ISNN 3030-3907

2026
MAY
ISSUE - 5
VOLUME - 6

DEVELOPMENT OF SCIENCE

scientific journal



Development of science

Ilmiy jurnal

MAY 2026
Issue - 5, VOLUME – 6

ISSN 3030 -3907

Ilmiy jurnal OAK rayosatining 2024 yil 27 sentabrdagi 361-son qaroriga asosan 02.00.00 kimyo fanlari hamda 2025 yil 12 fevral 367- son qaroriga asosan 05.00.00 texnika fanlari bo‘yicha falsafa doktori (PhD) va fan doktori (DSc) ilmiy darajasiga talabgorlarning dissertatsiya ishlari yuzasidan dissertatsiyalari asosiy ilmiy natijalarini chop etish tavsiya etilgan milliy ilmiy nashrlar ro‘yxatiga kiritilgan.

BOSH MUHARRIR:
Temirov Alisher Hoshim o‘g‘li – texnika fanlari falsafa doktori (PhD),Dotsent.
TAHRIRIYAT KENGASH RAISI:
Fozilov Sadriddin Fayzullayevich – texnika fanlari doktori, professor
TAHRIRIYAT KENGASH A’ZOLARI

TEXNIKA FANLARI/ TECHNICAL SCIENCES/ ТЕХНИЧЕСКИЕ НАУКИ

Bozorov G‘ayrat Rashidovich
Buxoro Davlat Texnika Universiteti, professor
Abdurahmonov Olim Rustamovich
Buxoro Davlat Texnika Universiteti, professor
Adizov Bobur Zamirovich
O‘zbekiston Respublikasi Fanlar akademiyasi Umumiy va noorganik kimyo instituti, professor
Hayitov Ruslan Rustamjonovich
Buxoro Davlat Texnika Universiteti, professor
Jumayev Qayum Karimovich
Buxoro Davlat Texnika Universiteti, professor.
Berdiyev Dorob Murodovich
Islom Karimov nomidagi Toshkent Davlat Texnika Universiteti, professor
Maxmudov Rafiq Amonovich
Buxoro Davlat Texnika Universiteti, professor.
Tilloyev Lochin Ismatilloyevich
Buxoro Davlat Texnika Universiteti, dotsent.
Raxmonov Qahramon Sanakulovich
Buxoro Davlat Texnika Universiteti, dotsent.
Barakayev Nusratullo Rajabovich
Islom Karimov nomidagi Toshkent Davlat Texnika Universiteti, professor.
Jo‘rayev Xayrullo Fayziyevich
Buxoro Davlat Texnika Universiteti, professor.
Panoyev Erali Rajabboyevich
Buxoro Davlat Texnika Universiteti, dotsent.
Ataullayev Sherzod Nabiullyevich
Buxoro Davlat Texnika Universiteti, dotsent.
Murodov Malik Negmurodovich
Buxoro Davlat Texnika Universiteti, dotsent.
Axmedova Ozoda Bahronovna
Islom Karimov nomidagi Toshkent Davlat Texnika Universiteti.
Safarov Bahri Jumayevich
Buxoro Davlat Texnika Universiteti, dotsent.
Xaydarov Axtam Amonovich
Buxoro Davlat Texnika Universiteti, dotsent.
Safarov Jasur Alijon o‘g‘li
Buxoro Davlat Texnika Universiteti, dotsent.

KIMYO FANLARI/ CHEMICAL SCIENCES/ ХИМИЧЕСКИЕ НАУКИ

Axmedov Voxid Nizomovich
Buxoro Davlat Texnika Universiteti, professor
Umarov Baqo Bafoyevich
Buxoro Davlat Universiteti, professor
Kodirov Abduaxad Abduraximovich
Qarshi davlat Universiteti, professor
Qurbonov Mingniqul Jumagulovich
Qarshi davlat Universiteti, dotsent
Turemuratov Sharibay Naurizbaevich
O‘zbekiston Respublikasi Fanlar akademiyasi Qoraqalpog‘iston bo‘limi Bosh ilmiy kotibi, professor
Tursunov Kaxor Shonazarovich
Qarshi davlat Universiteti, professor
Do‘stov Hamro
Buxoro Davlat Texnika Universiteti, professor
Panoyev Nodir Shavkatovich
Buxoro Davlat Texnika Universiteti, dotsent.
Olimov Bobur Bahodir o‘g‘li
Buxoro Davlat Texnika Universiteti, dotsent.
Kasimov Sherzod Abduazimovich
Termiz Davlat Universiteti, professor.
Aliqulov Rustam Valiyevich
Termiz Davlat Universiteti, professor
Tropov Xamza Tursunovich
Samarqand Davlat Universiteti, professor

