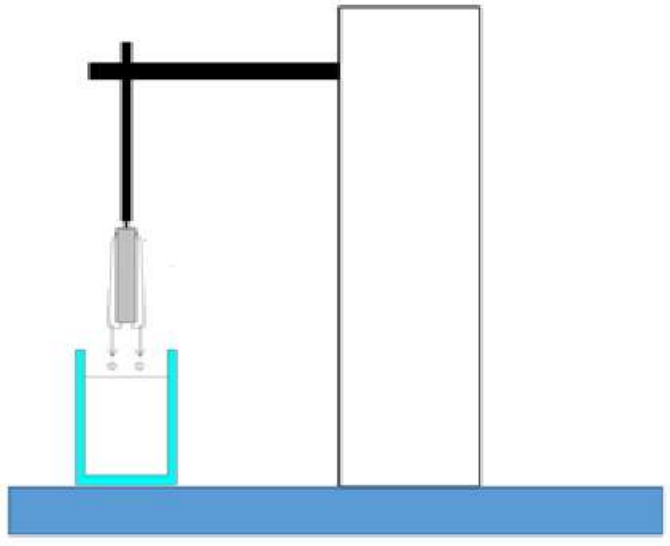
Bunday plenkalar 2 daqiqa vaqt mobaynida havoda 360 °C haroratda quritildi, so‘ngra issiqlik zo‘riqishlari natijasida tagliklarda yoriqlar paydo bo‘lishini oldini olish uchun 2 daqiqa vaqt mobaynida keramik tagliklar ustida sekin sovitildi. Shunday qilib, har bir namunada 10 ta qatlam olindi.

Sprey piroliz usulida ZnO va SnO_2 qatlamlarini olinishi.

Sprey piroliz usuli bilan eritmalar mikropreparatlarga mo‘ljallangan 26x76x1 mm o‘lchamli predmet (GOST 9284-75)oynasida o‘stiriladi. Ushbu oyna 245x60 mm o‘lchamli IK keramik qizdirgich elementi bilan qizdirildi. Sirtdagi haroratlar farqini minimal qilish uchun predmet oynasi isitgich bo‘ylab markazga joylashtirildi. Harorat Hold Pask HP- 1500 pirometri bilan o‘lchandi. Qizdirishda 300 dan 500 °C gacha turli haroratlar sinab ko‘rildi va SnO_2, ZnO uchun optimal deb 420°C tanlandi. Bu usul bilan eritmadan oksid qatlamni o‘stirish uchun soplo diametri d = 0.3 mm bo‘lgan aerograf yordamida aerozol hosil qilindi. Aerografdagi havo bosimi yog‘siz porshenli kompressor AS-186 yordamida olindi. Sprey – piroliz qurilmasini prinsipial sxemasi 4 – rasmda keltirilgan. SnO_2 va ZnO larning sintezi mos metall tuzlarning eritmalaridan amalga oshirildi.

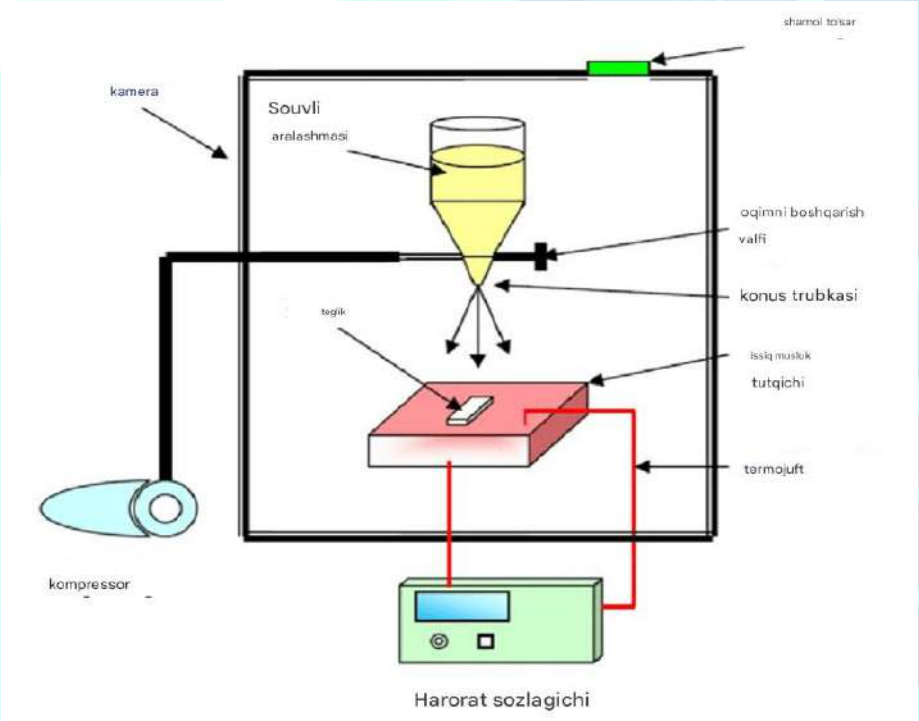
Qalay oksidi yupqa pardasini sintez qilish uchun prekursor sifatida qalay – xlorid [$SnCl_2 \cdot 2H_2O$] dan foydalanildi, sink oksidi esa sink asetatidan [$Zn(CH_3COO)_2 \cdot 2H_2O$] sintezlandi.

ISSN 3030-3907



3-rasm.Cho‘ktirish usulining qurilmasi.

Erituvchi sifatida 200 ml hajmli distrlangan suvdan foydalanildi. Qalay xloridni suvdagi gidrolizidan saqlanish uchun unga 1 ml xlorid kislotasi qo‘shildi. Keyin eritma 30 minut davomida aralashtirildi. Aralashtirish xona xaroratida IKA RH basis 2 magnitli aralashtirgich bilan amalga oshirildi. SnO_2, ZnO yupqa pardalarni sprey – piroliz usuli yordamida olishning soddalashtirilgan sxemasi 4 – rasmda keltirilgan.



4-rasm. Sprey piroliz qurilmasining sxemasi.

Natijalar va Munozara.

SnO_2 va ZnO yupqa pardalarni changlatish 2 mm.sim. ust havo bosimida, 8ml/min tezlikda olib borildi. Changlatuvchi tuynukdan dastlab qizdirib olingan predmet oynasigacha bo‘lgan masofa 85 sm ni tashkil etdi. SnO_2 yupqa parda 18

ISSN 3030-3907

minut davomida bir qavat qilib o‘stirildi. Ko‘p qatlamli ZnO yupqa pardasi taglik haroratini tiklab olish uchun 1 minutdan, 30 sekund tanaffus bilan amalga oshirildi. Shu usulda 14 qatlam hosil qilindi. Metallooksid SnO_2:Sb 1% yupqa parda sintezi 200 ml hajmli izopropil spirti eritmasidan olindi. Sintez uchun prekursor sifatida molyar konsentratsiyasi 0.25 M bo‘lgan qalayning ikki suvli xloridi [$SnCl_2 \cdot 2N_2O$] ishlatildi. Dastlab bu eritma och sut rangga ega bo‘lib, isitgichli IKA Ph basic 2 magnitli aralashtirgichida 80 °C xaroratda 60 minut davomida rangi to‘la shaffof bo‘lgunicha aralashtirildi. Legirlovchi kirishma sifatida surma xloridi [$SbCl_3$] 1 at.% miqdorda surmali yog‘ [$SbONCl_2$:NS1] ko‘rinishida ishlatildi. SnO_2:Sb yupqa pardani changlatish 2 bar havo bosimida, 8 ml/min tezlikda eritma to‘la tugaguncha olib borildi. Changlatuvchi tuynukdan dastlab qizdirib olingan predmet oynasigacha bo‘lgan masofa 35 sm ni tashkil etdi. Bu yupqa pardani o‘stirish 10 sekunddan kichik porsiyalar bilan, 20 sekund tanaffus bilan olib borildi.

Xulosa.

Xulosa qilib shuni aytishimiz mumkinki Zol-gel va Sprey piroliz usuli qolgan usullardan farqi va afzalligi, yupqa qatlamlarni sintez qilish va ulardagi optik xossalarini va yuzada xosil bo’ladigan nuqsonlarni ideal kamaytirish uchun samarali deb olindi. Bundan tashqari laboratoriya xolati hamda ishlab chiqarishga moslashgan sprey o’stirish usuli har bir modda uchun turli hil harorat va atmosfera bosimi gradiyentini aniqlash mumkinligini anglatadi. Sprey piroliz usulida, SnO_2 va ZnO yupqa pardalarni changlatish 2 mm.sim. ust havo bosimida, 8ml/min tezlikda olib borildi. Zol-gel usulida Ko‘p qatlamli ZnO yupqa pardasi taglik haroratini tiklab olish uchun 1 minutdan, 30 sekund tanaffus bilan amalga oshirildi. Shu usulda 14 qatlam hosil qilindi. Xlorli-qalay aralashma-eritmasidan 12 soat davomida tayyorlangan plenkalar eng yaxshi elektrofizik hamda fotoelektrik xossalarga ega ekanligi aniqlangan. Zol-gel va Sprey piroli oksidlarni sintez qilishda eng samarali usul deb xisoblandi.

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ISSN 3030-3907

ARRALI JIN ISHCHI KAMERASI ICHKI YUZALARI VA XOM-ASHYO VALIGI ORASIDAGI ISHQALANISH KUCHLARIGA ISSIQLIK TA'SIRINI O'RGANISH.

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Annotatsiya. Ushbu maqolada arrali jin ishchi kamerasining ichki yuzalari va xom-ashyo aligi orasidagi ishqalanish kuchlariga issiqlik ta'sirini o'rganish masalasi ko'rib chiqiladi. Ishqalanish natijasida hosil bo'ladigan issiqlik miqdori paxta tolalarining fizik-mexanik xususiyatlariga ta'sir ko'rsatib, ularning ishchi kamera ichki devorlari bilan ishqalanish jarayoniga ta'sir etadi. Olingan natijalar asosida issiqlik ta'sirining optimal chegaralarini aniqlash va ish jarayonining samaradorligini oshirish bo'yicha tavsiyalar ishlab chiqiladi.

Kalit so'zlar: Xom-ashyo valigi, ishqalanish, ishchi kamera, issiqlik uzatish, namlik.

Annotation.This article examines the impact of heat on friction forces between the inner surfaces of a saw gin working chamber and the raw material roller. The amount of heat generated due to friction affects the physical and mechanical properties of cotton fibers and influences their interaction with the inner walls of the working chamber. Based on the obtained results, recommendations are proposed to determine the optimal heat impact limits and improve the efficiency of the working process.

Keywords: Raw material roller, friction, working chamber, heat transfer, humidity.

Аннотация.В данной статье рассматривается влияние тепла на силы трения между внутренними поверхностями рабочей камеры пильного джина и валиком сырья. Количество тепла, образующееся в результате трения, влияет на физико-механические свойства хлопковых волокон и их взаимодействие с внутренними стенками рабочей камеры. На основе полученных результатов предлагаются рекомендации по определению оптимальных пределов теплового воздействия и повышению эффективности рабочего процесса.

Ключевые слова: Валик сырья, трение, рабочая камера, теплопередача, влажность.

Kirish

ISSN 3030-3907

Hozirgi vaqtda paxtani dastlabki qayta ishlash texnologiyalarini takomillashtirish, ayniqsa, paxta tolalarini chigitdan ajratish jarayoni va ushbu sohada qo‘llaniladigan texnika hamda texnologiyalarni yanada rivojlantirish bo‘yicha keng ko‘lamli fundamental va amaliy tadqiqotlar olib borilmoqda. Mazkur yo‘nalishdagi ilmiy izlanishlar paxtani jinlash jarayonining energetik va texnologik samaradorligini oshirishga qaratilgan bo‘lib, ilg‘or nazariy yondashuvlar asosida optimal jarayon parametrlarini aniqlash va ishlab chiqarish sharoitlariga mos innovatsion texnologiyalarni yaratishga asoslanadi.Paxta tolalarini chigitdan ajratish jarayonida uning dastlabki fizik-mexanik xususiyatlarini maksimal darajada saqlash, energiya sarfini optimallashtirish hamda yuqori sifatli mahsulot olishga yo‘naltirilgan texnologik yechimlarni ishlab chiqish bugungi kunning dolzarb ilmiy-amaliy vazifalaridan biri hisoblanadi. Shu bilan birga, paxta xomashyosini qayta ishlash jarayonlarida yuzaga keladigan energiya sarfini minimallashtirish, jarayon parametrlarini nazorat qilish va optimallashtirish, shuningdek, yuqori samaradorlikka ega bo‘lgan konstruktsion yechimlarni ishlab chiqish zamonaviy ilmiy izlanishlarning ustuvor yo‘nalishlaridan biri sifatida ko‘rilmoqda.

Adabiyotlar tahlili. Paxta sanoatida ilg‘or texnologiyalarni joriy etish va ishlab chiqarish jarayonlarini optimallashtirish masalalari global miqyosda dolzarb hisoblanadi. Xususan, paxtaga dastlabki ishlov berish texnologiyasini takomillashtirish, arrali jinlarning ishchi organlarini hisoblash va loyihalash metodikasini ishlab chiqish, yangi jin konstruksiyalarini yaratish hamda texnologik parametrlarni optimallashtirish bo‘yicha olib borilgan ilmiy tadqiqotlar muhim ilmiy hamda amaliy ahamiyat kasb etadi.Mazkur yo‘nalishda chet ellik olimlar va muhandislarning izlanishlari paxta sanoatining rivojlanishiga katta hissa qo‘shgan. Jumladan, **P. Pfieger, C.O. Jonkers, A.M. Martinenko, L. Gladinewiez, W. Pampel, H.H. Schommer, N.I. Kolchin, F. Reiner, J. Pfeifer, P. Bernard, G. Veit** kabi yetakchi tadqiqotchilarning ishlari paxtani qayta ishlash texnologiyasining samaradorligini oshirishga qaratilgan muhim ilmiy yechimlarni o‘z ichiga oladi. Ularning tadqiqotlari jin ishchi organlarining optimal ishlash sharoitlarini ta’minlash, paxta xomashyosini qayta ishlash jarayonining texnik va texnologik jihatlarini takomillashtirishga yo‘naltirilgan bo‘lib, ushbu sohadagi innovatsion metodlarni shakllantirish va amaliyotga joriy etishga xizmat qiladi.

Paxta tozalash texnologiyasini rivojlantirish bo‘yicha o‘zbek olimlari ham keng qamrovli tadqiqotlar olib borgan. Xususan, **B. Levkovich, G.I. Miroshnichenko, R.G. Maxkamov, G.D. Djabborov, G.I. Boldinskiy, V.G. Gulidov, P.N. Tyutin, A. Djurayev, M. Tillayev, R.M. Kattaxo‘jayev, A.Ye. Lugachev, B.M. Mardonov, A. Jurayev, S.Z. Yunusov** kabi yetuk mutaxassislarning fundamental va amaliy tadqiqotlari paxta tozalash sanoati fani, texnikasi va texnologiyasini

ISSN 3030-3907

rivojlantirishga sezilarli hissa qo‘shgan. Ushbu olimlarning izlanishlari paxta tolasini chigitdan ajratish jarayonini takomillashtirish, ishlab chiqarish texnologiyalarining samaradorligini oshirish va optimallashtirishga qaratilgan bo‘lib, sohaning rivojlanishiga katta ta’sir ko‘rsatgan.

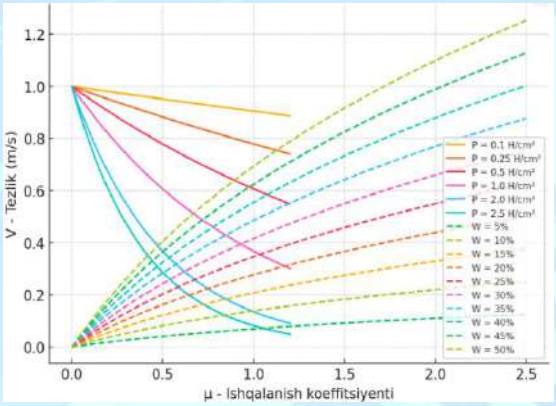
Xususan, arrali jin ishchi kamerasi bo‘yicha ham ko‘plab ilmiy izlanishlar olib borilgan. Jin ishchi kamerasining konstruktiv xususiyatlari va uning paxta xomashyosiga ta’sirini o‘rganish, ishqalanish jarayonining mexanik va termodinamik tahlili, ishchi organlarning optimal harakat parametrlarini aniqlash kabi masalalar ko‘plab ilmiy-tadqiqot ishlari markazida bo‘lib kelgan. Ushbu tadqiqotlar asosida arrali jin ishchi kamerasining samaradorligini oshirish, paxta tolasining sifat ko‘rsatkichlarini yaxshilash va energiya tejamkorligini ta’minlash bo‘yicha muhim ilmiy xulosalar ishlab chiqilgan.Shu bois, arrali jin ishchi kamerasi va uning ichki yuzalarining xom-ashyo aligi bilan o‘zaro ta’siri, ishqalanish kuchlari ta’sirida hosil bo‘ladigan issiqlik miqdori va uning paxta tolalarining fizik-mexanik xususiyatlariga ta’siri kabi jihatlarni batafsil o‘rganish ilmiy va amaliy jihatdan muhim ahamiyat kasb etadi. Mazkur maqolada aynan ushbu masalalar yuzasidan olib borilgan tadqiqot natijalari taqdim etiladi.

G.I. Miroshnichenko paxta xom-ashyosi ishqalanish koeffitsiyenti paxtaning nisbiy namligi va nisbiy siljish tezligiga bog‘liqligini tadqiqotlarida o‘rgangan. Paxta xom-ashyosining ishqalanish koeffitsiyenti quyidagi omillarga bog‘liq:

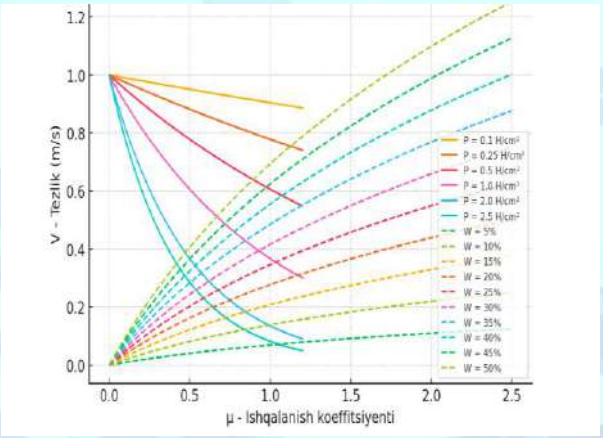
- nav
- namlik
- bosim
- nisbiy siljish tezligi.

Ishqalanish koeffitsiyenti quyidagi nomogrammda rezina (a-rasm) va po‘lat(b-rasm) yuzalar uchun o‘zgarish satxlarini ko‘rishingiz mumkin.

ISSN 3030-3907



a



b

1-rasm. a-paxa xom-ashyosining rezina sirti bilan ishqalanish nomografikasi; b-paxta-xom ashyosining po‘lat yuza bo‘yicha ishqalanish koefitsiyenti, w-paxta xom-ashyosi namligi, P-bosim.

Paxta xom-ashyosining ishqalanish koeffitsiyenti quyidagi omillarga bog‘liq:

- nav,
- namlik,
- bosim,
- nisbiy siljish tezligi.

Namlik oshishi bilan xom-paxtaning po‘lat yuzaga bo‘lgan ishqalanish koeffitsiyenti ortadi, lekin transporter lentasi uchun kamayadi. Nisbiy siljish tezligi oshganida po‘lat yuzada ishqalanish koeffitsiyenti ko‘payadi, transporter lentasi uchun esa turli namlik diapazonlariga bog‘liq holda o‘zgaradi. Masalan, namlik 10% bo‘lganda ishqalanish ortadi, lekin 42% ga yetganda kamayadi.[1]

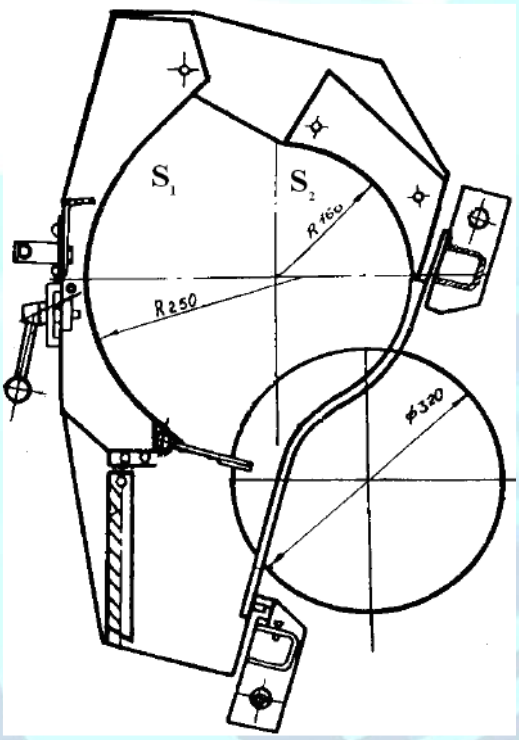
Yuqoridagi nomogrammadan xulosa qilish mumkinki paxta xom-ashyosi va po‘lat yuza orasidagi ishqalanish koeffitsiyenti namlik ortishi bilan oshar ekan.Demak Arrali jin mashinasining ishchi kamerasi va xom-ashyo valigi orasidagi ishqalanish kuchini kamaytirsh uchun paxta xom-ashyosi namligini pasaytirishimiz talab etilar ekan.

