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HELBA VA HELMA O‘SIMLIKLARI URUG‘I TARKIBIDAGI OQSILLAR MIQDORINI ANIQLASH

[1]Ismoilov Muminjon Yusupovich
Farg‘ona davlat universiteti, kimyo fanlari doktori, professor
mismoilov1971@gmail.com +998912833020
ORCIDID: 0000-0001-8212-4493
[2]Tolipov Xurshid To'lqinovich
Farg'ona davlat universiteti, Tovarlar kimyosi tayanch doktoranti,
txurshid144@gmail.com +998933700766
ORCIDID: 0000-0001-6391-0691

Annotatsiya. Ushbu maqolada helba (*Trigonella foenum-graecum* X Unxg µ L kimyoviy tarkibi va HPLC (yuqori samarali suyuqlik xromatografiyasi) yordamida D P D O J D R V K L U L O J D Q W D K O L O L E D \ R Q H W L O J D Q X U X J µ L I O D Y R Q R L G T O V D L U O O V D D U S R Q E Q E D U R Y D R E L U L yuqori oziqaviy va farmakologik qiymatga ega. HPLC tahlilida asosiy komponentlarning retensiya vaqtlarini aniqlash orqali ularning tarkibi va N R Q V H Q W U D W V L \ D V L W D V G L T O D Q G L \ D R Y K E X O R Q qarshi va lipid darajasini tartib J D V R O X Y F K L [X V X V L \ D W O D U L I D U P D W V H Y W L N D G D N H Q J T R µ O O D Q L O L V K L P X P N X U X J µ L Q L Q J W Y q a E L \ D R Y L - amaliy ahamiyatini yoritadi.

Kalit so‘zlar: + _ O E D k f r O R D moylari, achchiq seskviterpen laktonlar, flavonoidlar, aminokislotalar, oqsillar, flavonoidlar, organik kislotalar.

Аннотация. < w l h c k l Z l v _ h i b k Z g o b f b q _ k d b c k r i g o n e l l a foenum-graecum b b Z g Z e b a < W @ O \ u k h d h w n n _ d l b \ g h c o j h f Z l h] j Z n b J b _ a m e v l Z l u b k k e _ ^ h \ Z g b c i h d Z a u \ Z x l c [h] Z l u [b h e h] b q _ k d b Z d l b \ g u f b k h _ ^ b g _ g b y f b l Z d l k Z i h g b g u b [_ e d b d h l h j u _ b f _ x l \ u k h d m x i b s _ \ m x b p _ g g h k B v o k h k l Z \ b d h g p _ g l j Z p b y [u e b i h ^ l \ _ j ` ^ _ g \ j _ f _ g m ^ _ j ` b \ Z g b y h k g h \ g u o d h f i h g _ g l h Z e b a _ : g l b h d k b ^ Z g l g u _ i j h l b \ h \ h k i Z e b l _ e v g u _ b e b i b ^ j _] r w l h] h j Z k l _ g b y i j _ ^ i h e Z] Z x l _] h i h l _ g p b Z e ^ e y r b j h a ^ j \ Z h h o j Z g _ g b b b n Z j f Z p _ \ l b d _ > Z g g h _ b k k e _ l ^ h g \ Z g g Z m q g h _ b i j Z d l b q _ k d h _ a g Z q _ g b _ k _ f y g o _ e v [u ^ e i j h f u r e _ g g h k l b

Ключевые слова: O_ev[Z o_evfZ wnbjgu_ fZkeZ]hjvdb_ eZdlhgu neZ\hghb^u luZfb[g_heddbkehneZ\hghb^u hj]Z dbkehlu

Abstract. This article describes the chemical composition of fenugreek (Trigonella foenum-graecum) seeds and their HPLC (high performance liquid chromatography) analysis. The results show that fenugreek seeds are rich in bioactive compounds such as flavonoids, saponins and proteins, which have high nutritional and pharmacological value. Their composition and concentration were confirmed by determining the retention times of the main components in HPLC analysis. The antioxidant, anti-inflammatory and lipid-regulating properties of this plant suggest its potential for widespread use in health care and pharmaceuticals. This study sheds light on the scientific and practical significance of fenugreek seeds for the medical and food industries.

Key words: Helba, helma, essential oils, bitter sesquiterpene lactones, flavonoids, amino acids, proteins, flavonoids, organic acids.