IQTISODIYOT FANLARI/ ECONOMICS/ ЭКОНОМИЧЕСКИЕ НАУКИ

Nizamov Aslitdin Badreddinovich
Buxoro Davlat Texnika Universiteti, professor.
Boboyev Akmal Choriyevich
Buxoro Davlat Texnika Universiteti, professor.
Ergashxojayeva Shaxnoza Djasurovna
Toshkent davlat iqtisodiyot universiteti, professor
Saidaxmedova Nodira Ilxomovna
Toshkent davlat iqtisodiyot universiteti, professor
Muxsinov Bekzod Toxirovich
Buxoro Davlat Texnika Universiteti, dotsent.
Shakarov Qulmat Ashirovich
Renessans ta'lim universiteti,dotsent.
Jumaeva Zulfiya Qayumovna
Buxoro Davlat Texnika Universiteti, dotsent.
Norova Salomat Yusupovna
Buxoro Davlat Texnika Universiteti, dotsent.
Avezova Shaxnoza Maxmudjonovna
Buxoro Davlat Texnika Universiteti, dotsent.
Jalilov Jamshid G‘anijonovich
Toshkent davlat iqtisodiyot universiteti, dotsent
Xasanova Gulruh Djumanazarovna
Buxoro Davlat Texnika Universiteti, dotsent.

PEDAGOGIKA FANLARI/ PEDAGOGICAL SCIENCES / ПЕДАГОГИЧЕСКИЕ НАУКИ

Siddiqova Sadoqat G‘afforovna
Buxoro Davlat Texnika Universiteti, dotsent.
Zoyirov Erkin Xalilovich
Buxoro Davlat Texnika Universiteti, DSc, professor
Gaffarov Feruz Hasanovich
Puchon Universiteti, *professor*
Ruziyev Davron Yuldashevich
Buxoro Davlat Universiteti, professor
Muradova Firuza Rashidovna
Buxoro Davlat Texnika Universiteti, professor.
Yunusova Gulandon Samiyevna
Buxoro Davlat Texnika Universiteti, professor.
To‘xtayeva Zebo Sharifovna
Buxoro Davlat Texnika Universiteti, professor.
Navro‘zova Gulchixra Nigmatovna
Buxoro Davlat Texnika Universiteti, dotsent.
Uzoqova Laylo Polvonovna
Buxoro muhandislik – texnologiya instituti, dotsent.
To‘raqulova Marjona Qiyom qizi
Buxoro Davlat Texnika Universiteti, dotsent.
Muradova Zarina Rashidovna
Buxoro Davlat Texnika Universiteti, dotsent.
Murodov Sanjar Aslonovich
Buxoro Davlat Texnika Universiteti, dotsent.
Shodiyev Jahongir Jo‘raqulovich
Buxoro Davlat Texnika Universiteti, dotsent
Gaffarov Laziz Hasanovich
Buxoro muhandislik – texnologiya instituti, dotsent.

Tahririyat a’zolarning to‘liq ro‘yxati jurnalning www.devos.uz saytida keltirilgan.

Tahririyat hay’ati a’zolarining tarkibini o‘zgartirish hamda qo‘shimcha kiritish yoki tahririyat a’zoligidan chiqarish bosh muharrir tomonidan amalga oshiriladi.

ISSN 3030-3907

Development of science ilmiy jurnali 2024 yil 15 aprel kuni №256445 sonli guvohnoma bilan Davlat ro‘yxatidan o‘tgan.

To‘plam elektron ko‘rinishda (pdf formatida) mualliflarga taqdim etiladi. To‘plamga kiritiladigan maqolalarning mazmuni, ulardagi statistik ma’lumotlar va me’yoriy hujjatlarning to‘g‘riligiga hamda har qanday fikr - mulohazalarga mualliflarning o‘zlari mas’ul hisoblanadilar. Talablarga javob bermaydigan maqolalar to‘plamga kiritilmaydi. Tashkiliy qo‘mita maqola matnini qisqartirish, qisman tuzatish kiritish, seksiyalarga joylashtirish huquqiga ega.