Ishchi kamera ichki yuzasi va xom-ashyo valigi orasidagi ishqalanish kuchini kamaytirish maqsadida bir nechta ishlar amalga oshirilgan.S.Z. Yunusovning tadqiqotlariga ko‘ra, arrali jin mashinasining ishchi kamerasining old fartuk qismiga issiqlik ta’sirini qo‘llash orqali uning energiya tejamkorligini oshirish mumkin. Olim tomonidan olib borilgan tajribalarda O‘zbekistonda keng foydalanilayotgan 5DP-130 va 4DP-130 markali jin mashinalarining geometrik o‘lchamlariga mos keladigan 30 ta arrali laboratoriya jin mashinasida o‘tkazilgan tahlillar natijalari bu fikrni tasdiqlaydi. Issiqlik ta’siri ostida xomashyo valigi hamda old fartukning ichki yuzalaridagi ishqalanish kuchlari sezilarli darajada kamaygan. Natijada esa mashinaning umumiy energiya sarfi kamaygan.[2]

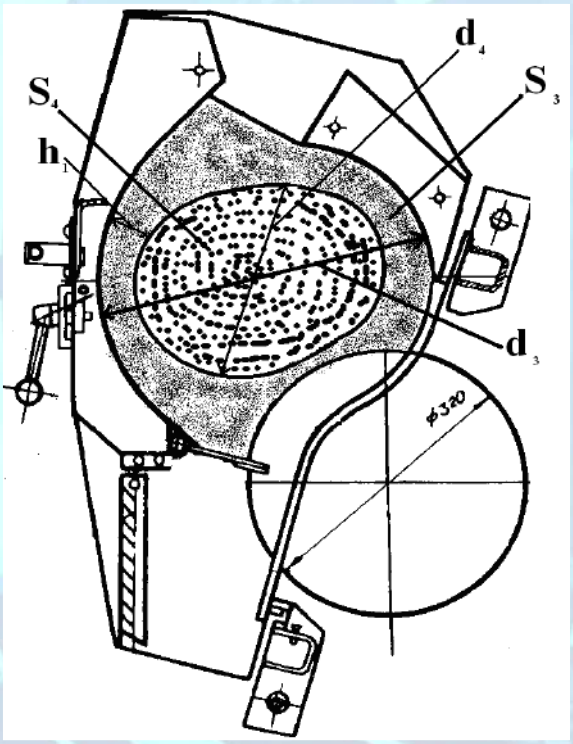
ISSN 3030-3907

Tadqiqot usuli va materiallar:"Tajribalar 30 arrali paxta tozalash jin mashinasida paxta tozalash mashinasi ishchi kamerasining ichki yuzalariga(old fartuk va orqa to‘sin) issiqlik berish orqali amalga oshirilgan. Eksperimentlar turli haroratlarda (60°C, 70°C, 80°C,) Andijon-35 III-sanoat navi 2-sinf , 9, 12 va 15% namliklarda amalga oshirilgan.Bizga ma’lumki 30 ta arrali labaratoriya jin mashinasining deyarli barcha parametrlari mavjud arrali jinlarga deyarli mos keladi. Shu sababli ushbu jin mashinasida olingan natijlar mavjud mashinlar uchun o‘rinli va ko‘plab tadqiqotlar davomida o‘z isbotini topgan.(2-rasm)

Natijalar.Tajriba davomida mashina ishchi kamerasidagi ishqalanish kuchlarini topib olish uchun kamera ichidagi paxta xom-ashyosining massasini hamda ishchi kameraning hajmini aniqlashimiz talab etiladi. Ishchi kamera ko‘ndalang kesim yuzasi va ishchi kamera uzunligi L=538 mm ekanini hisobiga olib hajmini va 2-rasmda ko‘rsatilgan jin ishchi kamerasini chap va o‘ng qismini yuzasini hisoblaymiz:



a-rasm



b-rasm

2-rasm.Jin mashinasining 30 arrali tajriba o‘tkazishga mo‘ljallangan qurilmasining ko'ndalang qirqim yuzasi

a-rasmda jin ishchi kamerasining geometrik tuzilishi, b-rasmda jin ishchi kamerasida xom ashyo valigining qatlamlarini joylashishi.

ISSN 3030-3907

Bu hisobimizda na’lum xatolik bo‘lishi mumkin, sababi e’tiborga olinmagan va ba’zi kattaliklar yaxlitlab olingan.

$$S_1 = \frac{\pi \cdot R_1 \cdot \alpha}{360^0} = \frac{\pi \cdot (0.25)^2 \cdot 150^0}{360^0} = 0{,}082\ m^2$$

$$S_2 = \frac{\pi \cdot R_2^2}{2} = \frac{\pi \cdot (0{,}168)^2}{2} = 0{,}044\ m^2$$

$$S = S_1 + S_2 = 0{,}082 + 0{,}044 = 0{,}126\ m^2$$

$$V = S \cdot L = 0{,}126 \cdot 538 = 0{,}067\ m^3$$

Tadqiqotchilar tomonidan jin ishchi kamerasining hajmini kompyuter dasturi orqali hisoblaganda V_0 =0,067m^3 ekanligi aniqlangan. Bu ko‘rsatkichning aniqlik darajasi yuqori bo‘lganligi sababli keyingi hisoblashlarimizda ishchi kamera hajmi V_0 =0,067m^3 deb hisoblaymiz.[3]

Paxta xom ashyosini o‘rtacha zichligi $\rho_0 = 325\ kg/m^3$ ekanini hisobga olib, ishchi kameradagi xomashyo valigining o‘rtacha massasini hisoblaymiz:

$$m_0 = \rho_0 \cdot V_0 = 325 \cdot 0{,}067 = 22 \quad kg$$

Jin mashinasining ishchi kamerasi ichidagi paxta xom-ashyosining masasini aniqlagan holda uning ichki yuzalar orasidagi ishqlanish kuchlarini aniqlashimiz mumkin.

1-jadval

Sinov rejimi	Paxta xomashyosining navi va sinfi	Belgilangan xaroratlar		Namlik, % va ishqalanish koeffitsiyenti			
		Old fartu k ^{0}C	Orqa fartu k ^{0}C	9	12	15	
				μ_{ish}	μ_{ish}	μ_{ish}	
1	Andijon III/2	-	-	0.4	0.43	0.46	
2	-//-	60	60	0.382	0.413	0.442	
3	-//-	60	70	0.379	0.409	0.438	
4	-//-	60	80	0.376	0.404	0.431	
5	-//-	70	60	0.379	0.407	0.434	

ISSN 3030-3907

6	-//-	70	70	0.375	0.404	0.430	
7	-//-	70	80	0.372	0.399	0.425	
8	-//-	80	60	0.371	0.398	0.426	
9	-//-	80	70	0.367	0.395	0.420	
10	-//-	80	80	0.352	0.392	0.419	

Tahlil: Natijalar shuni ko‘rsatadiki, issiqlik berish jarayonida ishqalanish koeffitsiyenti ichki yuzalarga issiqlik berish natijasida ma’lum bir darajagacha oshishini kuzatildi. 1-jadvaldan ko’rish mumkinki kameraning ichki ikkala devoridagi temperaturaning oshishi ishqalanish koeffitsiyentini kamayishiga olib keladi.Eng maksimal xolatda ichki old devor harorati 80°C va orqa devor harorati 80°C bo‘lganda ishqalanish koeffitsiyentini kamayishi maksimalni tashkil qilishini lekin paxtaning namligi 12% miqdordan yuqori namlikda asta pasayishini kuzatishimiz mumkin. Optimal parameter ichki old devor uchun 80°C va ichki orqa devor uchun 70°C darajada ishqalanish koeffitsiyentini kamayishi 7.6% gacha yetishi ma’lum bo‘ldi.

Xulosa. Ushbu tadqiqotda paxta tozalash jarayonida issiqlik berishning ishqalanish koeffitsiyentini kamayishiga ta'siri o‘rganildi. Tadqiqot natijalariga ko‘ra, issiqlik ta'siri paxta namligi va haroratining jarayon samaradorligiga ta'siri ko‘rsatildi, shuningdek, issiqlik berish tizimlarining optimallashtirilishi ish unumdorligini oshirishi aniqlandi.

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ISSN 3030-3907

MUQOBIL ENERGIYA MANBALARIDAN FOYDALANISHDA YARIM O'TKAZGICHLI QUYOSH ENERGIYALARINI PARAMETRLARINI ANIQLASH

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Anotatsiya: Ushbu maqolada hozirgi paytda o'rganilish ko'lami kengayib borayorgan kukunli texnoilogiya asosida yarimo'tkazgichli materiallar olish usullari va olingan materialni elektrofizik xossalarini o'rganishga qaratilgan. Astronomik kuzatishlarni fizika qonuniyatlari orqali tushuntirishdagi ba'zi muloxazalar yuritilgan.

Kalit so'zlar: Mikroelektron qurilma, metallurgiya, kibernetika, avtomatika, rodar texnikasi, Chaxral usuli, sharli va aylanma bolg'ali tegirmonlar.

Аннотация: Целью данной статьи является исследование методов получения полупроводниковых материалов и электрофизических свойств получаемого материала на основе порошковой технологии, что в настоящее время расширяет сферу исследований.

Ключевые слова: Микроэлектронные устройства, металлургия, кибернетика, автоматизация, радиолокационная техника, метод Чахрала, шаровые и молотковые мельницы.

Abstract: This article aims to study the methods of obtaining semiconductor materials and the electrophysical properties of the obtained material based on powder technology, which is currently expanding the scope of research.

Key words: Microelectronic device, metallurgy, cybernetics, automation, radar technique, Chakhral method, ball and rotary hammer mills.

Kirish

Yarim o'tkazgichli elektronikasiz va mikroelektronikasiz ilmiy-texnikaviy rivojlanishni tasavvar qilib bo'lmaydi. Turli xil yarim o'tkazgichli asboblar va mikrosxemalar tayyorlashda yarim o'tkazgichli materiallar va ko'p qatlamli strukturalardan keng foydalaniladi. Sifatli yarim o'tkazgich materiallarni ishlab chiqarishni rivojlantirish, ularning sifatini sanoat sharoitida tekshirish va ishlab chiqarilayotgan materiallarning sifatini yuqori darajaga ko'tarilishiga bog'liq. Bu esa ishlab chiqarishdagi texnologik yo'qotishlar , ishlab chiqarilayotgan materialning sifatini nazorat qilishga ketgan moddiy harajatlar o'lchamlarini aniqlash imkonini beradi. Bundan ko'rinadiki, sanoat korxonalarini yuqori aniqlikdagi va ishlab chiqarish unimdorligi yuqori bo'lgan vositalar bilan jixozlash

ISSN 3030-3907

, yarim o’tkazgich materiallarning sifatini tekshirish uchun ilg’or yangi usullardan foydalanish va ishlab chiqarish lozim.

Quyosh energiyasi yiliga 505 GVt ni tashkil qiladi, bu dunyodagi elektr energiyasining taxminan 2% ni tashkil qiladi. Quyosh energiyasidan quyosh nuri tushadigan har qanday joyda foydalanish mumkin; Biroq, elektr energiyasini ishlab chiqarish uchun ishlatilishi mumkin bo'lgan quyosh energiyasi miqdori ob-havo sharoiti, geografik joylashuv va kun vaqtiga ta'sir qiladi [15.28]

Hozirgi paytda integral mikrosxemalar uchun asosiy material kremniy monokristalidir. Albata yangi materiallar masalan geliy, arsenedi, indiy, fosfidi va oshqa materillar ustida ham tekshiruv ishlari olib boriliyapti.

Hozirgi zamon elektronikasida epitaksial strukturalar, polikristal va amorf yarimo‘tkazgichalar ham turli zamonaviy yangi asboblarni yaratilishiga olib kelmoqda. Polikristal yarimo‘tkazgichlarni

Olishning muhum axamiyati shundaki; **birinchidan,** polikristal quyma yoki parda ko‘rinishida yarimo‘tkazgich olish monokristallarga nisbatan soda va ancha unumdor texnologik jarayon hisoblanib, bu yarimo‘tkazgich modda va uning asosida tayyorlangan asboblarni ancha arzonlashtiradi; **ikkinchidan,** olingan ushbu yarimo‘tkazgichlardan donalar chegaralari maxsus elektrik va rekombinatsion xossalarga ega hamda ulardan bir qator asboblar yaratishda foydalanish mumkin; **uchinchidan,** kristal panjarasining tuzulishi jiddiy nuxsoni bo‘lmish donalar chegarasi samarali ichki getter vazifasini o‘tab, qoldiq krishmalar va xususiy nuqtaviy nuqsonlardan moddaning asosiy xajmini tozalash imkonini beradi bu xossa elektron qurilmalarning temperatura o‘zgarishiga barqarorligini va radiatsion bardoshliligini oshiradi.[76.98]

Bu yo’l bilan yarim o’tkazgich materiallar va strukturalarni ishlab chiqish iqtisodiy samaradorlikka olib keladi. Yarim o’tkazgichlarning hamma parametrlarini har doim oddiy va qulay bo’lgan usullar bilan o’lchash afsuski mumkin emas. Ularni ko’pchiligini o’lchash maxsus fizik usullardan hamda murakkab aparaturalardan foydalanishni talab qiladi. Shuning uchun so’ngi yillarda yarim o’tkazgichlarning parametrlarini o’lchash usullari yarim o’tkazgich fizikasi va texnikasi bo’limlari bilan bir qatorda rivojlanib mustaqil bo’lib qolmoqda.

Yarimo‘tkazgichlar elektronikasining muvaffaqiyatlari yarimo‘tkazgichli materiallar texnologiyasi yutuqlari bilan bog‘langan. Ananaviy hamda yangi yarimo‘tkazgichli materiallarni o‘zlashtiribsifatini keskin yaxshilash yangidan – yangi diskret yarimo‘tkazgichli asboblar va katta, o‘ta katta, o‘ta tezkor integral mikrosxemalarni yaratishga olib keladi. Natijada mikroelektron qurilmalarni miniatyurizatsiyalash darajasini yetarli darajada oshirish bilan yangi optoelektron

ISSN 3030-3907

va o‘ta yuqori chastotali asboblar yaratilishiga olib keladi. Elektron texnikada keng o‘lchamdagi murakkab masalalar yarimo‘tkazgichli materiallarni yangilarini yaratishni talab qilib qo‘ymoqda.

Polikristal qatlamlar amaliy qo‘llanishida quymalarga nisbatan samarali hisoblanadi. Eng ko‘p qo‘llaniladigan kremniy plikristal qatlamlardan integral sxemalarning tarkibiy qismlari – rezistorlar, diodlar, maydoniy va qo‘shqutubli tranzistorlar tayyorlashda foydalaniladi.

Yerda ishlatiladigan arzon Quyosh batareyalari yaratish uchun polikristal qatlamlardan foydalanilmoqda. Polikristal pardalar arzon tagliklar (kvarts, shisha, gafit, alund, molibden va h.k) asosida olinib, yetarlicha samarali Quyosh batareyalarini tayyorlash uchun ishlatiladi. Ularning foydali ish koeffitsenti 12% - 155 tartibida bo‘ladi.

Hozirga kunda polikristal kremniyning keng qo‘llanilishi eng muhimi Yer yuzida Quyosh energiyasidan to‘la foydalanish borasida izlanishlar bu materialni olish texnologiyasini yanada arzonlashtirish va elektrofizik xossalarini yaxshilash masalalarini yanada aktuallashtirib yubordi. Shu maqsadda polikristal kremniy olishni kukunli texnaligiya asosida yangi texnalogiyasini ishlab chiqish ustida izlanishlar boshlangan va davom etmoqda. Yarimo‘tkazgichlar elektronikasining muvaffaqiyatlari yarimo‘tkazgichli materiallar texnologiyasi yutuqlari bilan bog‘langan. Ananaviy hamda yangi yarimo‘tkazgichli materiallarni o‘zlashtiribsifatini keskin yaxshilash yangidan – yangi diskret yarimo‘tkazgichli asboblar va katta, o‘ta katta, o‘ta tezkor integral mikrosxemalarni yaratishga olib keladi. Natijada mikroelektron qurilmalarnim iniatyurizatsiyalash darajasini etarli darajada oshirish bilan yangi optoelektron va o‘ta yuqori chastotali asboblar yaratilishiga olib keladi. Elektron texnikada keng o‘lchamdagi murakkab masalalar yarimo‘tkazgichli materiallarni yangilarini yaratishni talab qilib qo‘ymoqda.

Yarim o’tkazgichli namunani solishtirma qarshiliguni uning to’la qarshiligi bo’yicha aniqlashda solishtirma qarshilik ρ ni namunaning to’la qarshiligi bo’yicha topishda tayoqcha (sterjen) korinishidagi namunani ko’ndalang kesimlariga metal kontakt olish usulidan foydalaniladi. [25.53.75]

Hozirgi zamon elektronikasi birinchi nomerli materiali kremniy bo‘lib qolmoqda. Kremniy poli va monokristali ananaviy usullar; zonali eritish va Chaxral usullarida olinmoqda. Integral mikrosxemalar yaratishda monokristall quyma diametri katta ahamiyatga ega bo‘lib, hozirga kunda Chaxral usulda olingan kremniy monokristall quyma diametri 150 – 200 mm, uzunligi esa 1000 mm ga etadi. Elektron texnikada chetroepitakonal strukturalarini olish mikroelektronikada va optoelektron qurilmalarda katta ahamiyatga ega bo‘lishi

ISSN 3030-3907

kutilmoqda. Hozirga kuda aniq bo‘ldiki, ko‘pqatlamli epitaksial strukturalar asosida murakkab elektron qurilmalar yaratish mumkin. Biroq bunday qurilmalarni yaratish uchun har bir qatlam strukturasini takomillashganiga, elektrofizik xossasiga va keskin p – n – o‘tishlarni olinishiga, epitaksial chetrogegara maydonlariga va boshqalarga katta talablar qo‘yadi. Bu erda shuni aytib o‘tish kerakki, o‘ta yupqa ko‘p qatlami epitanenel qatlamlarni yaratish yangi asboblar va ananaviy elektron qurilmalarning xarakteristikalarini keskin yaxshilash mumkin. Buning uchun juda yuqori sifatli materiallar yaratish va atom sathida ularni xossasini boshqarish usullarini ishlab chiqarish kerak.

1. Yarim o’tkazgich materialning solishtirma qarshiligi harorat oshishi bilan (0K dan) eksponensial qonun bilan kamayadi. Masalan, kremniyning harorati T=100°K dan 300°K ga oshaganda , uning solishtirma qarshiligi qiymati 10^{24} Om*sm dan $2*10^{5}$ Om*sm gacha, ya’ni 10^{18} karra kamayadi. Shu oraliqda eng yaxshi metall oltinni solishtirma qarshilagi bor yo’g’i 17% ortadi. Demak, yarim o’tkazgichlarni elekrt xossalarini harorat yordamida juda katta oraliqda boshqarish mumkin bo’ladi. Bu yarim o’tkazgichlarga xos juda noyob xossadir.

2. Yarim o’tkazgich materiallarning solishtima qarshiligi kirishma atomlarga o’ta sezgir bo’ladi. Misol uchun oltinga 30% mis yoki InGa moddasi qo’shilsa, uning solishtirma qarshiligi 3% gagina o’zgaradi xalos. Su holda xususiy 1kg Si ga 0,001 mg ya’ni Si dagi atomlar sonidan 10^{9} marta kam bo’lgan B, P yoki Sb ni qo’shadigan bo’lsak, uning solishtirma qarshiligi 10^{3} marta oshadi. Demak, xona haroratida Si ning solishtirma qarshiligi faqat krishma atomlar konsentratsiyasi $10^{11} \div 10^{19}$ sm^{-3} ga oshirish hisobiga uning solishtirma qarshiligi $\rho \approx 10^{5}$ Om*sm dan $\rho \approx 10^{-3}$ Om*sm ga o’zgartirish mumkin. Xulosa qilsak, yarim o’tkazgichlarga kirishma elementlari kritilganda ularning xususiyatlarining keskin o’zgarish ham ularning noyob xossaga ega ekanligidan dalolat brradi.