KIRISH

Helma (fenugreek yoki Trigonella foenum-JUDHFXP RµVLPOLJ oziq-RYTDW YD VKLIRED[VK YRVLWD VLIDWLGD N tarkibidagi ozuqaviy moddalar, xususan, oqsillar inson salomatligi uchun muhim ERµOJDQ NRµSODE IR\GDOL [XVXVL\DWODUJD HJ PDKVXOR WQDLLJDbERµQ gan talab qilinadigan moddalarga boy, ayniqsa, vegetarian va veganlar uchun tabiiy manbalar qimmatli hisoblanadi.

+HOPD XUXJµL WDUNLELGDJL RTVLOODU EL hujayralarning tiklanishi, mushak massasi shakllanishi va metabolik jarayonlarni qo µO-TDXE YDWODVKGD PXKLP URO Rµ\QD\GL 8VKE tDUNLEL XQLQJ VRJµOLT XFKXQ IR\GDODUL YD PD¶OXPRW WDTGLP HWLODGL

ADABIYOTLAR TAHLILI VA METODLAR

Helba (fenugreek yoki Trigonella foenum-JUDHFXP RµVLPOLJL WDUNLEJD HJD ERµOLE XQLQJ lmqoziqaviy moddalardan biri hisoblanadi. 4X\LGD KHOED XUXJµLQLQJ WDUNLELGDJL keltirilgan:

Oqsil miqdori. +HOED XUXJµLQLQJ WDUNLELGDJL R **30%** RUDOLJµLGD ERµOLE EX RµVL\XTRNLPNQEDY KLVREODQDGL 8VKEX RTVLOODU RGDP RUJDQL DPLQRNLVORWDODU[LQL Rµ] LFKLJD RODGL

Aminokislota tarkibi. +HOED XUXJµLGDJL RTVLOODU V aminokislotalar mavjud:

- **Lizin** ±K X M D \ U D O Y D L V K Q L Q Y D R Wµ R µ T L P D O D U Q L W L
- **Triptofan** ±N D \ I L \ D W Q L E R V K T D U L V K Y D V H U R W F E H U D G L
- **Leysin va izoleysin** ±P X V K D N W R µ T L P D O D U L Q L W L N F K L T D U L V K J D \ R U G D P E H U D G L
- **Fenilalanin** ±Q H \ U R W U D Q V P W L W J H D Q L V K W L U R N H W
- **Arginin** ± T R Q D \ O D Q L V K L Q L \ D [V K L O D V K Y D I R \ G D O L

Biologik qiymati. + H O E D X U R K T µ L G D U R V R Q K D] P E R µ L Q V R Q R U J D Q L] P L W R P R Q L G D Q \ D [V K L R µ] D V K kasalliklari va mushak massasini oshirish uchun foydali hisoblanadi[2].

Foydalari. + H O E D X U X J µ L Q L Q J \ X T R U L µ R T L O R \ G D W D ¶ P L Q O D \ G L ¸

1. **Mushaklar uchun foyda**: Sportchilar va faol hayot tarzini olib boradiganlar uchun oqsillar mushak massasini saqlash va tiklashda muhimdir.
2. **Immunitetni mustahkamlash**: Aminokislotalar immun tizimini T R µ - O O D quvvatlaydi.
3. **Gormonlar balansini boshqarish**: Oqsillar gormonlar sintezida muhim U R O R µ \ Q D \ G L

Ishlatilishi. + H O E D X U X J µ L N R µ S D ¸ L \ R N L E N U L X Q V K L V K O D W L O D G L 8 Q L K D U [O W D R P O D U J D ¸ T R µ V K E R µ O D G L

Agar sizga aniq miqdor yoki kimyoviy tahlil natijalari haqida ma'lumot kerak E R µ O V D L O P L \ W D - G T L T R W Q D U L \ R N O D R Q X Y F K L W D murojaat qilishingiz mumkin[3].

Helma (fenugreek yoki Trigonella foenum-graecum) X U X J µ L R T V L O O E R µ O L E X Q L Q J R] L T D Y L \ Y D V R J µ O L T X F K X Q I R \ X U X J µ L W D U N L E L G D J L R T L V L D O W O D U L P L K T D G T R L G L Y E D berilgan[4].

Oqsillar miqdori. + H O P D X U X J µ L Q 2 5 – 3 0 % W D U N L E L G D % X P L T G R U X U X J µ Q L R µ V L P O L N R T V L O O D U L Q L Q R T V L O O D U L Q V R Q R U J D Q L] P L X F K X Q R W D U U X E R µ oladi[5].