ISSN 3030-3907

MEDICINAL CHEMISTRY OF TARGETED CANCER THERAPY FROM UZBEK MEDICINAL PLANTS

Saif Mohammed
First-year student of the International Faculty at Samarkand State Medical University.
Anvarjon Buronov
Assistant of the Faculty of Biotechnology, Engineering, and Pharmacy at Samarkand State Medical University.
E-mail: mohammedsaif69450@gmail.com

Abstract. The treatment of cancer requires highly efficient and selective therapeutic strategies. Targeted therapy has emerged as a key approach in modern medicinal chemistry, aiming to enhance efficacy while reducing toxicity. Natural products, particularly medicinal plants, represent a promising source of bioactive compounds. Uzbekistan's flora, comprising over 4500 species with more than 600 medicinal plants, remains an underexplored resource for novel anticancer small molecules. In particular, phytochemical investigation of species such as *Helichrysum maracandicum* enables the identification of potential lead compounds. Through medicinal chemistry approaches, these natural products can be optimized into highly selective and effective drug candidates. This study highlights the integration of Uzbek ethnobotany with modern targeted drug design, outlining current opportunities and future challenges.

Keywords: targeted cancer therapy, medicinal plants, medicinal chemistry, flavonoids, Helichrysum maracandicum, drug discovery

Annotatsiya. Saraton kasalliklarini davolash yuqori samarali va selektiv yondashuvlarni talab qiladi. Nishonli terapiya zamonaviy tibbiy kimyoning muhim yo‘nalishi bo‘lib, davolash samaradorligini oshirish va toksiklikni kamaytirishga qaratilgan. Tabiiy manbalar, ayniqsa dorivor o‘simliklar, biofaol birikmalar uchun istiqbolli manba hisoblanadi. O‘zbekiston florasi 4500 dan ortiq turdan iborat bo‘lib, ularning 600 dan ortig‘i dorivor ahamiyatga ega. Bu esa yangi o‘smaga qarshi kichik molekulalarni izlash uchun hali yetarlicha o‘rganilmagan resursdir. Xususan, *Helichrysum maracandicum* kabi turlarni fitokimyoviy o‘rganish istiqbolli dori nomzodlarini aniqlash imkonini beradi. Tibbiy kimyo yondashuvlari orqali ushbu tabiiy birikmalarni yuqori selektiv va samarali dori nomzodlariga aylantirish mumkin. Mazkur ish o‘zbek etnobotanikasi va zamonaviy nishonli dori dizayni integratsiyasini yoritib, mavjud imkoniyatlar va kelajakdagi muammolarni ko‘rsatadi.

Kalit so‘zlar: nishonli saraton terapiyasi, dorivor o‘simliklar, tibbiy kimyo, flavonoidlar, *Helichrysum maracandicum*, dori kashfiyoti

ISSN 3030-3907

Аннотация. Лечение онкологических заболеваний требует высокоэффективных и селективных подходов. Таргетная терапия является важным направлением современной медицинской химии, направленным на повышение эффективности и снижение токсичности лечения. Природные источники, особенно лекарственные растения, представляют собой перспективный источник биоактивных соединений. Флора Узбекистана насчитывает более 4500 видов, из которых свыше 600 обладают лекарственными свойствами, что делает её недостаточно изученным ресурсом для поиска новых малых молекул с противоопухолевой активностью. В частности, фитохимическое изучение таких видов, как *Helichrysum maracandicum*, позволяет выявлять перспективные структуры-кандидаты. С использованием методов медицинской химии эти природные соединения могут быть преобразованы в высокоселективные и эффективные лекарственные кандидаты. Данная работа рассматривает интеграцию узбекской этноботаники и современного таргетного дизайна лекарств, выделяя существующие возможности и будущие вызовы.

Ключевые слова: таргетная терапия рака, лекарственные растения, медицинская химия, флавоноиды, *Helichrysum maracandicum*, разработка лекарств

INTRODUCTION.

Cancer remains one of the most formidable challenges in modern medicine. Historically, conventional chemotherapies have relied on broad-spectrum cellular destruction, which often results in severe systemic side effects for the patient. However, the model is shifting [1]. The development of targeted cancer therapies represents a major advancement in modern medicinal chemistry, aiming to improve treatment efficacy while minimizing toxicity. By refining in on specific cellular mechanisms, targeted therapies offer a more refined and humane approach to patient care.

To find the specialized molecules required for these targeted approaches, scientists are increasingly looking to nature. A promising strategy in this field is the utilization of natural products, particularly medicinal plants, as sources of bioactive compounds. For centuries, diverse cultures have relied on botanical remedies, and today, molecular science allows us to understand the mechanisms behind these historical treatments. Uzbekistan, characterized by rich biodiversity and a long tradition of herbal medicine, offers a valuable yet underexplored resource for the discovery of novel small molecule anticancer agents. The expansive botanical landscape — where traditional wisdom meets an incredibly varied ecosystem — provides a massive, largely untapped library of organic

ISSN 3030-3907

compounds [2]. The flora of Uzbekistan comprises more than 4,500 species, with over 600 plants used in traditional and modern medicine.