Yuqorida keltirganlarimizdan suni aytish joyizki, bu o’ta noyob xossalari bilan yarim o’tkazgichlar hozirga zamon elektronikasi, mikroelektronikasi va nanoelektronikasining asosi hisoblanadi. Yarim o’tkazgichlar fizikasi va yarim o’tkazgichli elektronika masalalari yoritilgan kitoiblar soni ko’p, lekin bu qo’llanmalarda yarim o’tkazgichlarning parametrlarini o’lchash va yarim o’tkazgich materiallarni tekshirish usullariga e’tibor kam qaratilgan. Oxirga chop etilayotgan yarim o’tkazgichlar , ularni parametrlarini o’rganishga oid qo’llanmalarda masalaning bu jixatiga e’tibor qaratila boshlangan. Bu esa shu soxada ilmiy ishlar qilayotgan yosh olimlarga bir qator engilliklar paydo bo’lishiga olib kelmoqda.[122.210]

ISSN 3030-3907

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ISSN 3030-3907

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TOSH TUTGICH USKUNASINING KONSTRUKSIYASINI TAKOMILLASHTIRISHNING TOZALASH SAMARADORLIGIGA TA’SIRI

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Annotatsiya. Begona og‘ir aralashmalar chigitli paxtani saqlash bilan bir qatorda qayta ishlash jarayonida ko‘pgina salbiy muammolar keltirib chiqaradi. Ishlab chiqarish jarayoniga uzatilayotgan chigitli paxta tarkibidagi og‘ir aralashmalarni keyingi texnologik jarayonga o‘tib ketishi natijasida tozalash mashinalarining ishchi organlariga urilishi natijasida yong‘in chiqish xavfi yoki jin va linter arralarining shikastlanishiga olib keladi. Ushbu maqolada paxta tozalash korxonalarida ishlatiladigan tosh tutgich uskunasining konstruksiyasini takomillashtirish orqali og’ir aralashmalardan tozalash samaradorligini oshirishga qaratilgan texnologik va konstruktiv yechimlar berilgan.

Kalit so’zlar. Paxta, og’ir ifloslik, tola, tozalash, tosh, rezina, baraban, cho’ntak.

Аннотация. Тяжелые примеси вызывают множество негативных проблем при переработке семян хлопчатника, а также при хранении. Тяжелые примеси в семенах хлопка, передаваемых в производственный процесс, могут переноситься в следующий технологический процесс и попадать на рабочие органы очистительных машин, вызывая опасность возгорания или повреждения волокноотделительных и льноочистительных пил. В данной статье представлен анализ воздействия устройств очистки мелких примесей, используемых в хлопкоочистительных машинах, и предложенной конструкции ворсового оборудования новой конструкции на хлопок и исследование движения хлопка в нем.

Ключевые слова. Хлопка сыра, мелкий сор, корткий волокна, очистит, пух, колок, барабан, питательный, песочное площадь.

ISSN 3030-3907

Annotation. Heavy impurities cause many negative problems during cotton seed processing and storage. Heavy impurities in cotton seeds transferred to the production process can be transferred to the next technological process and get onto the working parts of cleaning machines, causing the risk of fire or damage to the fiber separation and flax cleaning saws. In this article, analysis of the effects of small impurity cleaning devices and the proposed new design pile equipment on cotton and the study of cotton movement in cotton gins are presented.

Keywords. Cotton, small impurities, short fiber, cleaning, fluff, stick, drum, feeder, mesh surface.

Kirish

Jahon tajribasida paxta xom ashyosiga ishlov berish jarayonini, texnika va texnologiyasini rivojlantirishga katta ahamiyat berilmoqda. Jumladan, paxta xom ashyosini havo transportida tashish jarayonining samaradorligini oshirish, tola va chigitning dastlabki sifat ko‘rsatkichlarini saqlash va jarayonlarning energiya sarfini kamaytirish, uskunalariningixcham, sodda, kam material va energiya sarflaydigan konstruksiyalarini, zamonaviy, avtomatlashgan, maxsulot sifatini boshqara oladigan texnologiyalarini yaratish, shuningdek yaratilgan ilg‘or texnika va maxsulot sifatini yaxshilash va tannarxini pasaytirish mazkur sohani rivojlantirishning asosiy omillaridan hisoblanadi.

Respublikamizning paxta tozalash korxonalarida joylashgan g‘aramlardagi paxtani ishlab chiqarish bo‘limlarga yetkazib berishda mehnat hamda energiya sarfini kamaytirish va ish unumdorligini oshirishga qaratilgan yangi texnologiyalarni yaratish bo‘yicha tadqiqotlar o‘tkazish, ularni amalda qo‘llash bo‘yicha keng ko‘lamli chora-tadbirlar amalga oshirilmoqda. «2022-2026 yillarga mo‘ljallangan yangi O‘zbekistonning taraqqiyot strategiyasi to‘g‘risida» ko‘rsatilgan «Milliy iqtisodiyot barqarorligini ta‘minlash va yalpi ichki mahsulotda sanoat ulushini oshirishga qaratilgan sanoat siyosatini davom ettirib, sanoat mahsulotlarini ishlab chiqarish hajmini 1,4 marotabaga oshirish» [1] bo‘yicha vazifalar belgilangan. Ushbu vazifani paxta sanoatida bajarishda paxtani dastlabki ishlash texnologik jarayonlarini, xususan, paxtani pnevmotransport tizimida shikast yetkazmasdan tashish jarayoni samaradorligini oshirish, pnevmoquvurlarni germetikligini ta’minlash orqali energiya sarfini kamaytirish, pnevmoquvur materialini o‘ziga xos xossaga ega bo‘lgan materialga o‘zgartirish va parametrlarini asoslash muhim masalalardan hisoblanadi.

Paxta xomashyosi tarkibidan og‘ir aralashmalarni samarali ajratib olish jarayonini takomillashtirish muammosi juda muhimligiga qaramasdan, hozirgi paytgacha yetarlicha samaradorlikka ega bo‘lgan begona jismlarni tutivchi hamda tola va chigitning tabiiy xusussiyatlarini saqlab qoluvchi uskunalar ishlab

ISSN 3030-3907

chiqarilmagan. Shuning uchun, paxtani qayta ishlash texnologik zanjiriga og‘ir aralashmalarni tutib qoluvchi past samaradorlikka ega bo‘lgan bir necha qurilmalar qo‘yilib, ular tola va chigitning nuqsondor bo‘lishiga sababchi bo‘lmoqda, ishlab chiqarish unumdorligi va havo yordamida tashuvchi qurilma harakat radiusini kamaytirmoqda.

Toshtutgich konstruksiyalarida mavjud bo‘lgan asosiy kamchiliklar, tola va chigitni nuqsondor bo‘lishiga hamda uning geometrik va texnologik o‘lchamlari xomashyo tarkibidan og‘ir aralashmalarni to‘la tutib qolish imkonini bermayapti.

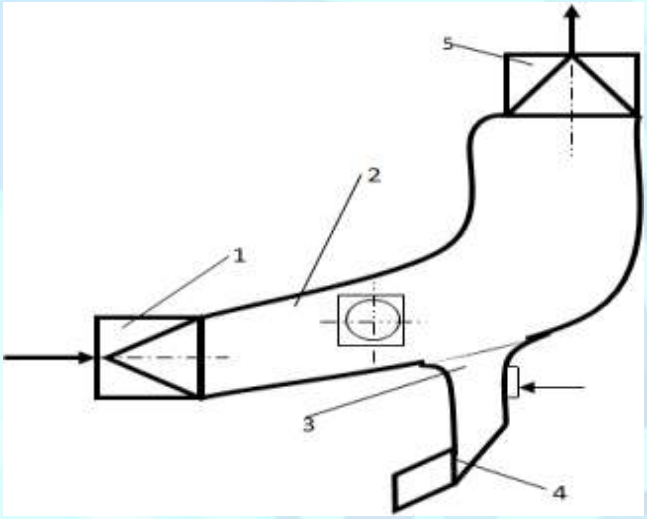
ADABIYOTLAR TAHLILI. Ma’lumki dala maydonlarida yetishtirilgan chigitli paxtani terish va bir joydan ikkinchi joyga tashish jarayonida uning tarkibiga turli xildagi begona jismlar qo‘p miqdorda qo‘shilib ketishi kuzatiladi. Shuning uchun paxta tozalash korxonalariga va paxta tayyorlov maskanlariga keltirilgan chigitli paxtaning tarkibida og‘ir aralashmalar va begona qattiq jismlar (tosh, qum, kesak, metall parchasi, va boshqa jismlar) ning ko‘p uchraydi. Ushbu begona og‘ir aralashmalar chigitli paxtani saqlash bilan bir qatorda qayta ishlash jarayonida ko‘pgina salbiy muammolar keltirib chiqaradi. Ishlab chiqarish jarayoniga uzatilayotgan chigitli paxta tarkibidagi og‘ir aralashmalarni keyingi texnologik jarayonga o‘tib ketishi natijasida tozalash mashinalarining ishchi organlariga urilishi natijasida yong‘in chiqish xavfi yoki jin va linter arralarining shikastlanishiga olib keladi. Natijada arralarning ishlash muddati kamayib, korxonaning iqtisodiy qismiga salbiy zarar yetkazadi.

Tadqiqotning asosiy maqsadi paxta xom ashyosi tarkibidagi og‘ir aralashmalarni ajratish jarayonida paxtaning tabiiy xususiyatlarini saqlab qoluvchi toshtutgich qurilmasida, shu davrgacha bajarilgan ilmiy tadqiqot ishlarining talilini o‘tkazish va yangi samarador toshtutgich qurilmasini yaratish. Bu masalani amaliy va nazariy tomondan asoslab, ishlab chiqarish sharoitida sinov o‘tkazishdan iborat.

Hozirgi kunda paxta tozalash korxonalarida keng qo‘llanilib kelinayotgan toshtutgich uskunalaridan 2CHTL markali chiziqli toshtutgich bo‘lib, kirish quvuri 1, ajratish kamerasi 2, yuk tushurish kamerasi 3, plastinin klapan 4 va chiqish quvuri 5 dan iborat. Uning sxemasi quyidagi rasmda keltirilgan (1-rasm).

Paxta bilan aralashib kelgan og‘ir qo‘shilmalar quvur (1) orqali ajratish kamerasi (2) ga keladi. Bu yerda og‘ir aralashmalar toshtutgichning qo‘zg‘almas devoriga urilganda tezligining yo‘qolishi, havo o‘tkazgichning ko‘ndalang kesim yuzasini birdaniga kengayishi hisobiga ularning ajralishi sodir bo‘ladi. Og‘ir aralashmalar yuk tushirish kamerasi (3) ga tushadi va moslamadan plastininning zaslonkasi (4) ochilganda chiqarib yuboriladi. Paxta esa chiqarish quvuri 5 orqali toshtutgichdan chiqariladi va navbatdagi tashish tizimiga yo‘naltiriladi. 2CHTL markali chiziqli toshtutgichning tutib qolish samaradorligi 60-70% ga yetadi.

ISSN 3030-3907



1-rasm. 2CHTL markali toshtutgich.
1-kirish quvuri, 2-ishchi kamera, 3-cho‘ntak, 4- klapan, 5- chiqish quvuri.

Ushbu qo‘llanilib kelinayotgan toshtutgichlarning asosiy kamchiliklari paxtaning toshtutgich ishchi kamerasida yetarli darajada titilmasligi va og‘ir aralashmalarni ajratish unumdorligining pastligidadir.

Paxtadan og‘ir aralashmalarni ajratib olish jarayonini takomillashtirish muammosi juda muhimligiga qaramasdan, hozirgi paytgacha yetarlicha samaradorlikka ega bo‘lgan uskunalar yaratilmagan. Shuning uchun paxtani qayta ishlash texnologik zanjiriga og‘ir aralashmalarni tutib qoluvchi past samaradorlikka ega bo‘lgan bir necha qurilmalar qo‘yilgan bo‘lib, ishlab chiqarish unumdorligi hamda tashish jarayonining harakat radiusini kamaytirmoqda va paxtaning sifat darjasini pasayishiga olib kelmoqda [2].

TADQIQOT METODOLOGIYASI. Mavjud chiziqli toshtutgichlarning ishchi kamerasi ko‘p xollarda silindrik yoki to‘g‘ri to‘rtburchak shaklida bo‘ladi. To‘g‘ri to‘rtburchak shaklidagi ishchi kamerali toshtutgichlar ko‘proq uchraydi.

Kamera kengligi og‘ir aralashmalarni tutib qolish jarayonida ishlanayotgan materialni normal holatda harakatlanishini ta’minlaydi [3].

Kamera kengligi yetarlicha katta, material qatlami unga qaraganda kichik bo‘lsa, og‘ir aralashmalarni tutib qolish uchun yaxshi sharoit tug‘iladi va bu aralashmalar cho‘ntakda tosh to‘plagichga tushishi osonlashadi.

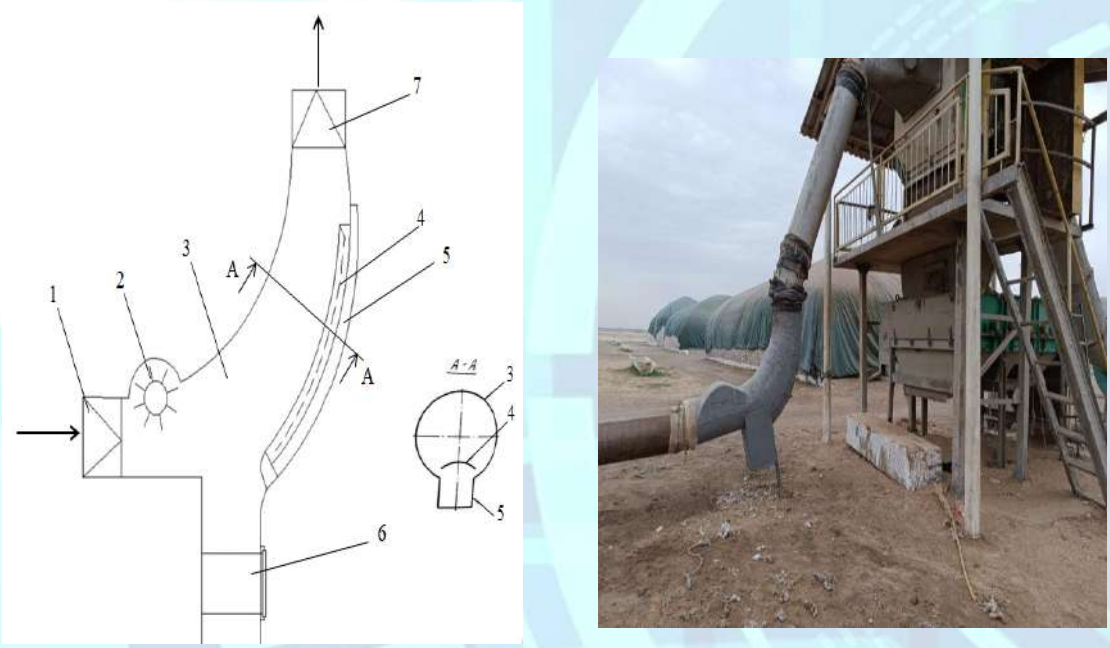
Toshtutgich kamerasi kichik bo‘lganda ishlanayotgan material qalinligi katta bo‘ladi va og‘ir aralashmalarning (ayniqsa, mayda jismlar) paxta tarkibidan ajralishi qiyinlashadi. Bu holatda paxta bilan og‘ir jismlarning birligi mukammalroq bo‘ladi [4].

Shunday qilib, qatlam qanchalik kichik bo‘lsa, paxta tarkibidan og‘ir jismlarni ajratish jarayoni shunchalik unumli bo‘ladi, deb xulosa qilish mumkin. Paxtadan og‘ir jismlarni tutib qolish jarayoni unumdorligini oshirish maqsadida

ISSN 3030-3907

ajratish kamerasi ko‘ndalang kesimi yuzasini 0,25 m^2 (2CHTL va LKS toshtutgichlarida) havo tezligi kamerada 12,5 m/s va 16 m/s qilib olish tavsiya etilgan. Toshtutgichning unumli va ishonchli ishlashi uchun ishchi kameraning shaklini va o‘lchamlarini aniqlash maqsadida eksperimental tadqiqot o‘tkazish zarurati vujudga keldi.

MUHOKAMA VA NATIJALAR. Eksperimental tadqiqot uchun toshtutgich ishchi kamerasining 3 xil turi tanlab olindi. Bu kameralar bir-biridan cho‘ntaklar joylashishi va ular orasidagi oraliqlarning geometrik shakli, bundan tashqari tutib qolish jarayoni, asosan ishlatilishi, markazdan qochma kuch va inersiya kuchlari bilan farq qiladi. Bu hollar paxta va og‘ir jismlarning fizik-mexanik va aerodinamik xususiyatlari kabi tashish rejimi va ishchi kameralarining o‘lchamlariga bog‘liq bo‘ladi [5,6]. Shularni inobatga olgan holda yangi konstruksiyadagi takomillashtirilgan toshtutgich qurilmasi ishlab chiqildi (2-rasm).



2-rasm. Yangi konstruksiyadagi toshtugich sxemasi.
1-kirish quvuri; 2-ishchi kamera; 3- elastik qoplamali qoziqchali baraban; 4-qavariq shaklidagi to‘rli yuza; 5-bo‘ylama cho‘ntak; 6-tosh to‘plagich; 7-chiqish quvuri.

Taklif etilayotgan toshtutgich qurilmasida yuqorida keltirilgan kamchiliklarni bartaraf qilish maqsadida toshtutgich qurilmasi takomillashtirilib rezina parrakli baraban va qavariqli yunaltirgich o‘rnatilishi hisobiga paxta xomashyosi tarkibidan begona jismlarni ajratib oladi, tola hamda chigitning tabiiy xususiyatlarini saqlab qoladi. Shu bilan bir qatorda toshtutgich qurilmasining ishchi kamerasidan paxta xomashyosi tarkibidagi og‘ir aralashmalarning tashqariga uzluksiz ravishda chiqib ketishini ta’minlovchi moslama yaratilgan.

ISSN 3030-3907

Yangi taklif etilayotgan toshtutgich qurilmasining vazifasi paxta tozalash korxonalarida xomashyoga dastlabki ishlov berish texnologik jarayonida pnevmotransportda to‘p-to‘p bo‘lib xarakatlanayotgan paxta xom ashyosi tarkibidan og‘ir va mayda aralashmalarni samarali ajratish, zarba kuchini kamaytirib chigit shikastlanishini oldini olish va og‘ir+mayda aralashmalar bilan cho‘ntakga tushgan paxta bo‘lakchalarini ajratib olishdan iborat.

Paxta tozalash korxonalarida qo‘llanib kelinayotgan toshtutgichlardan farqli toshtutgichning kirish quvuriga elastik qoplamali qoziqchali baraban hamda titilgan paxta ishchi kamera elastik asosiga o‘rnatilgan qavariq shaklidagi to‘rli yuza yordamida tarkibidagi mayda og‘irliklarni ajratib olish va paxtani tabiiy holatini saqlash maqsadida kirish quvuri qarshisida elastik asosga to‘rli yuza o‘rnatilgan. Natijada to‘p-to‘p bo‘lib ishchi kameraga kirib kelgan paxta titilib og‘ir va mayda aralashmalarni to‘liq ajratish va o‘z navbatida tola hamda paxtaning tabiiy xususiyatlarini saqlab qoladi. Cho‘ntakga tushgan og‘ir aralashmalar esa uzluksiz tarzda tashqariga chiqib ketadi.

Bu elastik asosga o‘rnatilgan to‘rli yuzaning teshiklar oval shaklida qilib tanlanganligi paxta xomashyosi tarkibidagi mayda og‘irliklardan ma’lum miqdorda tozalandi. Cho‘ntak qismiga o‘rnatilgan plastinkalar prujina yordamida birin ketin ochilib paxta tarkibidan ajralgan og‘ir aralashmalar uzluksiz tarzda tashqariga chiqib ketadi.

Elastik qoplamali qoziqchali baraban hamda to‘rli yuza joylashtirilishi tola hamda chigitning tabiiy xususiyatlarini saqlab qolishni yangicha usulda bo‘lishini taьminlaydi. Bu toshtutgichning yana bir afzallik tomoni shundaki, u ishlaganda elektr energiya talab qilmaydi, bunda elastik qoplamali qoziqchali baraban o‘z inersiyasi bilan xarakatlanadi.

Takomilashtirilgan toshtutgich qurilmasining samaradorligini aniqlash bo‘yicha o‘tkazilgan ilmiy-amaliy tadqiqotlar natijasida paxtaning og‘irligi tozalanganligi, chigitni shikastlanishi kamayganligi, paxta tarkibidan og‘ir aralashmalarni 90-95 % gacha ajratib olinganligi hamda cho‘ntak moslamasidan mayda va og‘ir aralashmalar uzluksiz ravishda tashqariga chiqganligi kuzatildi. Paxta tarkibidagi og‘ir aralashmalarni fraksiyalar bo‘yicha ajratib olingan natijalar (1-jadval) da ko‘rsatilgan.