REVIEW.

The Phytochemical Landscape of Uzbekistan. Plants are master chemists. To survive in diverse environments, they produce complex organic molecules to defend against predators, infections, and environmental stress. These plants are rich in secondary metabolites such as flavonoids, alkaloids, terpenoids, and phenolic compounds, which are known to exhibit diverse pharmacological activities, including anticancer effects.

When examining these ecosystems through a scientific lens, we realize that nature has already done the preliminary synthetic work [3]. From a medicinal chemistry perspective, these natural compounds serve as important lead structures that can be optimized through chemical modification to improve selectivity, potency, and pharmacokinetic properties.

An isolated compound from a plant might not be a perfect drug on its own; it may break down too quickly in the human body or lack sufficient binding affinity. However, it provides medicinal chemists with a vital structural blueprint to engineer the perfect targeted therapy.

Helichrysum maracandicum: A Case Study in Lead Discovery. To truly understand the value of this regional flora, we must look at specific examples that have demonstrated remarkable biological activity. A key example of the therapeutic potential of Uzbek medicinal plants is Helichrysum maracandicum, a species widely distributed in the region. This resilient plant is more than just a fixture of the local ecology; it is a repository of potent bioactive molecules. Studies have demonstrated that extracts from this plant exhibit significant antiproliferative activity against cancer cells.



Picture 1. Helichrysum

ISSN 3030-3907

The power of Helichrysum lies in its specific molecular constituents. Specifically, compounds such as isosalipurposide and its aglycone, naringenin chalcone, have been identified as active constituents that inhibit tumor promotion and suppress key signaling pathways, including p38 mitogen-activated protein kinase [4]. These pathways are critical for cancer cell survival and proliferation; by suppressing them, these natural compounds act as targeted molecular brakes. These findings highlight the importance of flavonoid-based structures in anticancer drug design.

Flavonoids, which are abundant in many Uzbek medicinal plants, play a crucial role in cancer prevention and therapy due to their antioxidant and cell-regulating properties. Quantitative studies have confirmed the presence of multiple flavonoid compounds in species such as Helichrysum, demonstrating their biochemical diversity and therapeutic potential. Medicinal chemistry approaches often involve structural modification of these flavonoids to enhance their bioavailability and target specificity, enabling the development of more effective small molecule drugs.

METOGOLOGY OF RESEARCH.

Expanding the Pharmacological Collection. The rich biodiversity of Uzbekistan means the search for anticancer agents extends far beyond a single species. In addition to Helichrysum species, several other medicinal plants native to Uzbekistan—such as Glycyrrhiza glabra, Peganum harmala, and Hypericum perforatum—contain biologically active compounds with demonstrated pharmacological effects [5].

ISSN 3030-3907



Picture 2. Glycyrrhiza glabra and Peganum harmala

These plants produce alkaloids, phenolic acids, and essential oils that contribute to their anticancer, anti-inflammatory, and antioxidant activities. Furthermore, phytochemical studies have revealed that essential oils and other plant-derived extracts from Uzbekistan contain a variety of biologically active components, including fatty acids and volatile compounds, which may contribute to their medicinal properties. These compounds can act synergistically or serve as precursors for the synthesis of novel anticancer agents. Such compounds provide a diverse chemical library for screening and drug discovery [6].

Bridging the Gap: Modern Medicinal Chemistry. The journey from a wild-grown plant to a clinical cancer ward is far from straightforward—it requires deep, multidisciplinary scientific intervention that bridges ethnopharmacology, organic synthesis, and molecular biology. Modern medicinal chemistry plays a central role in this transformation by integrating centuries-old traditional knowledge with advanced technologies such as molecular docking, high-throughput screening, and structure–activity relationship (SAR) analysis. These

ISSN 3030-3907

tools allow researchers not only to identify biologically active compounds but also to understand their mechanisms at the molecular and atomic levels.

By leveraging computational models, including in silico docking and molecular dynamics simulations, alongside automated bioassays, scientists can rapidly predict and evaluate how natural plant-derived molecules interact with specific cancer-related targets such as kinases, receptors, and DNA-associated enzymes. High-throughput screening platforms further accelerate this process by enabling the simultaneous testing of thousands of compounds across multiple biological pathways. SAR analysis then provides a rational framework for modifying chemical structures to enhance potency, selectivity, and pharmacokinetic properties.

Importantly, natural compounds isolated from Uzbek medicinal plants—many of which contain unique heterocyclic scaffolds and alkaloid frameworks—serve as valuable starting points for drug development. Through targeted chemical modifications, such as functional group optimization, bioisosteric replacement, and scaffold hopping, these natural products can be transformed into more effective and safer therapeutic agents. This optimization improves their therapeutic index, enhances bioavailability, and minimizes off-target toxicity.

Ultimately, the synergy between traditional botanical resources and cutting-edge medicinal chemistry eliminates much of the uncertainty historically associated with drug discovery. Instead of relying on trial-and-error approaches, researchers can now design and refine anticancer agents with precision, targeting specific molecular pathways involved in tumor progression, metastasis, and resistance. This integrated strategy not only accelerates the drug development pipeline but also increases the likelihood of producing highly effective, selective, and well-tolerated treatments for cancer patients.

Challenges and Sustainable Practices. While the horizon is promising, translating ethnobotanical knowledge into clinically viable pharmaceuticals remains a complex and resource-intensive endeavor. Despite the immense potential of medicinal plants in drug discovery, multiple scientific and practical barriers persist. One of the primary challenges lies in the intrinsic variability of natural sources. Unlike synthetic compounds, plant-derived metabolites are highly sensitive to environmental factors such as soil composition, climatic conditions, altitude, seasonal variation, and harvesting time. These fluctuations can significantly alter the qualitative and quantitative profiles of bioactive constituents, thereby complicating reproducibility, standardization, and regulatory approval.

In addition, large-scale extraction and isolation of target compounds often present technical and economic limitations. Many pharmacologically active

ISSN 3030-3907

metabolites are present in trace amounts, requiring extensive purification procedures that may not be feasible for industrial production. Moreover, the lack of comprehensive clinical data and well-designed pharmacokinetic and toxicological studies further slows the transition from preclinical findings to approved therapeutics. Issues such as poor bioavailability, rapid metabolism, and off-target effects must be systematically addressed through advanced formulation strategies and rational molecular optimization.

To overcome these challenges, an integrated and multidisciplinary approach is essential. The convergence of phytochemistry, pharmacology, and medicinal chemistry—supported by in silico modeling, SAR analysis, and modern synthetic methodologies—enables a more precise understanding and refinement of plant-derived compounds. Techniques such as semi-synthesis, total synthesis, and metabolic engineering can also be employed to ensure consistent supply and improved efficacy of lead molecules.

Equally important is the growing concern over the sustainability of natural resources. As global demand for medicinal plants increases, the risk of overharvesting, habitat destruction, and biodiversity loss becomes more pronounced. Many valuable species face ecological pressure, which not only threatens ecosystems but also jeopardizes future drug discovery efforts. Therefore, the implementation of sustainable harvesting practices, cultivation strategies, and conservation programs is critical. Approaches such as plant tissue culture, controlled agriculture, and biotechnological production (e.g., microbial biosynthesis of natural products) offer viable alternatives to wild collection.

Ultimately, safeguarding biodiversity is not merely an environmental responsibility but a scientific necessity. Protecting and sustainably managing plant resources ensures a continuous pipeline of novel chemical entities while maintaining ecological balance. By aligning drug discovery efforts with principles of sustainability and conservation, the scientific community can responsibly harness nature's chemical diversity for the development of safe, effective, and accessible therapeutics.

CONCLUSION.

In conclusion, medicinal plants of Uzbekistan represent a promising source of bioactive compounds for the development of targeted cancer therapies. Through the application of medicinal chemistry techniques, these natural products can be transformed into novel small molecule drugs with improved efficacy and specificity. Continued interdisciplinary research will play a crucial role in bridging traditional medicine and modern pharmaceutical science, ultimately contributing to the advancement of cancer treatment. By respecting the profound biochemical intelligence of nature and refining it through advanced scientific

ISSN 3030-3907

rigor, we can uncover targeted, humane, and effective treatments for cancer patients worldwide.

REFERENCES

1. Egamberdieva, D., et al. Phytochemical and Pharmacological Properties of Medicinal Plants from Uzbekistan: A Review (2017).
2. Yagura, T., et al. Anticarcinogenic compounds in the Uzbek medicinal plant, Helichrysum maracandicum. Journal of Natural Medicines (2008).
3. Abdurakhimov, U., et al. Flavonoid content of Helichrysum species grown in Uzbekistan (comparative analysis study).
4. Zhabborova, H.S., et al. Pharmacological properties of medicinal plants growing in Uzbekistan (2026).
5. Mutalipova, D.B., et al. Chemical analysis of essential oils extracted from medicinal plants growing in Uzbekistan (2021).
6. Nalkiran, I., et al. Phytochemical profile and anticancer potential of Helichrysum arenarium extracts (2025).

ISSN 3030-3907