1-jadval

Paxta tarkibidagi og‘ir aralashmalarni fraksiyalar bo‘yicha ajratib olingan natijalar

№	Tajribadagi toshlarning o‘lchami (mm)	Tajribadagi toshlarning soni (dona)	Toshtutgichda tutibkolingan toshlar soni	Foiz i %

ISSN 3030-3907

			(dona)	
1	5-10	10	8	80
2	15-20	10	9	90
3	25-30	10	9	93
4	35-40	10	8	84
5	45-50	10	9	93
6	55-65	10	10	100
7	70-80	10	9	97

XULOSA VA TAKLIFLAR. Paxta xomashyosi tarkibidan mayda+og‘ir aralashmalarni ajratish jarayoni samaradorligini oshirish, tola va chigitning shikastlanishini kamaytirish hamda cho‘ntakdan og‘ir aralashmalarni uzluksiz tarzda chiqarib yuborish maqsadida toshtutgich qurilmasini takomillashtirish bo‘yicha olib borilgan tadqiqotlar tahlili bo‘yicha quyidagi xulosalarga kelindi:

1. Respublika va xorijiy mamlakatlar ilmiy tadqiqotchilari tomonidan toshtutgich va uning asosiy elementlarini takomillashtirish maqsadida o‘tkazilgan tadqiqotlar tahlili mavjud toshtutgichlarning bir qator kamchiliklarni aniqlash va toshtutgichda mayda+og‘ir aralashmalardan samarali tozalash va tola va chigitga ko‘rsatiladigan zarba kuchlarini kamaytirish bo‘yicha tadqiqot olib borish zarurligini ko‘rsatdi.

2. Toshtutgich qurilmasining ishchi kamerasida paxta xom ashyosini titib berish maqsadida o‘rnatiladigan elastik qoplamali qoziqchali baraban joylashishi joyni aniqlash maqsadida og‘ir aralashmalarni tutib qoladigan moslamalarning konstruksiyalarini o‘rganildi.

3. Toshtutgich qurilmasi ishchi kamerasida paxta xomashyosini titish moslamasi paxtani mayda +og‘ir aralashmalardan oson ajratib olishjarayoni ko‘rib chiqildi.

4. Toshtutgich qurilmasi ishchi kamerasida harakatlanayotgan paxta va og‘ir aralashmalarning harakatini nazariy yo‘l bilan o‘rganish natijasida olingan differensial tenglamalar tahlili asosida paxta bo‘lakchalarining harakat trayektoriyasi aniqlandi va uning elastik asosiga o‘rnatilgan to‘rli yuzaga urilish maydoni va zarba kuchlari aniqlandi hamda zarba kuchini kamaytirish uchun zarbani qabul qiluvchi rezina qoplama o‘rnatish tavsiya etildi.

5. Toshtutgich qurilmasi elastik asosga o‘rnatilgan to‘rli yuza orqali paxta bo‘lakchasining harakatini o‘rganish natijasida paxtani mayda og‘irliklardan qo‘shimcha tozalash imkoniyati mavjudligi aniqlandi va toshtutgich ishchi kamerasiga qavariq shaklidagi to‘rli yuza o‘rnatish orqali mayda og‘irliklardan tozalashga asoslangan texnologiya ishlab chiqildi.

ISSN 3030-3907

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SHAXTA SHAMOLLATISH VENTILYATOR QURILMALARINING ELEKTR YURITMASINI ISH REJIMINI AVTOMATLASHTIRISH CHORA TADBIRLARI

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Annotatsiya. Ushbu maqolada shaxtalarda is gazini so‘ruvchi ventilyator qurilmasini avtomatik boshqarish tizimini yaratish va joriy etish masalalari ko‘rib chiqilgan.

Ventilyatorni ishga tushirish va o‘chirish jarayoni shaxtadagi havo tarkibi va ventilyatsiyaga bo‘lgan ehtiyojdan kelib chiqqan holda avtomatik tarzda amalga oshirilishi ta’kidlangan. Bunda turli datchiklar va nazorat qurilmalari orqali monitoring olib borilib, tegishli boshqaruv signallari qabul qilinadi. Shuningdek, ventilyatorning ish parametrlari – havo bosimi va harorati kabi ko‘rsatkichlar doimiy nazoratda bo‘lib, zarurat tug‘ilganda uning ishlash holati avtomatik ravishda o‘zgartiriladi. Elektr energiyasini tejash maqsadida ventilyatorning aylanish tezligini avtomatik boshqarish imkoniyati ko‘zda tutilgan. Butun tizim mikrokontroller yoki programmalashtiriladigan logik kontroller (PLK) orqali avtomatlashtiriladi. Shaxta is gazini so‘ruvchi ventilyator qurilmalarini ish rejimini avtomatlashtirish chora tadbirlari ko‘rsatilgan.

Kalit so‘zlar: ventilyator, elektr yuritma,datchiklar, is gazi, avtomatlashtirish.

Аннотация. В данной статье рассмотрены вопросы создания и внедрения системы автоматического управления вентиляторным устройством для всасывания угарного газа в шахтах. Отмечается, что процесс пуска и отключения вентилятора осуществляется автоматически, исходя из состава воздуха в шахте и потребности в вентиляции. При этом мониторинг осуществляется с помощью различных датчиков и контрольных устройств, и принимаются соответствующие управляющие сигналы. Кроме того, такие показатели, как рабочие параметры вентилятора - давление и температура воздуха - находятся под постоянным контролем, и при необходимости его рабочее состояние автоматически изменяется. Для экономии электроэнергии предусмотрена возможность автоматического регулирования скорости вращения вентилятора. Вся система автоматизируется с помощью микроконтроллера или программируемого логического контроллера (ПЛК). Описаны меры по автоматизации режима работы шахтных вентиляторных установок для отсасывания угарного газа.

Ключевые слова: вентилятор, электропривод, датчики, угарный газ, автоматизация.

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Abstract. This article examines the issues of creating and implementing an automatic control system for a ventilation device for exhaust gases in mines. It is noted that the process of starting and turning off the fan is carried out automatically, depending on the composition of the air in the mine and the need for ventilation. In this case, monitoring is carried out through various sensors and control devices, and the corresponding control signals are received. Also, the operating parameters of the fan - such indicators as air pressure and temperature - are constantly monitored, and if necessary, its operating state is automatically changed. In order to save electricity, the possibility of automatic control of the fan speed is provided. The entire system is automated using a microcontroller or programmable logic controller (PLC). Measures for automating the exhaust mode of mine exhaust ventilation units are indicated.

Keywords: fan, electric drive, sensors, carbon monoxide, automation.

Kirish

Hozirgi kunda sanoatning barcha sohalarida ishlab chiqarish samaradorligini oshirish va energiya resurslaridan oqilona foydalanish dolzarb masalalardan biri hisoblanadi. Shu jihatdan, elektr yuritmalarni avtomatlashtirish va energiya tejamkor texnologiyalarni joriy etish nafaqat iqtisodiy foyda, balki ekologik barqarorlikni ham ta’minlaydi. Ayniqsa, elektr yuritmalarni chastota o‘zgartirgich yordamida boshqarish orqali energiya iste’molini 30–60% gacha kamaytirish mumkin. Foydali qazilmalarni yer osti usuli bilan qazib olishda kon lahimlari eng kamida ikkita tik yoki qiya stvollar bilan yer sathi (atmosfera)ga tutashgan bo‘ladi.

Bu stvollarning biridan shaxtaga toza havo kiradi. U kon lahimlarini shamollatib ikkinchi stvoldan atmosferaga chiqib ketadi.

Havo harakatda bo‘ladigan muhit ya’ni shaxta stvoli, yer osti lahimlari va ventilyator qurilmaning havo yo‘laklari shamollatish shaxobcha yoki qurilmaning tashqi tarmog‘i deb atalgan.

Tashqi tarmoqda havo harakati shaxtaga kirish va chiqish tomonlardagi bosimlar farqi hisobiga paydo bo‘ladi. Bosimlar farqi tabiiy yoki sun’iy, ya’ni ventilyator qurilma yordamida paydo bo‘ladi. Tabiiy holda bosimlar farqi kirish va chiqish tomonlardagi havoning harorati va ular oralig‘idagi tik balandlikka bog‘liq bo‘lib u quyidagi ifoda bilan topiladi:

$$P_T = g \cdot Z \cdot (\rho_a - \rho) \qquad (1)$$

bu yerda: ρ_a, ρ - atmosfera sharoitidagi va shaxtadan chiqadigan kon havosi zichliklari, kg/m^3; Z- kirish va chiqish oralig‘idagi tik balandlik, m.

Ma’lumki harorat past bo‘lgan muhitdagi havo zichligi harorat yuqori bo‘lgan muhitdagi havo zichligidan yuqori bo‘ladi. Shuning uchun yilning sovuq kunlarida tabiiy havo harakati atmosferadan shaxtaga qarab yo‘nalgan bo‘ladi. U

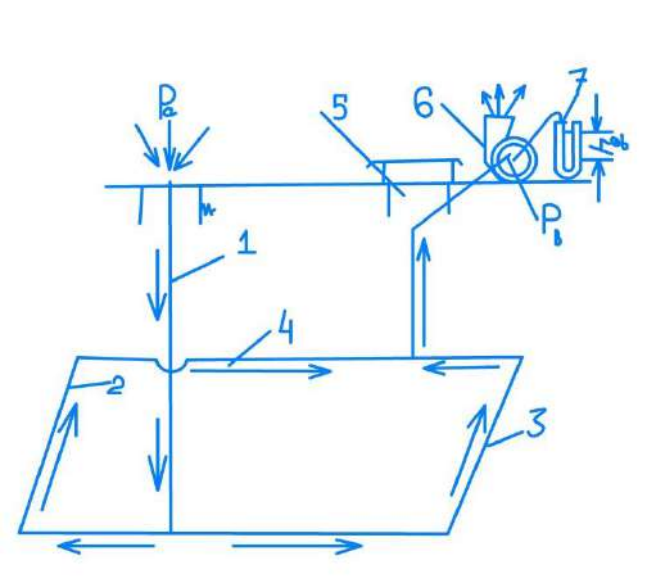
ISSN 3030-3907

ventilyator qurilma ishini yaxshilaydi. Aks hollarda (shaxtadan chiqadigan havoning harorati atmosfera haroratidan past bo‘lgan) havo harakati shaxtadan atmosfera tomonga yo‘nalgan bo‘ladi. Bu hollarda tabiiy havo oqimi ventilyator qurilma ishini qiyinlashtiradi. Chunki ventilyator zo‘riqmasining bir qismi tabiiy havo harakatini yengishga sarflanadi.

Ventilyator qurilma kon havosini shaxtadan so‘rib olish yoki toza havoni shaxtaga haydash rejimida ishlay oladi.

Qurilma kon havosini shaxtadan so‘rib olish rejimida ishlatilganda uning oldi tomonidagi bosim atmosfera bosimidan kichik bo‘ladi. Shuning uchun toza havo oqimi stvol-1 va stvol atrofi qo‘rasi orqali shaxtaga kiradi (1-rasm). Toza havo oqimi yer ostida konning ikki tomoniga bo‘linadi, har tomonga bo‘lingan havo oqimi chap-2 va o‘ng-3 tomonlardagi kavjoyni shamollatib, shamollatish lahim-4 va stvol-5 hamda ventilyator qurilma 6-orqali atmosferaga chiqib ketadi.

Atmosfera-P_a va ventilyator qurilmaning oldi tomonida bosimlar ayirmasi, ya’ni P_a-P_e shamollatish shaxobchaning depressiyasi deb ataladi. Uni maxsus o‘lchov asbobi depressiometr 7–yordamida o‘lchash mumkin. Depressiometrdagi suyuqlik sathlarining ayirmasi h bosimlar ayirmasi R_a-P_v teng.



1-rasm. Konlarda havo oqimi harakati

Ventilyator qurilmalarda, shaxtaga havo kiradigan va undan chiqadigan tomonlar oralig‘idagi tik masofa ya’ni geodezik balandlik kam bo‘lganligi sababli u ventilyator qurilma ishiga ta’sir ko‘rsata olmaydi. Shuning uchun qurilmaning tashqi tarmoq xarakteristikasini ifodalovchi tenglama quyidagi ko‘rinishda bo‘ladi.

$$\Delta P = R \cdot Q^2 \qquad (2)$$

bu yerda: R- shamollatish shaxobchasining aerodinamik qarshiligi: Uhar bir lahim uchun quyidagi ifoda bilan hisoblanadi.

ISSN 3030-3907

$$R_i = \alpha_i \cdot \frac{П_i \cdot L_i}{S_i^3} \cdot Q_i^2 \qquad (3)$$

bu yerda: α_i - aerodinamik qarshilik koeffitsienti; $П_i$ - lahimning ko‘ndalang kesim perimetri, m; - lahim uzunligi,m; - ko‘ndalang kesim yuzasi,m2; Shamollatish xarakteristikasining aerodinamik qarshiligi-R ketma-ket yoki parallel ulangan lahimlarning qarshiliklari yig‘indisiga teng.

Konchilik korxonalarining shaxta va karyerlarida shamollatish hamda is gazi ajralib chiqqanda so‘ruvchi ventilyatorlar keng qo‘llaniladi. Shaxta shamollatish ventilyatorlarning ish rejimini yuritma aylanish tezligini o‘zgartirish usuli bilan moslashtirilmaydigan ventilyator qurilmalarda asinxron yoki sinxron elektr yuritmalar qo‘llaniladi.

Ulardan qaysi birini tanlab olish ventilyatorning iste’mol quvvatiga bog‘liq. Iste’mol quvvat 150-200 kVt.gacha bo‘lgan qurilmalarda past kuchlanishli (kuchlanish 380V) qisqa tutashgan rotorli asinxron, 150-350kVt.gacha bo‘lgan hollarda esa past kuchlanishli sinxron va 350 kVt.dan yuqori bo‘lganda kuchlanishi 6000 V, quvvati 400-1000 kVt bo‘lgan СД, СДС va СДВ rusumli sinxron elektr yuritmalar qo‘llaniladi.

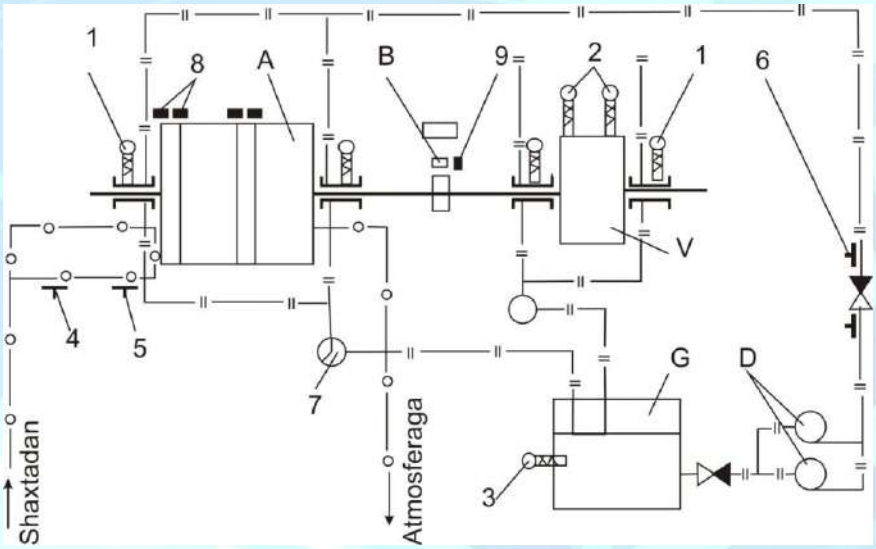
ВЦД-47 “Север” rusumli ventilyator faqat aylanish tezligi o‘zgartiriladigan asinxron elektr yuritmali mashina ventilli kaskad tizimidagi yuritma bilan jihozlangan ventilyatorlarning ish rejimi rotorni aylanish tezligini o‘zgartirish usuli bilan amalga oshiriladi.

Ventilyator qurilmasining ish holati quyidagi ko‘rsatkichlar bilan tavsiflanadi: havo bosimi va uning hajmi; elektr yuritgich va ventilyator rotorlari podshinniklarining harorati; elektr yuritgich chulg‘ami va moylash tizimidagi moyning haroratlari; moyning bosimi va uning miqdori.

Bu ko‘rsatkichlar doimiy ravishda o‘lchab boriladi. Ularni o‘lchash uchun qo‘llaniladigan o‘lchov asboblarining joylashishi 1.-rasmda ko‘rsatilgan[4].

Bu rasmda: 1-podshipniklar haroratini nazorat qilish asboblari, 2-elektr yuritma chulg‘amini nazorat qilish datchigi, 3-moylash tizimidagi moyning haroratini nazorat qilish datchigi, 4-va 5-havo bosimini va uning miqdorini o‘lchovchi datchigi, 6-moyning bosimini nazorat qilish datchigi, 7-podshinniklardan chiqadigan moy miqdorini nazorat qilish datchigi, 8-havo yo‘naltiruvchi va to‘g‘rilovchi apparatlar parraklarning holatini ko‘rsatish datchigi, 9-tormozlash tizimi holatini ko‘rsatish datchigi; A-ventilyator, B-tormozlash tizimi, V-elektr yuritgich, G-moy idishi, D-moylash tizimi nasoslari.

ISSN 3030-3907



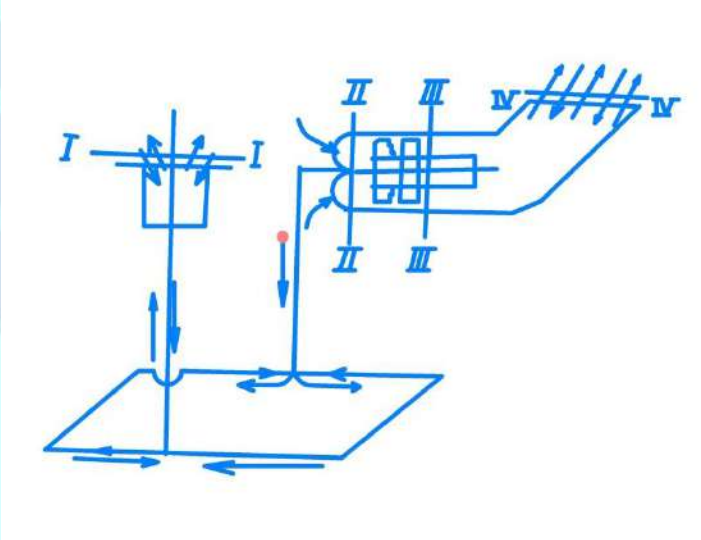
2-rasm.Ventilyator qurilma ishini nazorat qilish qurilmalarining joylashish sxemasi

Shaxtalar kon havosini so‘rib olish usulida shamollatilganda (3-rasm) havo oqimi harakatini aerogidromexanikaning asosiy qonunlaridan biri bo‘lgan Bernulli tenglamasi asosida o‘rganib chiqamiz.

Ma’lumki ventilyator ish g‘ildiragi orqali havo oqimiga uzatilgan energiya, ya’ni ventilyator zo‘riqmasi, chiqish (III-III) va kirish (II-II) kesimlardagi havoning to‘liq nisbiy energiyalari ayirmasiga teng. Ya’ni:

$$P_в = P_{III} - P_{II};$$

Bu yerda: P_{II}, P_{III} – mos ravishda kirish (II-II) va chiqish (III-III) kesimlardagi havoning to‘liq nisbiy energiyalari.



3-rasm.Ventilyator qurilmani ishlash usuli,kon havosini shaxtadan so‘rib olish; toza havoni shaxtaga xaydash

ISSN 3030-3907

Xulosa

Kon shaxtalarini samarali va xavfsiz shamollatish maqsadida ventilyator qurilmalarining ishlash rejimi va parametrlarini avtomatlashtirish bugungi kunda dolzarb ahamiyat kasb etmoqda. Ushbu tadqiqotda shaxta ventilyatorlarini avtomatik boshqarishga doir talablar, texnik yechimlar hamda amalga oshirilayotgan chora-tadbirlar atroflicha yoritildi. Xususan, ishni avtomatlashtirishda mikrokontroller va PLK tizimlari, havo parametrlarini monitoring qiluvchi datchiklar, uzluksiz yozuvchi depressiometrlar va diagnostika usullarining joriy etilishi tahlil etildi.

Avtomatlashtirilgan boshqaruv tizimlari orqali ventilyatorlarning ishlash samaradorligi oshirilib, elektr energiyasini tejash, texnik xizmat ko‘rsatish samaradorligini yuksaltirish va xavfsizlik darajasini ta’minlash imkoni yaratiladi. Shu bilan birga, atmosferaga chiqariladigan zararli moddalarning nazorat qilinishi va ekologik talablarga muvofiq harakat etilishi ta’minlanadi. Ventilyatsiya tizimini boshqa muhandislik tizimlari bilan integratsiya qilish, real vaqtda monitoring qilish va profilaktik diagnostika kabi funksiyalar esa shaxtadagi ish jarayonlarini muvozanatlashtirish va optimallashtirishga xizmat qiladi.

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ОЦЕНКА НАДЁЖНОСТИ ВОЛОКОННО-ОПТИЧЕСКИХ СИСТЕМ ПЕРЕДАЧИ ИНФОРМАЦИИ

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Аннотация. В статье рассматриваются методы аналитической оценки надёжности волоконно-оптических систем передачи информации (ВОСПИ) с учётом особенностей восстановления и резервирования элементов. Показано, что использование преобразования Лапласа–Стилтьеса позволяет формализовать вероятность безотказной работы системы при наличии восстановления элементов. Особое внимание уделено моделированию деградации элементов и асимптотическому анализу надёжности с учётом различий в законах распределения отказов аппаратных и программных элементов. Представлен графический анализ, демонстрирующий эффективность предложенного подхода в сравнении с системами, не имеющими резервирования.

Ключевые слова: волоконно-оптические системы передачи информации, преобразование Лапласа–Стилтьеса, законы распределения отказов.

Abstract. The article considers methods of analytical assessment of reliability of fiber-optic data transmission systems taking into account features of restoration and redundancy of elements. It is shown that the use of the Laplace–Stieltjes transform allows one to formalize the probability of failure-free operation of the system in the presence of restoration of elements. Particular attention paid to modeling the degradation of elements and asymptotic analysis of reliability taking into account differences in the laws of failure distribution of hardware and software elements. Graphical analysis presented demonstrating the effectiveness of the proposed approach in comparison with systems that do not have redundancy.

Keywords: fiber-optic data transmission systems, Laplace–Stieltjes transform, laws of failure distribution.

Annotatsiya. Maqolada tolali-optik ma’lumot uzatish tizimlari ishonchliligini analitik baholash usullari, xususan, elementlarning tiklanish va zaxiralanish xususiyatlari hisobga olingan holda ko‘rib chiqiladi. Laplas–Stiltjes almashtirishidan foydalanish orqali qayta tiklanishi mavjud bo‘lgan elementlar tizimining rad etmasdan ishlash ehtimolini ifodalash mumkinligi ko‘rsatib berilgan. Elementlarning degradatsiyasini modellashtirishga va apparat va dasturiy elementlarning nosozliklarni taqsimlash qonuniyatlaridagi farqlarni hisobga olgan holda asimptotik ishonchlilik tahliliga alohida e’tibor beriladi. Taklif etilgan

ISSN 3030-3907

yondashuvning samaradorligi zaxiralanmagan tizimlar bilan taqqoslanib, grafik tahlillar orqali ko‘rsatigan.

Kalit so‘zlar: tolali-optik ma’lumotlar uzatish tizimlari, Laplas–Stiltjes almashtiishi, rad etishlar taqsimoti qonunlari.

Введение

Волоконно-оптические системы передачи информации (ВОСПИ) являются основным элементом телекоммуникационной инфраструктуры, обеспечивая высокоскоростную и надёжную передачу данных на большие расстояния. Высокие требования к отказоустойчивости таких систем обусловлены необходимостью обеспечения непрерывности информационного обмена.

Надёжность ВОСПИ определяется комплексом факторов, в частности характеристики аппаратных и программных компонентов, схемы резервирования, а также способность системы к восстановлению после отказов. В реальных условиях компоненты системы могут подчиняться различным законам распределения времени отказов и восстановления, что требует применения более универсальных и точных аналитических методов моделирования.

Одним из таких методов является преобразование Лапласа–Стилтьеса, позволяющее учитывать дискретные, непрерывные и смешанные функции распределения, а также проводить асимптотический анализ надёжности систем с восстановительными процессами. Преобразование Лапласа–Стиелтьеса применимо для проведения асимптотического анализа надёжности в ВОСПИ, где отказ одного элемента может зависеть от того, успеет ли восстановиться другой, и где требуется учитывать совместные вероятности состояний.

Метод исследования.

ВОСПИ представляет собой совокупность компонентов и устройств, предназначенных для преобразования, передачи и приёма оптических сигналов, задачей которой является обеспечение надежной и высокоскоростной передачи данных на дальние расстояния [1,2].(рис.1)

Для повышения точности оценки надёжности ВОСПИ с резервируемыми и восстанавливаемыми компонентами целесообразно рассматривать аналитические методы, позволяющие учитывать как восстановление элементов, так и эффект деградации при многократных отказах, в частности для элементов таких как волоконно-оптическая линия связи и усилитель. Один из таких методов предложен в работе [3], в которой предлагается аналитическая модель для системы с двумя компонентами и

ISSN 3030-3907

холодным резервом, в которой после каждого отказа система переходит в состояние восстановления. Особенностью модели является учёт процесса деградации, при котором с каждым последующим отказом среднее время восстановления увеличивается.

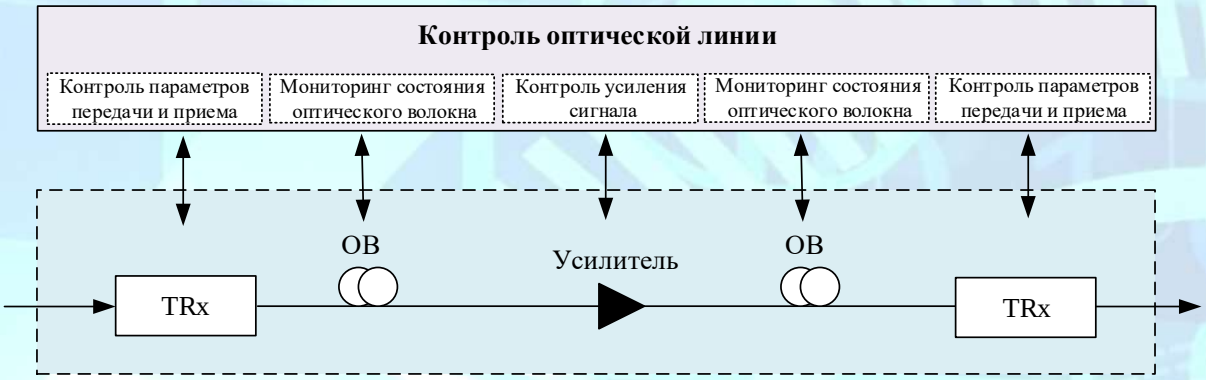


Рис 1. Схема волоконно- оптической системы передачи информации. TRx – Трансивер, ОВ – Оптическое волокно

ВОСПИ, как высоконадёжные системы, включают резервирование и возможность восстановления элементов. В таких случаях важна оценка вероятности того, что один элемент не выйдет из строя до восстановления другого. Эта вероятность выражается как [4]:

$$p = P\{\xi > \gamma\} = \int_0^{\infty} e^{-\lambda x} d\Phi(x) = \Phi^*(\lambda) \qquad (1)$$

где λ — интенсивность отказов работающего элемента, Φ(x) — функция распределения времени восстановления, $\Phi^*(\lambda)$ — преобразование Лапласа–Стиелтьеса от распределения времени восстановления, показывающее вероятность, что один элемент не выйдет из строя во время восстановления другого, ξ - время отказа резервного элемента системы, γ - время восстановления основного элемента, $P\{\xi > \gamma\}$ - вероятность того, что резервный элемент не откажет, пока не восстановится основной элемент.

Закономерности изменения надёжности во времени моделей надёжности аппаратных и программных элементов волоконно-оптических систем передачи информации эффективно описываются с использованием вероятностных распределений. Применение рассмотренных моделей позволяет количественно оценивать надёжность элементов ВОСПИ с учётом различий в характере отказов, в частности, постоянной интенсивности для электронных компонентов и возрастающей интенсивности отказов.

В последовательных системах все компоненты должны быть в исправном состоянии для функционирования системы, а её надёжность выражается как [5]:

ISSN 3030-3907

$$P_{сис}(t) = \prod_{i=1}^{m} P_i(t) \qquad (2)$$

где $P_i(t)$ - надежности компонентов.

Отказ компонентов аппаратного обеспечения ВОСПИ, таких как, трансивер, усилитель, лазер и программного обеспечения, например, системы управления, системы мониторинга могут подчиняться разным законам распределения. Общая надёжность системы на основе формулы (2) будет иметь следующий вид [6]:

$$P_{\text{сис}}(t) = P_{\text{тр}}(t) \cdot P_{\text{кс}}(t) \cdot P_{\text{ус}}(t) \cdot P_{\text{ПО}}(t). \qquad (3)$$

где $P_{\text{тр}}(t)$ - вероятность безотказной работы трансивера, $P_{\text{кс}}(t)$ - вероятность безотказной работы канала связи, $P_{\text{ус}}(t)$ - вероятность безотказной работы усилителя, $P_{\text{ПО}}(t)$ - вероятность безотказной работы программного обеспечения.

Произведение индивидуальных функций плотности вероятности для различных компонентов системы используется для построения совместной плотности вероятности при условии, что компоненты независимы друг от друга [7,8]. В ВОСПИ различные компоненты аппаратного и программного обеспечения рассматриваются как независимые. Это означает, что вероятность того, что определенные события произойдут одновременно в различных компонентах системы, равна произведению вероятностей этих событий в каждом отдельном компоненте.

Суммирование индивидуальных функций плотности вероятности для создания совместной плотности вероятности не является корректным подходом для независимых случайных величин так как сумма функций плотности вероятности не отражает свойства совместной вероятности независимых случайных величин. Суммирование приводит к неверному результату, который не соответствует законам вероятности.

Результаты и обсуждение.

Для оценки надёжности ВОСПИ важно учитывать не только вероятность отказов, но и возможность восстановления элементов системы, что важно для систем с постоянным резервированием, где отказ основного элемента компенсируется резервируемым. Надёжность системы в этом случае определяется с учётом вероятности безотказной работы резервного элемента до завершения восстановления основного элемента (или заменой если элемент невосстанавливаемый). В таких условиях применимо

ISSN 3030-3907

преобразование Лапласа–Стиелтьеса и формулу общей надёжности системы (3) можно написать в следующем виде [4,5]:

$$P_{\text{сис}}(t) = \prod_{i \in A} P_i(t) \cdot \prod_{j \in R} \Phi_j^*(\lambda_j) \qquad (4)$$

где А – элементы без резервирования, R- элементы с резервированием, $\Phi_j^*\left(\lambda_j\right)$ - преобразование Лапласа-Стилтьеса от функции распределения восстановления $\Phi_j(t)$, рассчитывающее вероятность того, что восстановление элемента j завершится до отказа другого элемента с интенсивность отказов λ_i

Предположим, что линия связи и усилитель резервированы, в этом случае формулу (2) с учётом (4) можно написать в следующем виде:

$$P_{\text{сис}}(t) = P_{\text{тр}}(t) \cdot \Phi_{\text{кс}}^*(\lambda_{\text{кс}}) \cdot \Phi_{\text{ус}}^*\left(\lambda_{\text{ус}}\right)(t) \cdot P_{\text{ПО}}(t). \qquad (5)$$

При частичном резервировании, когда некоторые элементы системы могут быть восстановлены до отказа резерва, вероятность безотказной работы системы представляется как произведение надёжностей невосстанавливаемых компонентов и вероятностей успешного восстановления, выраженных через преобразование Лапласа–Стилтьеса [4,9]:

$$\Phi^*(\lambda) = \int_0^\infty e^{-\lambda t} d\Phi(t) \qquad (6)$$

При вычислении этого интеграла (или приближении), можно использовать численное значение, либо аппроксимацию через:

В результате полная вероятность безотказной работы системы принимает вид:

$$P_{\text{сис}}(t) = P_{\text{тр}}(t) \cdot P_{\text{ПО}}(t) \cdot \left[\int_0^\infty e^{-\lambda_{\text{кс}} t} d\Phi_{\text{кс}}(t)\right] \cdot \left[\int_0^\infty e^{-\lambda_{\text{ус}} t} d\Phi_{\text{ус}}(t)\right] \qquad (7)$$

Особенность полученной формулы заключается в том, что она позволяет учитывать восстановление элементов системы. В отличие от моделей, предполагающих только невосстанавливаемые элементы, здесь применяется преобразование Лапласа–Стилтьеса, которое используется в качестве математической основы для вычисления вероятности того, что основной элемент будет успешно восстановлен до наступления отказа резервного элемента. Это делает модель более реалистичной и адаптированной к условиям эксплуатации системы с частичным резервированием.

ISSN 3030-3907

Для наглядного сравнения эффективности данной модели проведён графический анализ, где сопоставлены результаты, полученные на основе базовой формулы (2) и выражения (7) с учётом восстановительных процессов (рис.2).

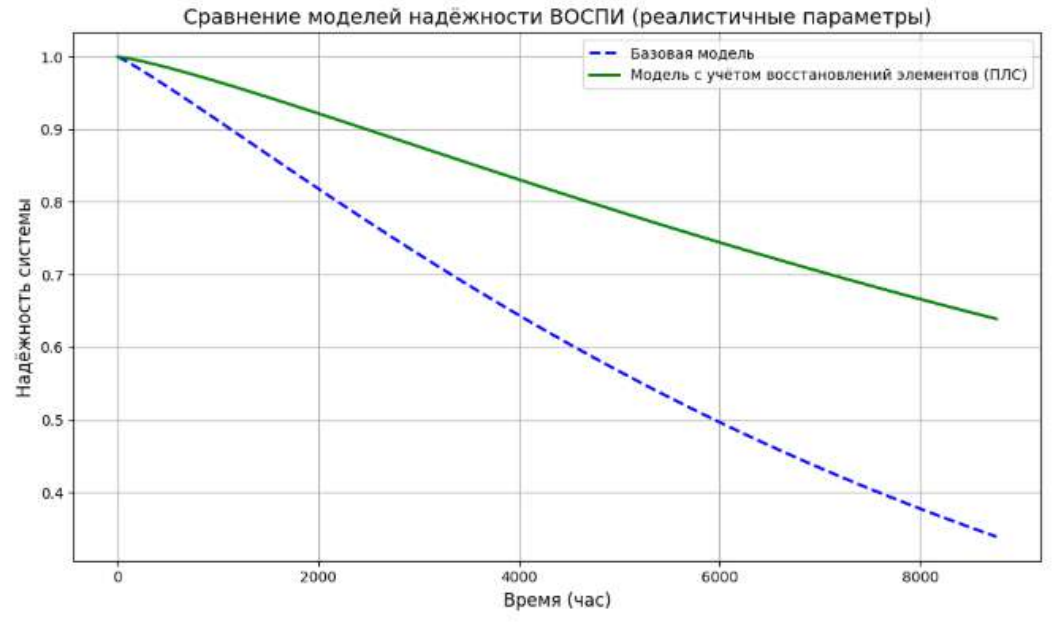


Рис. 2. Сравнение моделей надёжности ВОСПИ с учётом преобразования Лапласа–Стиелтьеса

График (рис.2) показывает, что внедрение восстановительных процессов приводит к значительному увеличению общей вероятности безотказной работы системы, особенно на более длительных временных интервалах. Это подтверждает эффективность предложенного математического подхода и демонстрирует его практическую применимость при проектировании высоконадёжных телекоммуникационных систем.

Таким образом, включение преобразования Лапласа–Стиелтьеса в модель надёжности позволяет не только учитывать возможность восстановления компонентов, но и адаптировать расчёты под реальные условия эксплуатации, что особенно важно для проектирования надёжных волоконно-оптических систем передачи информации.

Заключение.

Проведённый графический анализ подтвердил, что включение восстановительных процессов в расчёт существенно увеличивает надёжность системы по сравнению с моделями, не учитывающими такие процессы. Это открывает возможности для более точного проектирования систем, ориентированных на высокую отказоустойчивость, и разработки эффективных алгоритмов прогнозирования и минимизации отказов.

ISSN 3030-3907

Разработанная модель позволяет более точно оценивать надёжность систем с частичным резервированием, в которых важна вероятность успешного завершения восстановления до отказа резервного элемента.

Полученные результаты могут быть использованы в построении телекоммуникационных систем, а также как база для дальнейших исследований в области надёжности сложных технических систем с переменной интенсивностью отказов и восстановлений.

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ISSN 3030-3907

TEXNOLOGIYANI TAKOMILLASHTIRISH

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Annotatsiya: Maqolada har xil turdagi separatorlarda don aralashmalarini ajratish xususiyatlari tasvirlangan. Donni qayta ishlash sanoatida raqamlashtirish ommaviy xizmatlarni ajratish tizimlarining matematik modellarini ishlab chiqish imkonini beradi. Don massasining fizik xususiyatlarini tahlil qilish algoritmlari ishlab chiqilgan. Bug'doyni qayta ishlash mahsulotlarini o'rganish kompyuter ko'rish usullari va dasturiy vositalar tomonidan ishlab chiqilgan sun'iy neyron tarmoqlardan foydalangan holda maydalangan don tahliliga asoslangan. Geometrik xossalari bo'yicha donni maydalash zarralarining ishlab chiqilgan tasnifi bug'doy sifatining texnologik xususiyatlarini, xususan, uning don qattiqligi indeksini yuqori aniqlik bilan (baholash xatosi 3,7% dan ko'p emas) bashorat qilish imkonini beradi.

Kalit so'zlar: don, bug'doy, donni qayta ishlash.

Аннотация: В статье рассмотрены особенности разделения зерновых смесей в различных типах сепараторов. Цифровизация в зерноперерабатывающей отрасли позволяет разрабатывать математические модели систем массового обслуживания и разделения. Разработаны алгоритмы для анализа физических свойств зерновой массы. Исследование продуктов переработки пшеницы основано на анализе измельченного зерна с использованием искусственных нейронных сетей, разработанных методами компьютерного зрения и программными средствами. Разработанная классификация частиц дробления зерна по геометрическим свойствам позволяет с высокой точностью (погрешность оценки не более 3,7%) прогнозировать технологические характеристики качества пшеницы, в частности показатель ее твердозерности.

Ключевые слова: зерно, пшеница, переработка зерна.

Annotation: THe article describes the features of the separation of grain mixtures in different types of separators. In the grain processing industry, digitization makes it possible to develop mathematical models of mass service separation systems. Algorithms for analyzing the physical properties of the grain mass have been developed. The study of wheat processing products is based on crushed grain analysis using artificial neural networks developed by computer vision methods and software tools. The developed classification of grain grinding particles by their

ISSN 3030-3907

geometric properties makes it possible to predict the technological characteristics of Wheat Quality, in particular, its grain hardness index with high accuracy (evaluation error not more than 3.7%).

Keywords: grain, wheat, grain processing.

Kirish

Tadqiqot maqolasiMaqolada don aralashmalarini har xil turdagi separatorlarda ajratish xususiyatlari tasvirlangan. Donni qayta ishlash sanoatini raqamlashtirish navbat tizimlarini ajratishning matematik modellarini ishlab chiqish imkonini beradi. Hozirgi tadqiqotda don massasining fizik xususiyatlarini tahlil qilish algoritmlari keltirilgan. Bug'doyni qayta ishlash mahsulotlarini o'rganish kompyuter ko'rish usullari va sun'iy neyron tarmoqlari yordamida maydalangan donni tahlil qilishga asoslangan. Geometrik xususiyatlarga asoslangan don maydalagich zarralarining shakllangan tasnifi bug'doy sifatining texnologik xususiyatlarini, xususan, donning qattiqligini (baholash xatosi 3,7% dan ko'p emas) yuqori aniqlik bilan bashorat qilish imkonini beradi.Evropa Ittifoqi mamlakatlarida don ekinlarining yilning ob-havo sharoitlariga bog'liqligi yuqori. Shunday qilib, Buyuk Britaniyada 2020 yilda 9,65 million tonna yig'ildi [1]. Bu 2019-yilga nisbatan 40,5 foizga kam, bu 2019-yilning ho‘l kuzidan so‘ng dehqonlar tomonidan kuzgi bug‘doy ekishning qisqargani bilan izohlanadi. Shuningdek, bug‘doy hosilining pastligi keyingi qurg‘oqchil bahor tufayli ham og‘irlashdi. 2020 yilda Rossiyada bug'doy hosili taxminan 88 million tonnani tashkil etdi. Yaqin besh yilda rossiyalik fermerlar bug‘doyning yangi navlarini joriy etish va ishlab chiqarish texnologiyalarini modernizatsiya qilish hisobiga ekin maydonlarini 40 foizga kengaytiradi. Bu qattiq bug‘doy yetishtirishni yiliga 2 million tonnagacha oshirish imkonini beradi [2]. Qattiq bug'doy ishlab chiqarishni rag'batlantirish federal darajada subsidiyalar bilan qo'llab-quvvatlanadi - bunday don etishtirish uchun subsidiyalar ajratish bo'yicha tegishli nizom loyihasi tayyorlandi [3].

Bug'doy donini ajratish uchun uskunalarning ish rejimini tanlashni raqamlashtirish dolzarbdir. Donni qayta ishlash samaradorligini oshirishning muhim jihati ajratish jarayonining modellarini ishlab chiqishdir [4].

Axborot texnologiyalari sohasidagi zamonaviy ishlanmalar don massasining fizik xususiyatlarini tahlil qilish algoritmlarini ishlab chiqish orqali donni qayta ishlash uchun mavjud axborot va o'lchov tizimlarini modernizatsiya qilish va yangilarini ishlab chiqish imkonini beradi [5].

Tadqiqot materiallari va usullari. Tadqiqotda Buxoro viloyatidan bug'doyning 14 navi ishtirok etdi, ularning tabiiy og'irligi 720 g dan 850 g gacha, namlik 12,5% dan 14,7% gacha va shishasimonligi 45% dan 100% gacha.

ISSN 3030-3907

Silliqlash xususiyatlari. Donni maydalash namunalarini olish uchun laboratoriya tegirmonida donni sinovdan o'tkazish amalga oshirildi. Har bir namunadan 10 kg don maydalangan. Silliqlash yuqori oqimni tanlash bilan beshta silliqlash tizimi yordamida amalga oshirildi [6], [7], [8].

Tegirmonlangan zarrachalarning fraktografik tahlili laboratoriya qurilmasi (SonyIMX raqamli kamerasi, RaspberryPi4 mini-kompyuteri) yordamida zarrachalar tasvirlarini OpenCV texnik ko‘rish kutubxonalari va Deeplearning4 sun’iy neyron tarmog‘i kutubxonalari yordamida yaratilgan dasturiy ta’minot yordamida tahlil qilish uchun o‘tkazildi [9].

Natijalar va muhokama. Seperatorda don aralashmalarini ajratish natijasi ikki turdagi baxtsiz hodisalar bilan belgilanadi. Birinchisi (massa) yuqori konsentratsiyadagi zarrachalarning ajratuvchi organda o'zaro ta'siri bilan tavsiflanadi, ba'zi zarralar boshqalarni ajratishdan to'siqsiz o'tishga to'sqinlik qiladi. Ikkinchisi (individual) massa tasodifiyligi yo'qligida, don oqimining juda past konsentratsiyasida bitta zarrachalar ajratilganda aniqlanadi. Ushbu holatda ajratish natijasi ham oldindan noma'lum, chunki separatordagi donning yo'nalishi tasodifiy [10], [11], [12]. Ushbu yondashuv doirasida, ehtimollik ajratish natijasi tabiiy ravishda ikkala komponentning ta'sirini hisobga oladi.

Ommaviy xizmatlarni ajratish tizimlarining modellarini yaratishda quyidagilar zarur:

- ishchi elementni ajratish tizimlarining kanallari (qurilmalari) vazifasini bajaradigan ajratuvchi elementlarning parallel-ketma-ket tizimi sifatida tasavvur qiling (trier hujayralari, elak teshiklari, havo kanalining elementar hajmlari va boshqalar);

- seperatorning texnologik xususiyatlari, xususan, unumdorligi orqali kirish va chiqish don oqimlarining intensivligini ifodalash;

- ishchi organning elementlarida don zarralari (so'rovlari) ga xizmat ko'rsatish (ajratish) intizomini aniqlash: ketma-ketlik, ishonchlilik darajasi, sabr-toqat, ustuvorlik va boshqalar;

- ishchi elementning mumkin bo'lgan holatlarini tavsiflash (xizmat ko'rsatilmagan donalar mavjud emas; bitta don; ikkita; uchta va boshqalar) [13].

Shu tarzda aniqlangan model ommaviy xizmat nazariyasi uchun standart usullardan foydalangan holda ajratish tizimining ehtimollik xususiyatlarini hisoblash uchun tenglamalarni olish imkonini beradi [14].

Tadqiqotlar shuni ko'rsatdiki, ajralish natijasi tabiiy ravishda ajratish jarayonining tasodifiyligining individual va ommaviy tarkibiy qismlariga bog'liq. Shu bilan birga, u ikkita ajratuvchi guruh mavjudligini bashorat qiladi, ulardan biri bitta zarracha bilan ajratish imkoniyatini beradi, ikkinchisi esa yo'q. Birinchi

ISSN 3030-3907

guruhga ma'lum turdagi separatorlarning ko'pchiligi (havo, ekran, elektr, magnit, optik va boshqalar) kiradi va ikkinchi guruhga faqat ajratilgan zarrachalarga qaraganda biroz kattaroq ekran ochilish o'lchamlari bilan ajralib turadigan disk ajratgich va yuqori zichlikdagi ekran modullari kiradi. Bundan tashqari, u don oqimining o'ziga xos yuki va tezligiga, hosildorlikka va hokazolarga ajratish sifatining ma'lum tajriba bog'liqliklarini aniq aks ettiradi [15].

Ajratuvchi tizimning holatini uning mahsuldorligi nolga moyil bo'lganda o'rganish kerak, bu fizik jihatdan bitta zarrachalarning ajralishini ifodalaydi va shuning uchun ma'lum bo'lgan separatorlarning klassik modellaridan, ya'ni dinamikaning ma'lum tenglamalaridan boshqa narsa bo'lmagan bunday modellardan foydalanishni talab qiladi. Bunday tenglamalarning tabiati harakatning dastlabki shartlari, don zarralarining fizik xususiyatlari va ajratuvchi organning ish rejimlari bilan belgilanadi. Etarli hisoblash quvvati bilan har qanday rejimda har xil turdagi separatorlar uchun juda past mahsuldorlikda don aralashmalarining turli komponentlarini chiqarish ehtimolini hisoblash mumkin. Shunday qilib, modellashtirishga taklif etilayotgan yondashuv har qanday ish rejimlarida, shu jumladan unumdorlikda har xil turdagi separatorlar uchun talab qilinadigan sifat ko'rsatkichlarini (qorishma tarkibiy qismlarining hosildorligi va fraksiyalardagi tarkibi) amalda hisoblash (prognoz qilish) imkonini berdi.

Alohida ajratgichlar modellari asosida donni tozalash texnologik liniyalarida aralashmalarni ajratish sifatini bashorat qilish va quyidagi optimallashtirish muammolarini hal qilish mumkin bo'ldi:

- har bir separatorning belgilangan ish rejimlarida qattiq texnologik liniya (separatorlar soni, ularning turi va o'rnatish ketma-ketligi ma'lum) bo'yicha don partiyasini (aralashma komponentlarining tarkibi va tarkibi ma'lum) tozalash; model bu aralashmaning GOST talablariga javob berish uchun tozalanishi va qanday hosil bo'lishiga javob beradi;

- qattiq texnologik chiziqda GOST talablariga javob beradigan don partiyasini tozalash; model ushbu liniyadagi barcha separatorlar qanday rejimlarda ishlashi kerakmi yoki yo'qligini aniqlaydi, qaysi fraktsiyalar asosiy va qanday chiqish bo'ladi, asosiy chiziqqa qaraganda qancha ko'p;

- egiluvchan texnologik liniyada GOST talablariga javob beradigan don partiyasini tozalash; Model bunday chiziqdagi ajratgichlarning soni, turi va ketma-ketligini, har bir separatorning asosiy fraktsiyalari va ish rejimlarini, tozalangan donning hosildorligini va asosiy chiziqqa nisbatan ortiqcha miqdorini aniqlaydi.

Donni qayta ishlash sanoatini raqamlashtirish turli fizik-kimyoviy ko‘rsatkichlar asosida don sifatini baholash usullarini o‘z ichiga oladi. Shunday qilib, kompyuter ko'rish algoritmlari yordamida donning ifloslanishi va

ISSN 3030-3907

shishasimonligini baholash usullari mavjud. Don tozalash mashinalarining samaradorligini oshirish uchun optik xossalari bo'yicha dondan aralashmalarni ajratish usullari qo'llaniladi - fotosuratlarni ajratish yoki fotosuratlarni tozalash. Fotosuratlarni ajratish uchun don massasini yuqori tezlikda skanerlash va oldindan o'rnatilgan algoritm (farq qiluvchi mezon) bo'yicha tasvirni keyinchalik qayta ishlash qo'llaniladi. Donni hajmi, rangi, shakli va boshqa xususiyatlariga ko'ra saralash mumkin.

Oqimdagi don xomashyosi vibratsiyali oziqlantiruvchilar tufayli bir qatlamda bir tekis taqsimlanadi, bu har bir alohida zarrachaning tasvirini skanerlash imkonini beradi. Zarrachalarni tanlash havo oqimlari yordamida (pnevmatik ejektor tufayli), aralashmalar yoki sifatsiz donni chiqindi idishiga yo'naltirish orqali amalga oshiriladi. Fotosuratlarni ajratishning zamonaviy usullari xom ashyoni alohida va umumiy xususiyatlarning butun majmuasi bo'yicha saralash, eng yaxshi texnologik xususiyatlarga ega mahsulotni olish imkonini beradi.

O'rganilayotgan xom ashyoning sifati haqida qo'shimcha ma'lumotni yorug'lik o'rniga ko'rinadigan yorug'likdan foydalanish orqali olish mumkin.

Unni qayta ishlash sanoati amaliyotida donni tasniflash uchun ko'pincha donning shishasimonligi ko'rsatkichi qo'llaniladi, ammo bu ko'rsatkich turli xil bug'doy navlarining un tegirmon sifatini to'liq tavsiflamaydi (genotipik omil). Shishasimonlikning o'zgaruvchanligi tuproq, iqlim va agrotexnik sharoitlar (fenotipik omil) bilan ham bog'liq. Shuni hisobga olib, izchillikni miqdoriy baholash uchun va donning mustahkamlik xususiyatlarini aniqlash uchun donning qattiqligi indeksidan foydalanish taklif etiladi. Qattiqlik sinovlari yordamida ushbu ko'rsatkichni aniqlashning to'g'ridan-to'g'ri usullari ko'p mehnat talab qiladi va shuning uchun keng amaliyotda amalda qo'llanilmagan.

Tadqiqotda geometrik xususiyatlar asosida donni maydalovchi zarralarni topish va tasniflash uchun kompyuter ko'rish va sun'iy neyron tarmoqlardan foydalanildi. Maydalash zarralari tasvirlarining konturlarining xususiyatlari hisobga olingan.

Xulosa. Donni qayta ishlashning olingan matematik modellari asosida sifatni bashorat qilish qobiliyatini oshirish va donni ajratishni optimallashtirishni ta'minlovchi dasturiy vositalar ishlab chiqilgan. Bug‘doyning mustahkamlik sifatlarini shakllantirish xususiyatlari aniqlanib, donni qayta ishlash sanoatida zamonaviy raqamlashtirish vositalaridan foydalangan holda donning qattiqligini baholash metodikasi ishlab chiqildi.

ISSN 3030-3907

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GURUCH DONI ASOSIDA BIOLOGIK FAOL QO'SHIMCHALAR (BFQ) ISHLAB CHIQARISH

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Annotatsiya: Mazkur maqolada ta’lim-tarbiya sohasida pedagogik va innovatsion texnologiyani qo`llash haqida so`z yuritiladi. Uning samaradorligi tahlil qilingan, natijalar va boshqa farqlar ko`rsatilgan holda uning maqsad, vazifalari hamda ta’limdagi yutuqlarini ko`rsatib berishga harakat qilingan.

Kalit so'zlar: Innovatsion texnologiya, qizil donli tozalanmagan guruch, mexanik-kimyoviy faollashtirish, samaradorlik, sifat.

Аннотация: В статье рассматривается использование педагогических и инновационных технологий в образовании. Проанализирована ее эффективность, сделана попытка продемонстрировать ее цели, задачи и образовательные достижения, показав результаты и другие отличия.

Ключевые слова: Инновационная технология, краснозерный нешлифованный рис, механохимическая активация, эффективность, качество.

Annotation: this article will talk about the application of pedagogical and innovative technology in the field of Education. Its effectiveness has been analyzed, trying to show its goals, objectives and achievements in education with the indication of results and other differences.

Keywords: innovative technology, red grain unpeeled rice, mechanical-chemical activation, efficiency, quality.

Maqsad: Qizil donli tozalanmagan guruch asosida yuqori sifatli BFQ olishning innovatsion texnologiyasini ishlab chiqish.

Kirish

O`zbekiston o`z mustaqilligini qo`lga kiritgan, uni mustaxkamlash yulida chuqur islohotlar olib borilayotgan bir vaqtda, O`zbekiston Respublikasining «Yoshlarga oid davlat siyosati to`g`risida»gi Qonuni bugungi davr talablariga mos ravishda xar tomonlama barkamol, mustaqil fikrlaydigan, mamlakatimiz istiqboli uchun mas’uliyatni o`z zimmasiga olishga qodir, tashabbuskor, zamonaviy texnologiyani mukammal o`zlashtirgan, xalq manfaati yo`lida bor kuch va saloxiyatini safarbar qiladigan, shijoatli yosh kasb egalarni tarbiyalash, ularning intellektual va ijodiy saloxiyatini ro`yobga chiqarish uchun mustahkam huquqiy poydevor yaratish eng dolzarb muammolardan biri hisoblanmoqda.

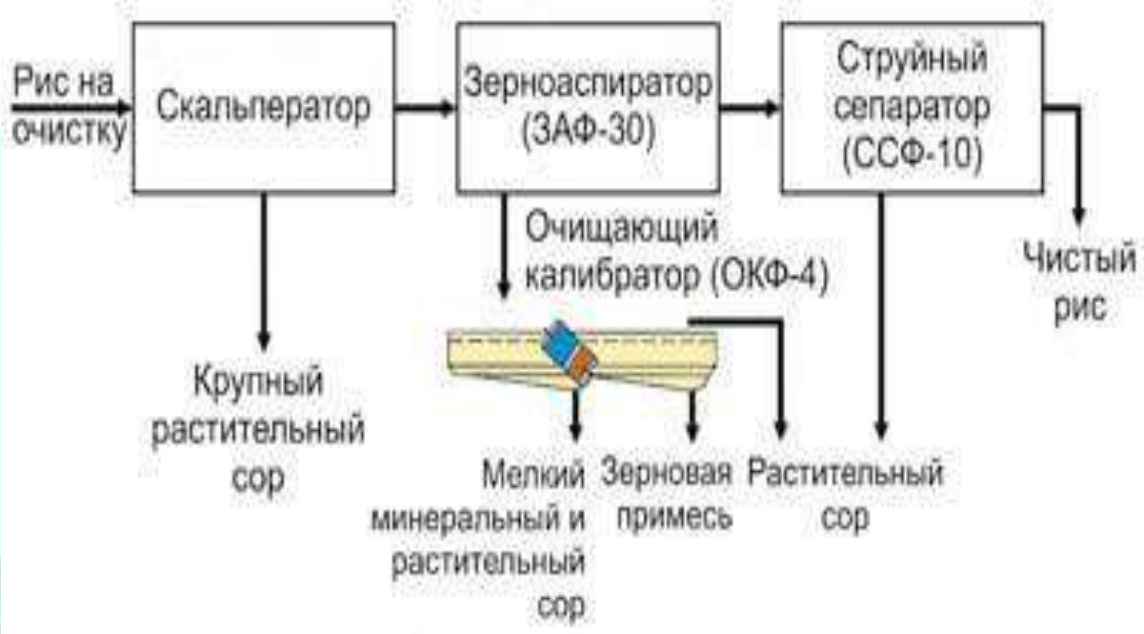
ISSN 3030-3907

Umuman ishlab chiqarish jarayonlarida texnologiya - bu fan tomonidan taqdim qilingan algoritmlar, usullar va vositalar tizimi bo`lib, ulardan foydalanish faoliyatning oldindan belgilangan natijalariga olib boradi, berilgan miqdordagi va sifatdagi maxsulot olinishini kafolatlaydi. Hozirgi, zamonaviy ishlab chiqarishning barcha soxalari texnologiyalarga tayanib ish ko`radilar. "Texnologiya"- bu ishlab chiqarishning erishilgan darajasini jamlangan ifodasidir: bu fan yutuqlarini joriy qilishning usuli ham va natijasi hamdir.

Adabiyotlar tahlili va metodlar. Avvalgi izlanishlarda qizil donli tozalanmagan guruchning yuqori oziqlik qiymati ko'rsatilgan edi. Biroq, uning asosida BFQ olish uchun, avvalo, umumiy don massasidan qizil donli guruchni ajratib olish texnologiyasini ishlab chiqish zarur. [1]

Bunday imkoniyat fotoelektron separatorni ishlab chiqish tufayli paydo bo'ldi, uning ishlash printsipi don massasini rangiga qarab ajratishga asoslangan.

Buni hisobga olgan holda, birinchi bosqichda qayta ishlashga yuboriladigan umumiy guruch doni massasidan qizil donli tozalanmagan guruchni ajratib olishning texnologik sxemasi ishlab chiqildi.



1-rasmda umumiy don massasidan tozalanmagan qizil donli guruchni ajratib olishning texnologik sxemasi keltirilgan.

Ishlab chiqilgan sxema bo'yicha amalga oshirilgan texnologiya quyidagi texnologik operatsiyalarni o'z ichiga oladi. Yorma sifatli shartlarga ega bo'lgan tozalanmagan guruch doni partiyasi guruch donidan kengligi, qalinligi va aerodinamik xususiyatlari bilan farq qiluvchi begona aralashmalarni umumiy don massasidan ajratish uchun ixtisoslashtirilgan havo-elakli separatordan (1-pozitsiya) o'tkaziladi. Jarayon samaradorligini oshirish uchun mahsulotni separatorga

ISSN 3030-3907

berishdan oldin maxsus mexanizm yordamida guruch donlarining uchlaridan tuklar tozalanadi, bu mahsulotning oquvchanligini yaxshilaydi, so'ngra mahsulot ishchi yuzaning kengligi bo'ylab bir xilda taqsimlanadi va havo oqimi bilan puflanadi, bu aralashmalarni samarali olib tashlashga imkon beradi. Keyin don massasi saralash elagiga yuboriladi, undan yirik aralashmalar olib tashlanadi va o'tish joyi orqali mahsulot ekish elagiga tushadi. Ushbu elakdan o'tish joyi orqali mayda aralashmalar ajratiladi va o'tish joyi pnevmatik ajratish kanaliga tushadi, unda engil aralashmalarni ajratishning ikkinchi bosqichi amalga oshiriladi. Tozalangan don massasi keyin magnit separator (4-pozitsiya) va bufer sig'imi (5-pozitsiya) orqali tozalanadi va bufer sig'imi (2-pozitsiya) orqali kombinatorga (3-pozitsiya) tushadi, uning yordamida don massasini mineral aralashmalar, zaif to'lmagan donalardan tozalashning yuqori darajasiga erishiladi, shuningdek, ezilgan donalar fraktsiyalarining bir qismi olib tashlanadi.

Ikki bosqichli ajratishdan so'ng don massasi magnit separator (4-pozitsiya) va bufer sig'imi (5-pozitsiya) orqali po'stlog'ini tozalash moslamasiga (6-pozitsiya) tushadi, u erda guruch doni yuzasidan gul qobiqlari (kepak) olib tashlanadi.

Po'stlog'ini tozalash moslamasidan so'ng don massasi duospiratorga (7-pozitsiya) yuboriladi, unda mahsulot ikki fraktsiyaga ajratiladi: 1-fraksiya - ezilgan butun, ezilgan maydalangan, ezilmagan butun donlar aralashmasi; 2-fraksiya - guruch kepagi. Guruch kepagi texnologik jarayondan olib tashlanadi va mahsulotlar aralashmasi (1-fraksiya) bufer sig'imi (8-pozitsiya) orqali uch fraktsiyaga ajratish uchun paddi-separatorga (9-pozitsiya) tushadi: 1-fraksiya - tozalanmagan guruch; 2-fraksiya - tozalanmagan va tozalangan guruch aralashmasi; 3-fraksiya - tozalangan guruch.

Fotoelektron separatorning ishlash rejimi shunday sozlangan-ki, tozalangan guruchda deyarli qizil donli guruch bo'lmasligi kerak, shuning uchun qizil donli va oddiy guruch aralashmasi bufer sig'imi (12-pozitsiya) orqali qayta fotoelektron separatsiyaga (13-pozitsiya) yuboriladi, u erda asosiy seksiyalarda (o.) qizil donli guruchdan oddiy qobiqli donalar olib tashlanadi, so'ngra qizil donli guruch undan qolgan mineral aralashmalarni olib tashlash uchun nazorat seksiyasiga (k.) yuboriladi. Fotoelektron separatordan (13-pozitsiya) ajratilgan tozalangan qizil donli guruch oraliq sig'imga (14-pozitsiya) yuboriladi.

Natijalar. Tozalangan qizil donli guruchni biologik faol qo'shimchalar olish uchun xom ashyo sifatida qo'llash maqsadida ishlab chiqilgan texnologik sxema bo'yicha olingan tozalangan qizil donli guruchning sifati va xavfsizligi ko'rsatkichlari o'rganildi.

1 va 2-jadvallarda tozalangan qizil donli guruchning organoleptik va fizik-kimyoviy sifat ko'rsatkichlari keltirilgan.

ISSN 3030-3907

1-jadval

Qizil donli sholining mag'zining sifat ko'rsatkichlari (Organoleptik)

Ko'rsatkich nomi	Ko'rsatkich tavsifi
Rangi	Turli intensivlikdagi qizil tusli jigarrang
Ta'mi	Guruch yormasiga xos, begona ta'mlarsiz, nordon emas, achchiq emas
Hidi	Guruch yormasiga xos, begona hidlarsiz, dimog'langan emas, mog'orlangan emas
Tashqi ko'rinishi	Gul qobiqlaridan tozalanmagan, meva va urug' qobig'ini, shuningdek, murtak va aleyron qatlamini saqlab qolgan guruch donlari

1 va 2-jadvallarda keltirilgan ma'lumotlardan ko'rinib turibdiki, organoleptik va fizik-kimyoviy ko'rsatkichlar bo'yicha qizil donli sholining mag'zi biologik faol qo'shimchalar (BFQ) ishlab chiqarishda qo'llaniladigan o'simlik xom ashyosining sifatiga qo'yiladigan talablarga javob beradi.

2-jadval

Qizil donli sholining mag'zining sifat ko'rsatkichlari (Fizik-kimyoviy)

Ko'rsatkich nomi	Ko'rsatkich qiymati
Namlikning massa ulushi, %	12,5-13,0
Sifatli yadroning massa ulushi, %, shu jumladan:	99,6-100,0
maydalangan guruch	5,0-7,0
bej rangli guruch donalari	0,5-1,0
Tozalanmagan so'k yadro massasi ulushi, %	Mavjud emas
Tozalanmagan guruch donining massa ulushi, %	Mavjud emas
Aralashmalarning massa ulushi, %, shu jumladan	Mavjud emas
mineral aralashma	Mavjud emas
organik aralashma	Mavjud emas
Buzilgan donlarning massa ulushi, %	Mavjud emas
Muichkaning massa ulushi, %	Mavjud emas
Kislotalilik, grad.	0,15
G'alla zahirasining zararkunandalari bilan zararlanishi va ifloslanishi	Mavjud emas
Metallomagnit aralashmalarning massa ulushi, mg/kg	Mavjud emas

ISSN 3030-3907

Aniqlanishicha, xavfsizlik ko'rsatkichlari bo'yicha qizil donli sholining mag'zi San Q va M talablariga javob beradi.

Yuqori ozuqaviy qiymatga, shuningdek, saqlanuvchanlikka ega bo'lgan BFQ olish uchun qizil donli sholining mag'zi avval diskli maydalagichda maydalanadi, so'ngra qo'pol maydalangan material mexanik-kimyoviy faollashtirish usuli yordamida qayta ishlanadi.

Ilgari Kuban davlat texnika universiteti (KubDTU) yog'lar texnologiyasi, kosmetika va tovarlar ekspertizasi kafedrasining ishlarida maxsus konstruksiyali vertikal tipdagi rotorli-valikli dezintegratorda (RVD) amalga oshiriladigan mexanik-kimyoviy faollashtirish usulini texnologik xususiyatlarni boshqarish, shuningdek, o'simlik xom ashyosidan olingan BFQning saqlanuvchanligini ta'minlashda yuqori samaradorligi ko'rsatilgan [2].

Buni hisobga olib, rotorli-valikli dezintegratorda mexanik-kimyoviy ishlov berishning texnologik rejimlarining qizil donli sholining mag'zi maydalanish darajasiga, shuningdek, mikrobiologik ko'rsatkichlarga va olinayotgan BFQning saqlanuvchanligiga ta'sir qiluvchi fermentlar - lipaza va lipoksigenazaning faolligiga ta'sirini o'rgandik.

Qizil donli sholining mag'zini maydalashning yuqori darajasini ta'minlaydigan rotorli-valikli dezintegratorning ishchi elementlari kontakt zonasida samarali bosimni aniqlash uchun dezintegratordagi bosim 10 dan 50 MPa gacha bo'lgan oraliqda o'zgarib turgan maxsus tajribalar o'tkazildi.

Dezintegratorning ishchi elementlari kontakt zonasidagi bosimning qizil donli sholining mag'zi maydalanish darajasiga ta'siri bo'yicha ma'lumotlar keltirilgan.RVDning ishchi elementlari kontakt zonasidagi bosimning qizil donli sholining mag'zi maydalanish darajasiga ta'siri, keltirilgan ma'lumotlardan ko'rinib turibdiki, granulometrik tarkibi bilan aniqlanadigan (30 mkm dan kam zarrachalar o'lchamiga ega bo'lgan fraktsiyalarning 98% dan ortig'i) qizil donli sholining mag'zi maydalanishning maksimal darajasiga uning dezintegratorda ishchi elementlar kontakt zonasidagi bosim 40 MPa, mexanik-kimyoviy ishlov berish chastotasi - 128 Hz, rotorning aylanish chastotasi - 16 s-1 va harorat 20-25°C da qayta ishlash natijasida erishish mumkin.

Shuni ta'kidlash kerakki, qayd etilgan ishlov berish rejimlarida maydalangan qizil donli sholining mag'zida BGKP (mahsulotning 0,1 g da), patogen mikroorganizmlar (mahsulotning 25 g da), achitqi va mog'orlar (mahsulotning 1 g da) mavjud emas edi, shuningdek, mezofil aerob va fakul'tativ-anaerob mikroorganizmlar (mahsulotning 1 g da) aniqlanmagan.

Biroq, qayd etilgan haroratda maydalangan materialdagi lipaza va lipoksigenaza faolligi yetarlicha yuqori ekanligi aniqlandi, shuning uchun RVDda

ISSN 3030-3907

qizil donli sholining mag'ziga ishlov berishning samarali harorat rejimlarini aniqlash zarur edi.

Keltirilgan ma'lumotlardan ko'rinib turibdiki, dezintegratorda qizil donli sholining mag'ziga ishlov berish harorati 50°C gacha oshirilganda, lipaza va lipoksigenaza faolligi maksimal darajada pasayadi, haroratni keyingi oshirish fermentlarning faolligini pasaytirmaydi.

O'tkazilgan tadqiqotlar asosida BFQ olish bilan RVDda diskli maydalagichda qo'pol maydalangan qizil donli sholining mag'ziga ishlov berishning texnologik rejimlari ishlab chiqildi (3-jadval).

3-jadval

BFQ olishning texnologik rejimlari

Texnologik rejim	Texnologik rejimning qiymati
RVDda ishlov berish: Harorat, °C,	50 40
Bosim MPa	
mexanik-kimyoviy ishlov berish chastotasi, Hz	128
rotorning aylanish chastotasi, s-	16
Qadoqlash: Iste'mol texnologiyasi	polimer materialdan tayyorlangan 300 g nett massali bankalar
Iste'mol texnologiyasi	qog'oz qoplar 10 kg nett massali

Xulosa

Texnologning texnologiyalarini samarali kullash pedagogning kasbiy kompetentligiga xam boglik. Shu sababli texnologiyalarning samaradorligini texnolog tomonidan ularning kullanilishiga kura xam baxolash mumkin. Bunda kuyidagi mezonlar muxim axamiyatga ega:

- texnologning texnologik madaniyatga egaligi;
- texnologning pedagogik texnologiyalarni kullash borasida tajribaga egaligi;
- texnologlar tomonidan pedagogik texnologiyalarga "ijodiy" uzgarishlar kiritilishi va ularning kayta shakllantirilishi;
- pedagogik texnologiyalarni ta’lim amaliyotiga tatbik etishda ukituvchi va talabalar urtasida uzaro xamkorlik negizida muvaffakiyatli vaziyatlarning karor topganligi;
- pedagogik texnologiyalarning tarkibiy kismlari urtasidagi uzaro alokadorlik;
- pedagogik texnologiyalarning talabalar va pedagoglarning kasbiy rivojlanishini ta’minlashdagi imkoniyatlarga egaligi;

ISSN 3030-3907

- talabalar ukuv-bilish faoliyatining ijobiy axamiyat kasb etishi.

Xulosa kilib aytganda, mamlakatimizda yuz berayotgan tub o`zgarishlar xar bir ishlab chikarish muassasasida texnologiyani soxasini jadallashtirishni talab etadi, yangilikni joriy etish yuli esa xar doim murakkab va uzok jarayon xisoblanadi. Ishonch bilan aytish mumkinki, pedagogik texnologiya va innovatsion texnologiyalar ta'limda yangilik kiritishning asosiy manbai bulib kolmokda.

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ISSN 3030-3907

JUN TOLASI TARKIBIDAGI O‘SIMLIK ARALASHMALARINI TOZALASH USKUNASINING KONSTRUKSIYASINI TAKOMILLASHTIRISH

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Annotatsiya: Maqolada Respublika va xorijda soxa uchun texnika va texnologiyalar ishlab chiqaruvchi korxonalarni ishlab chiqarayotgan texnikalarini ishlash samaradorligi, kamchiligi va afzalliklarini, zamonaviy kompyuterlashgan, avtomatlalarning tasnifi, tuzilishi va texnologik parametrlarini qiyosiy tahlil qila olish, qadoqlovchi vositalar sifatini yaxshilash bo'yicha texnologik uskunalarni optimal rejimlardan foydalanish.

Kalit so’zlar. Baraban, uskunalar, texnologiya, tasma, prujina, kinematik sxemasi.

Аннотация: В статье рассматривается эффективность, недостатки и преимущества производимой техники предприятий-изготовителей техники и технологий для промышленности в республике и за рубежом, возможность проведения сравнительного анализа классификации, структуры и технологических параметров современных компьютеризированных, автоматизированных, оптимальных режимов использования технологического оборудования для улучшения качества упаковочных материалов.

Ключевые слова. Барабан, оборудование, технология, лента, пружина, кинематическая схема.

Annotation: In the article, the use of optimal modes of technological equipment to improve the quality of packaging equipment, be able to carry out a comparative analysis of the efficiency, disadvantages and advantages of working equipment, classification, structure and technological parameters of modern computerized, Automata, and the production of equipment and technologies for Soha in the Republic and abroad.

Keywords. Drum, equipment, technology, band, spring, kinematic scheme.

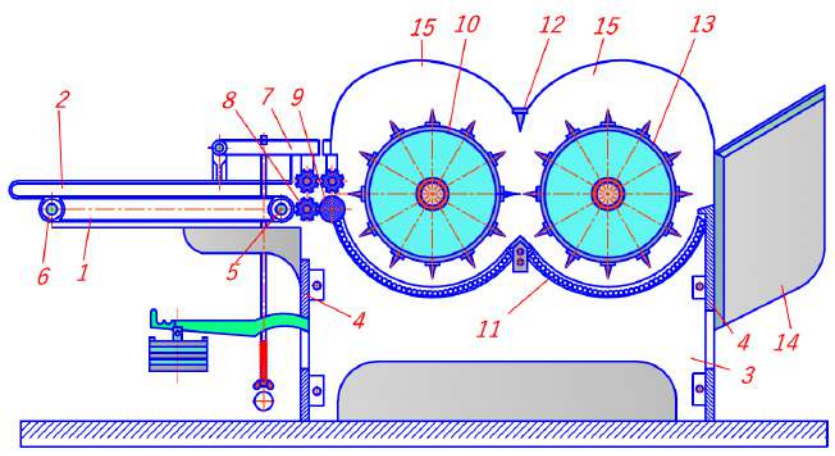
Kirish

Jahonda tabiiy jun tolasini fizik mexanik usulda qayta ishlash va qimmatbaho mahsulot olish yetakchi o‘rinlardan birini egallamoqda. Dunyo miqyosida jun tolasini tayyorlashning asosiy qismi Avstraliya, AQSh, Xitoy, Argentina, Eron, Rossiya, Qozog‘iston va Yevropa mamlakatlariga to‘g‘ri keladi. Jundan sifatli tola olishda tarkibidagi mayda va yirik o’simlik aralashmalaridan samarali tozalash orqali qimmatbaho mahsulot ishlab chiqarish va amaliyotga joriy etishni taqozo etadi. Shu jihatdan rivojlangan davlatlarda junni qayta ishlash va

ISSN 3030-3907

turli materiallar ishlab chiqarishning zamonaviy texnologiyalari qo‘llanilib kelinmoqda. Jun tarmog‘ida ishlab chiqarish hajmini oshirish va xalqaro standartlarga javob beradigan texnologiyalar asosida to‘qimachilik mahsulotlari ishlab chiqarish muhim ahamiyatga ega hisoblanadi.

Jun tolasi asosan 2 xil usulda tozalanadi: mexanik va kimyoviy usullarda. Hozirgi kunda mamlakatimizdagi jun tolasini qayta ishlash zavodlarida asosan, 2BT rusumidagi titish-tozalash uskunasi ishlatilmoqda (1-rasm). 2BT titish-tozalash uskunasining ishlash prinsipi quyidagicha: yuvilmagan jun tolasini bir xil qalinlikda ta’minlash tasmasi 2 ga tashlaydi. Tasma 0,067-0,133 m/s tezliklarda xarakatlanadi. Ta’minlash valigi 9 (yuqorigi-riflali, pastki-silliq) diametri Ø-125 mm bo‘lib, jun tolasini mahkam siqadi va titish-tozalash kamerasiga uzatadi. Ta’minlash valiklarining siqilishini bir juft prujina 3 bilan hosil qiladi va uning siqish kuchi 1,75 kN ga teng.

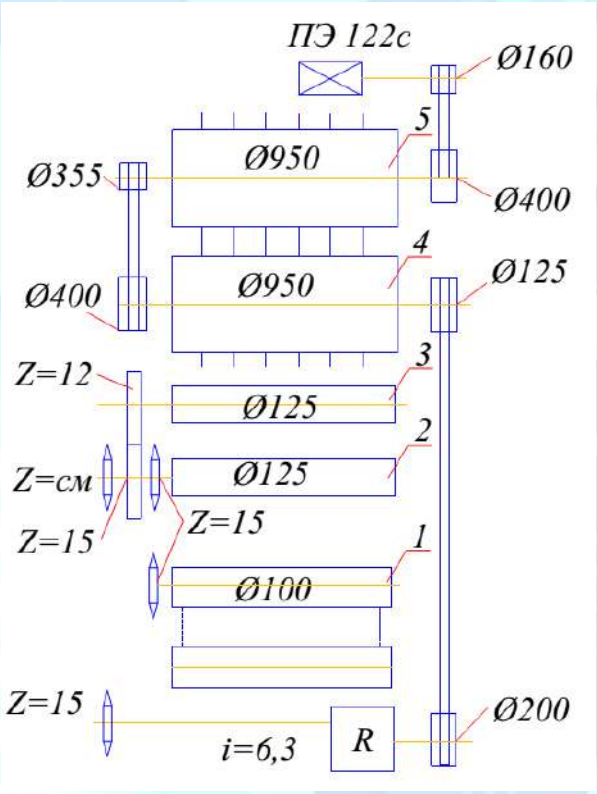


1-rasm. 2BT markali titish agregati sxemasi

Yuqori valik jun bo‘laklarini siljishi va rostlanishini ta’minlab, pastki valikka nisbatan tezroq aylanadi. Birinchi baraban 10 12,5 m/s tezlikda, ikkinchi baraban 13 esa 14,3 m/s tezlikda aylanadi. Ta’minlash valigi siqilgan jun bo‘lakchalarini birinchi qoziqchali barabanga uzatadi. Qoziqchali baraban jun bo‘lakchalarini kolosnikli panjara 11 ustidan sudrab o‘tib, ikkinchi barabanga uzatadi. Ikkinchi baraban jun tolasini titib, iflos aralashmalardan tozalaydi. Jun tutamidan ajralgan ifloslik kolosnikli panjara tirqishlaridan ifloslik bunkeri 3 ga tushadi, so‘ngra transportyor yordamida uskuna ostidan chiqarib tashlanadi. Baraban qoziqlari ildirib olgan jun bo‘laklari prizma 15 ga urilishi titish jarayonini jadallashtiradi. Jun tolasini titish va tozalashdan so‘ng barabanning markazdan qochma kuchi tezligini yo‘naltirgich 14 so‘ndiradi va uchib chiqish traektoriyasini o‘zgartiradi. Birinchi barabandan ikkinchisiga o‘tishda jun tutamining ayrim qismlari qo‘zg‘almas qoziq 12 da ushlanib qoladi, qoziq bilan ikkinchi baraban ta’siri natijasida jun qo‘shimcha titiladi. 2BT-150-Sh titish-tozalash uskunasining kinematik sxemasi asosida ish unumdorligi aniqlanadi.

ISSN 3030-3907

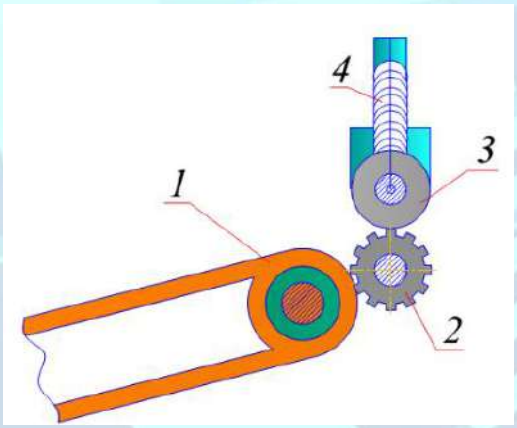
Uskunaning ishchi organlarini harakatlantirishda A02-61-8 elektrodvigateldan foydalaniladi, uning aylanish tezligi 750 r/min Ta’minlash valiklarining aylanish tezligi yulduzcha tishlarining soniga bog‘liq bo‘ladi—y_{sm}=14; 16; 19; 22; 25 tish.

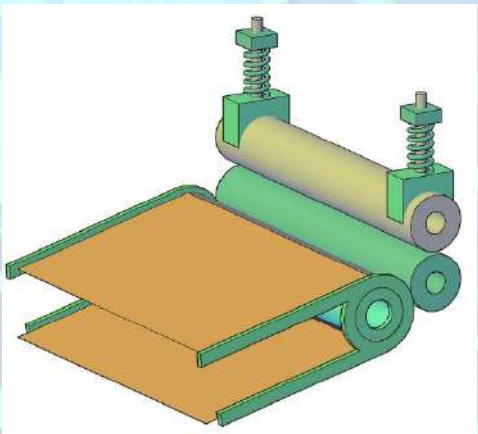


2-rasm. 2BT-150Sh titish-tozalash uskunasining kinematik sxemasi.

1- ta’minlash tasmasi; 2 - ostki ta’minlash valigi (silliq); 3 - ustki ta’minlash valigi (riflali); 4 - birinchi qoziqli baraban; 5 - ikkinchi qoziqli baraban.

2BT-150Sh titish-tozalash uskunasidagi valiklarning aylanishlar sonining o‘zgarishi yulduzcha tishlariga bog‘liq bo‘lib u quyidagi 1–jadvalda keltirilgan.





3-rasm. 2BT-150Sh rusumli tozalash jihozini ta’minlash mexanizmi

1-ta’milovchi transportyor; 2-ta’minlash roligi; 3-tekislovchi silindr; 4-prujina.

ISSN 3030-3907

1-jadval

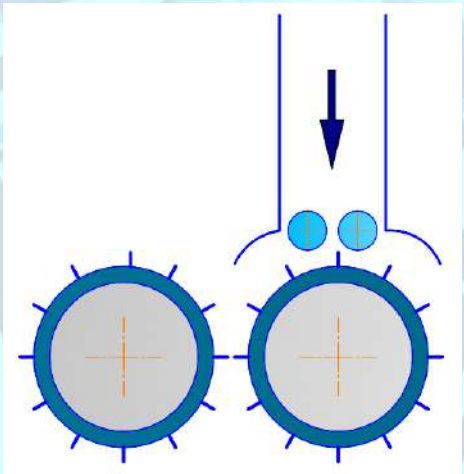
2BT-150Sh rusumli titish-tozalash uskunasidagi valiklarning aylanishlar sonining o‘zgarishi

	Ta’minlash tasmasi		Silliq valik		Riflali valik	
y_{sm}	n, s^{-1}	v, m/s	n, s^{-1}	v, m/s	n, s^{-1}	v, m/s
14	0,42	0,13	0,42	0,17	0,5	0,2
16	0,37	0,11	0,37	0,15	0,45	0,175
19	0,31	0,1	0,31	0,12	0,38	0,15
22	0,27	0,08	0,27	0,11	0,33	0,12
25	0,24	0,075	0,24	0,09	0,29	0,11

Korxonalarda ishlatilayotgan titish-tozalash uskunasining ta’minlash mexanizmi noqulay yasalganligi, bu esa uskunaning ish unumdorligiga, tola sifatiga salbiy ta’sir ko‘rsatishi va iqtisodiy samaradorlikning sezilarli darajada pasayishiga sabab bo‘lishi aniqlandi. Jun tolasini titish-tozalash uskunasining eng asosiy va murakkab konstrutsiyasiga ta’minlash mexanizmlari kiradi. Uskuna uzluksiz bir me’yorda tola bilan ta’minlanishi, energiya va vaqt sarfi to‘g‘ri taqsimlanishi uchun ta’minlovchi mexanizmlarni ahamiyati katta. Titish-tozalash uskunalarini ta’minlash mexanizmlari 3 xil usulda o‘rnatiladi:

- vertikal ta’minlash mexanizmi;
- gorizontal ta’minlash mexanizmi;
- qiya ta’minlash mexanizmi.

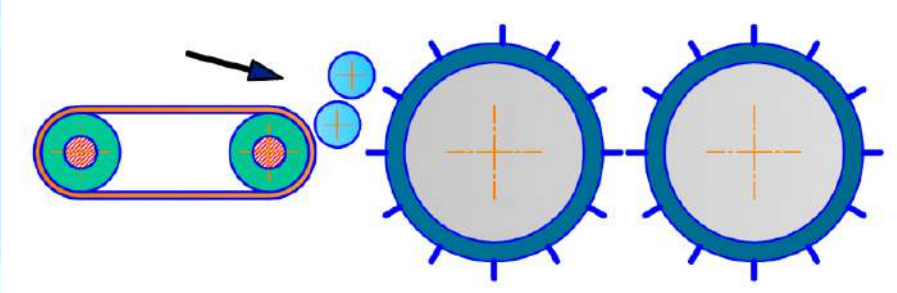
Vertikal ta’minlash mexanizmi asosan chigitli paxta tolalari tarkibidagi iflosliklarni tozalash uskunalarining ishchi kamera yuqori qismiga o‘rnatiladi. Bunday ta’minlash mexanizmlari iflosligi yuqori bo‘lmagan tolalarni tozalash uskunalariga tavsiya qilinadi (4-rasm).



4-rasm. Vertikal ta’minlash mexanizmi

ISSN 3030-3907

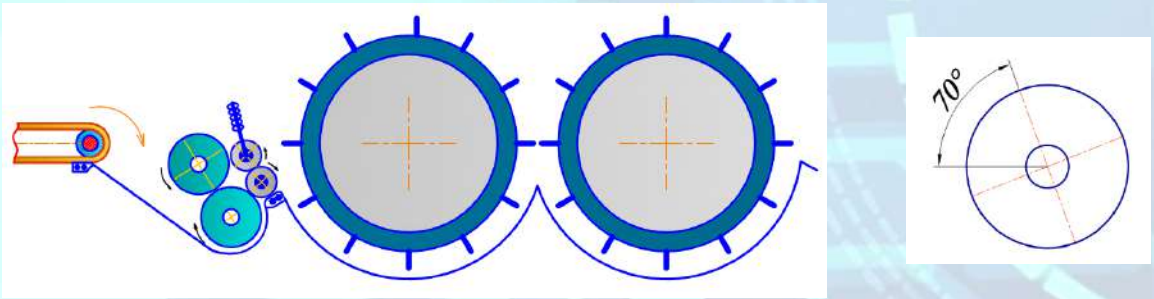
Gorizontal ta’minlash mexanizmi iflosligi yuqori bo‘lgan tolalarni titish va tozalash uskunalariga o‘rnatiladi (5-rasm). Jun tolasi ham ifloslanish darajasi yuqori bo‘lgan tolalar qatoriga kiradi.



5-rasm. Gorizontal ta’minlash mexanizmi

Tozalashda tola qatlamining bir me’yorda uzatilishi muhim ahamiyatga ega. Tolali qatlam gorizontal, vertikal va qiya holatda ta’minlovchi juftlar tomonidan tozalash mexanizmiga uzatiladi. Tozalash uskunalarida bunkerli ta’minlash usuli ham taklif qilinmoqda va qo‘llanilmoqda.

D.Jo‘rayevning ilmiy ishida taklif qilingan ta’minlash mexanizmida 55° S qiya o‘rnatilgan. Bu holatda tolani olib ketish me’yorini rostlashda qiyinlik tug’diradi. Tadqiqotlar natijasida ta’minlash mexanizmlarining o‘rnatilish usullaridan afzalligi va kamchiligi o‘rganilib, qiya holati va bunkerli usuli (6-rasm) tanlab olindi. Chunki ta’minlovchi valiklar uskunaga nisbatan 70° gradus qiyalikda o‘rnatilgan, diametri ikki marta kattalashganini evaziga tolani olib ketish samaradorligi oshgan.



6-rasm. Takomillashtirilgan bunkerli va qiya ta’minlash mexanizmi sxemasi

Yuqorida aytilganidek, 2BT-150Sh rusumli titish-tozalash uskunasining asosiy kamchiligi, uning jun bilan ta’minlash mexanizmi konstruksiyasini tolani bir hil me’yorda ta’minlamasligidir, natijada bu yerda tola tiqilishi sodir bo‘ladi, uskunaning ortiqcha energiya sarflanishiga va tola sifatining pasayishiga sabab bo‘ladi. Bundan tashqari jun tutamini urib bo‘laklarga bo‘lish qoziqchalari va tola chiqish novi noqulay yasalishi, o‘simlik aralashmalaridan qisman tozalashi yoki (qo‘ytikan)larini umuman ajrata olmasligidir.

Adabiyotlarning tahlili. Jahonda tabiiy jun tolasini fizik mexanik usulda qayta ishlash va qimmatbaho mahsulot olish dolzarb masalalardan biri hisoblanadi.

ISSN 3030-3907

Dunyo miqyosida jun tolasini Avstraliya, AQSh, Xitoy, Argentina, Eron, Rosiya. Qozog‘iston va Yevropa mamlakatlari katta qismini yetishtiradi. Jundan sifatli tola olishda tarkibidagi mayda va yirik ifloslikdan samarali tozalash orqali qimmatbaho mahsulot ishlab chiqarishga erishish mumkin. Rossiyaning “OOO KardMach” korxonasi jun tolasini qayta ishlash va jun tarkibidagi yengil aralashmalarni tozalashga ixtisoslashgan.

Tadqiqot metodologiyasi. Respublika va xorijda soha uchun texnika va texnologiyalar ishlab chiqaruvchi korxonalarni, texnologik jarayonlarni namunaviy modellari va, zamonaviy o‘lchov asboblari, tajriba uskunalarini, tahlil uchun organik xom ashyolarni tayyorlash, mahsulotning xavfsizlik ko‘rsatkichi texnologiyasini takomillashtirish.Ishlab chiqarish jarayonlaridagi ilmiy muammolarni, ilmiy tadqiqot natijalarini amaliyotga tadbiq etish va qo'llash tartibini bilish vu ulardan foydalana olishi.

Tahlil va natijalar. Jun tolasini dastlabki ishlash korxonalariga qabul qilingan xomashyo saralanadi va qo‘l yordamida yengil aralashmalardan ajratiladi. Jun tolasini titish-tozalash uskunasi yordamida xomashyo tarkibidagi organik va mineral chiqindilar, og‘ir aralashmali va iflosliklar tozalanadi. Jun tolasi tarkibidagi qiyin ajraluvchi o‘simlik qoldiqlari titish-tozalash va yuvish jarayonida ham ajralmay qoladi. O‘simlik qoldiqlarini tozalash uchun mexanik usulda tozalanadi.

Xulosa va takliflar. Jun tolasi tarkibidagi iflosliklarni tozalash uskunalari ish unumdorligi va ish samaradorligini oshirish uchun yangi ishchi organlar hamda mashinalarni ishlab chiqish asosida jun tolasidan o’simlikni tozalash texnologiyasini takomillashtirish, parametrlarini asoslash.

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ISSN 3030-3907

UDK 622.765/666.171

COALESCER FILTRLARINING QATTIQ ZARRACHALAR BILAN TO‘LIB QOLISH MUAMMOLARI

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Annotatsiya. Ushbu maqolada coalescer filtrlari va ularning sanoat sohalaridagi ahamiyati tahlil qilindi. Filtrlarning qattiq zarrachalar bilan to‘lib qolgan namunani turli usullar yordamida kimyoviy tarkibi aniqlangan. Atomic Absorption Spectrophotometer (AAC-spektri) va X-ray fluorescensiya (XRF) spektroskopiyasidan olingan natija tasvirlari, natijalar coalescer filtrda Fe qattiq zarachalari bilan to’lib qolganligi haqidagi ilmiy asoslari keltirilgan. Dastlabgi ilmiy natijalar olindi va maqolada keltirildi.

Kalit so’zlar. Coalescer, filtir, temir, zarracha, vodorod xlorid, kislota.

Abstract. This article analyzes coalescer filters and their importance in industrial sectors. The chemical composition of the sample filled with solid particles in the filters was determined using various methods. The results obtained from Atomic Absorption Spectrophotometer (AAC-spectrum) and X-ray fluorescence (XRF) spectroscopy are presented, and the scientific basis for the results is presented, indicating that the coalescer filter is filled with Fe solid particles. Preliminary scientific results have been taken and outlined in the article.

Keywords. Coalescer, filter, iron, particle, hydrogen chloride, acid.

Аннотация. В этой статье анализируются коалесцирующие фильтры и их значение в промышленных секторах. Химический состав образца, заполненного твердыми частицами в фильтрах, определялся с использованием различных методов. Представлены результаты, полученные с помощью атомно-абсорбционного спектрометра (AAC-спектр) и рентгеновской флуоресцентной (XRF) спектроскопии, а также представлена научная основа результатов, указывающая на то, что коалесцирующий

ISSN 3030-3907

фильтр заполнен твердыми частицами Fe. Предварительные научные результаты были получены и изложены в статье.

Ключевые слова. Коагулятор, фильтр, железо, частица, хлористый водород, кислота.

KIRISH

Coalescer filtrlari sanoatning turli sohalarida, jumladan, neft-gaz, kimyo, energetika va aviatsiya sanoatida keng qo‘llaniladi. Ushbu filtrlar gaz va suyuqliklardan suv va mayda iflosliklarni ajratib olish uchun mo‘ljallangan. Biroq, ekspluatatsiya jarayonida coalescer filtrlari qattiq zarrachalar, ayniqsa temir qoldiqlari tufayli tezda to‘lib qolishi mumkin.[1]

Coalescer filtrlari mayda suyuqlik tomchilarini birlashtirish (coalescing) yo‘li bilan ajratib olishga mo‘ljallangan. Bu filtrlar odatda ikki bosqichli bo‘ladi:

1. **Koalesser bosqichi –** mayda tomchilarni yiriklashtirib, ajralishni osonlashtiradi.
2. **Ajratish bosqichi** – yirik tomchilar ajratilib, filtrlangan suyuqlik yoki gaz chiqadi.[2]

Ishlatilayotgan suyuqlik tarkibida ortiqcha qattiq zarrachalar, ayniqsa zang, metall qoldiqlari yoki boshqa mexanik aralashmalar mavjud bo‘lsa, filtr tezda to‘lib qoladi. Hozirgi kunda kop zavodlarda Coalescer filtrlardan foydalanilyotgani ma’lum. Coalescer filtrlarini temir zarachalaridan tozalash dolzarb muammolardan biri hisoblanadi.

MATERIAL VA METODLAR

X-ray fluorescensiya (XRF) spektroskopiyasi — materiallarning element tarkibini aniqlash uchun ishlatiladigan kuchli tahlil usuli. Bu usul namuna yuzasiga yuqori energiyali rentgen nurlarini yo‘naltirish orqali ishlaydi. Ushbu nurlar materialdagi atomlarni qo‘zg‘atib, ularning o‘ziga xos ikkilamchi (fluoresan) rentgen nurlarini chiqarishiga sabab bo‘ladi. Har bir element o‘ziga xos energiyaga ega rentgen nurlarini chiqaradi, bu esa ularning aniqlanishini ta’minlaydi.[3][4][5]

Atomik Absorbsiya Spektrofotometri (AAS) – bu namunadagi ma’lum metall elementlarning konsentratsiyasini aniqlash uchun ishlatiladigan tahliliy asbobdir. U gaz holatidagi erkin atomlar tomonidan yorug‘likning yutilishini o‘lchash printsipiga asoslangan. Namuna alangada yoki grafit pechda bug‘lanib, metall ionlari erkin atomlarga aylanadi. Maxsus lampadan chiqqan yorug‘lik (har bir elementga xos bo‘lgan to‘lqin uzunligida) atomlar tomonidan yutiladi. Yutilgan yorug‘lik miqdori elementning konsentratsiyasiga to‘g‘ri proportsional bo‘ladi. Asbob yutilishni oldindan tayyorlangan kalibrovka grafigi bilan solishtirib, element miqdorini aniqlaydi.[6]

ISSN 3030-3907

NATIJA VA MUHOKAMALAR

O‘zbekiston Respublikasida Coalescer filtrlari ishlatadigon zavodlar ko’pligini hisobga olsak, ularni har xil qattiq zarachalardan tozalash jarayoni hal etilmagan. Chet eldan olib kelinayotgan coalescer filtrlari tozalash bugungi kunda dolzarb masalalaridan biri bo‘lib qolmoqda. Coalescer filtrlari tozlash chet eldan valyuta hisobiga import qilinishini kamaytirish mumkin.



1-rasm. Qattiq zarachalar bilan to’lib qolgan coalescer filtr

Qattiq zarachalarga to’lib qolgan coalescer filtrni 2x2 sm^2 qilib kesib olib Epsulon3 X-ray fluorescence uskunasining mahsus yachekasiga qoyildi.

Application	12_08_2024
Sequence	1 of 1
Position	1
Measurement time	12-Aug-2024 11:11:28

Minimum He Flow (l/min)	0.82

Compound	F	Na	Mg	Si	S	Cl	K	Ca	Cr	Mn
Conc	33.816	2.900	0.256	26.427	95.352	3203.601	-4.311	6.383	271.956	8.598
Unit	cps	cps	cps	cps	cps	cps	cps	cps	cps	cps

Compound	Fe	Cu	Zn	Rb	Zr
Conc	3349.224	0.449	0.280	0.111	1.062
Unit	cps	cps	cps	cps	cps

2-rasm. Bu rasm X-ray fluorescensiya (XRF) tahlili natijalarini ko‘rsatadi. Jadvalda turli elementlarning namuna ichidagi konsentratsiyasi **cps (counts per second)** birliklarida berilgan.

Element	Konsentratsiya (cps)	Element	Konsentratsiya (cps)
F (Ftor)	33.816	**Cr (Xrom)**	271.956
Na (Natriy)	2.900	**Mn (Marganets)**	8.598
Mg (Magniy)	0.256	**Fe (Temir)**	3349.224
Si (Kremniy)	26.427	**Cu (Mis)**	0.449
S (Oltingugurt)	95.352	**Zn (Rux)**	0.280
Cl (Xlor)	3203.601	**Rb (Rubidiy)**	0.111

ISSN 3030-3907

K (Kaliy)	-4.311	**Zr (Zirkoniy)**	1.062
Ca (Kalsiy)	6.383		

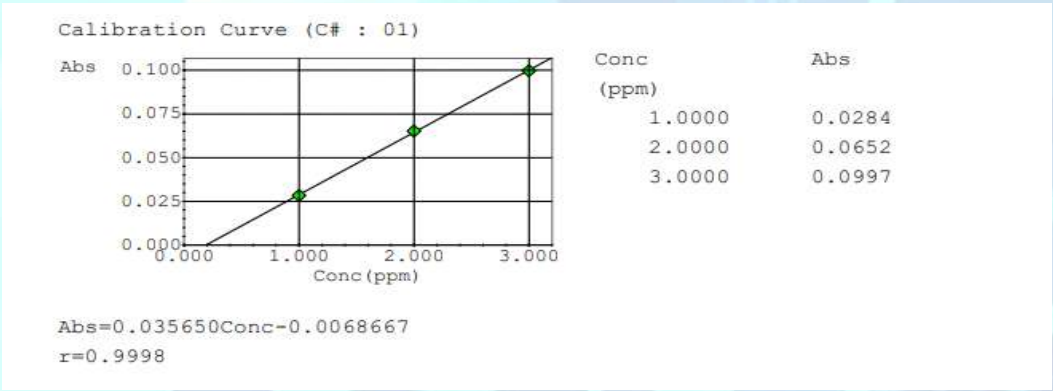
Eng yuqori konsentratsiyaga ega bo'lgan element Fe (temir): 3349.224 cps (eng asosiy kompanent) ekanligini korishimiz mumkin.

AAC-spektr qurilmasida tekshirish metodi orqali 1×1 sm² o'lchamdagi namuna torozida tortib olinindi. 2.2084 g namunaga 20 ml HCl eritmasida eritildi 100 ml. Eritmani 0,45 mkm filtrdan o'tkazildi. 1 ml-100 ml-1ml-100 ml-1ml-10 ml ga suyiltirildi. Keyinchalik tahlil uchun atom absorbsiya spektrometriyasi (AAC- (SHIMADZU AA-700 Atomic Absorption Spectrophotometer)ga yuborildi.

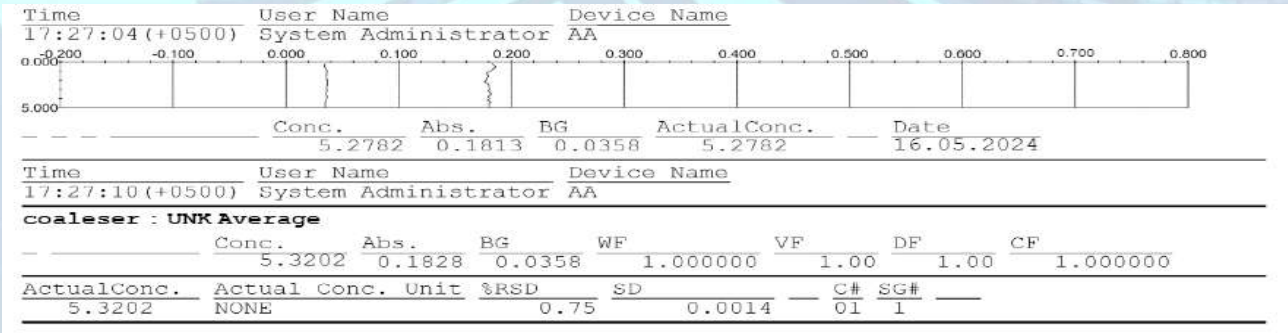
A



B



C



3-rasm. AAC-spektrdan olingan natija tasviri.

ISSN 3030-3907

Element	To‘lqin uzunligi (nm)	Lampa toki (mA)	Yarim teshik kengligi (nm)	Lampa rejimi
Fe (Temir)	248.3	12	0.2	BGC-D2

Optik parametrlar (3-a rasm).

Kalibrovka egri chizig‘i (Calibration Curve) atom absorbsiya spektrometriyasi (AAS) uchun kontsentratsiya (ppm) va yutilish (Abs) orasidagi bog‘liqlikni ko‘rsatadi.

Kalibrovka tenglamasi: Abs=0.035650×Conc−0.0068667, Korrelatsiya koeffitsiyenti **r = 0.9998**, bu esa juda yuqori aniqlikni bildiradi.

Standart nuqtalar: 1.0000 ppm – 0.0284 Abs, 2.0000 ppm – 0.0652 Abs, 3.0000 ppm – 0.0997 Abs (3-b rasm).

Natijalarni qurilma miqdoriy tahlil qilgandagi grafik tasvirdan Fe ionining miqdorini aniqlash mumkin hisoblanadi (3-c rasm).

$$x = \frac{5{,}3202 * 100 * 100 * 10}{10000} = 53{,}202\%$$

Xulosalar

Coalescer filtrlari sanoat sohalarida muhim rol o‘ynaydi, lekin ular noto‘g‘ri ekspluatatsiya qilinsa yoki texnik xizmat yetarlicha ko‘rsatilmasa, tezda to‘lib qolishi mumkin. Ayniqsa, qattiq zarrachalar va temir qoldiqlari filtr tizimlarining samaradorligini pasaytiradi. Ushbu muammoning oldini olish uchun muntazam texnik xizmat ko‘rsatish, sifatli filtr elementlaridan foydalanish va optimal ish sharoitlarini ta’minlash zarur. Shu yo‘l bilan ishlab chiqarish jarayonlarining samaradorligini oshirish va xarajatlarni kamaytirish mumkin. Temirni aniqlashda zamaonaviy AAC (atomic absorption spectrometry) uskunasidan foydalanilgan. Uskuna natijasiga ko’ra coalescer filtridan olingan namuna tarkibida 53,202% Fe metali borligi aniqlandi. Xulosa qilib aytadigan bo’lsak coalescer filtrlari to’lib qolishning asosiy qismi Fe zarachalardan iborat ekanligi aniqlandi.

Foydalanilgan adabiyotlar

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ISSN 3030-3907

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ISSN 3030-3907