Aminokislota tarkibi. + H O P D X U X J µ L G D J L R T V L O O D U W H J D E R µ O L E T X \ L G D J L P X K L P D P L Q R N L V O R W D O D

- **Lizin** ±P X V K D N O D U Q L W L N O D V K Y D L P P X Q W L] L
- **Triptofan** ±N D \ I L \ D W Q L \ D [V K L O D V K Y D V W U H V V Q

- **Fenilalanin** ± D V D E W L Q L U R Q L Q J I D R O L \ D W L X F K X Q
- **Leysin va izoleysin** ± H Q H U J L \ D L V K O D E F K L T D U L V K X F K X Q P X K L P
- **Arginin** ± T R Q D \ O D Q L V K L Q L \ D [V L K Q L L O D Q V D K [R Y D W T \ R U G D P > E ' H @ U D G L

Biologik qiymati. + H O P D X U X J µ L Q L Q J F R E V R µ O D G L L Y D V E L R O R J L N T L \ P D W J D H J D 8 O D U Q L Q J D P L Q R N L V O muhim qiladi. Ayniqsa, vegetarian va veganlar uchun oqsil manbai sifatida tavsiya etiladi.

Sog‘liq uchun foydalari. + H O P D X U X J µ L G D J L R b r q a t O D U muhim vazifalarni bajaradi:

- **Mushak massasi va tiklanish** ¸ 2 T V L O O D U P X V K D N O D U Q W L N O D V K G D \ R U G D P E H U D G L
- **Immunitetni kuchaytirish** ¸ $ P L Q V R N W D O D U L P P X Q W L T X Y Y D W O D \ G L
- **Qon shakarini boshqarish** ¸ 2 T V L O Y D P E G R V K O D U T D Q G E R V K T D U L V K G D \ R U G D P E H U D G L
- **Metabolizmni yaxshilash** ¸ + H O P D X U X J µ L R T V L O O D U F K L T D U L V K Q L > @ W H] O D V K W L U D G L

Ilmiy ma’lumotlar. Tad T L T R W O D U V K X Q L N R µ U V D W D tarkibidagi oqsillar qondagi xolesterin m L T G R U L Q L N D P D \ W L U L V K R O G L Q L R O L V K G D Y D P X V K D N O D U Q L Q J W L N O D Q L P D Y M X G E R µ O J D Q R T V L Q O D U L W D U N L E L G D J O L W V P D Y M X G E R µ O L E X O D U [R U J D Q L] P X F K X Q] D U X U G va izoleysin kabi muhim aminokislotalar

Ishlatish usullari.

- **Ovqatga qo‘shish** ¸ 8 U X J µ O D U Q L P D \ G D O D E N X N X Q V I V P X] L O D U J D T R µ V K L V K P X P N L Q
- **Choy yoki damlama** ¸ + H O P D F K R \ L K D P O D U Q L D O T L E X T \ R U G D P E H U D G L
- **Sport ovqatlanishida** ¸ 6 S R U W F K L R µ V K X P K D S U R W H L Q L V K O D W L O D G L

+ H O P D X U X J µ L Q L Q J W R µ O L T W D U N L E L Y D X Q L W D K O L O Q D W L M D O D U L Q L R µ U J D Q L V K X F K X Q L O D E R U D W R U L \ D O D U L Q D W L M D G D U J D P X U R M D D W

Umumiy oqsil miqdorini aniqlash. Usul Kjeldahl usuli yordamida azotni aniqlashdan, so'ngra oqsilga aylantirishdan iborat. Usulning mohiyati namunadagi organik moddalarni konsentrlangan sulfat kislota bilan qaynatishda ammoniy

tuzlarini hosil qilish bilan parchalanishi, ammoniyni ammiakga aylantirish, uni kislota eritmasiga distillash, ammiakni titrimetrik usulda miqdoriy hisobga olishdir va o'rganilayotgan materialdagi azot miqdorini hisoblash[10].

Sinov namunasining o'rtacha maydalangan bir hil namunasidan aniq namuna tahlil uchun probirkada tortilgan, xatosi 0,1% dan oshmagan. Namuna miqdoriy jihatdan Kjeldahl kolbasiga o'tkazildi. Keyingi tajribalar uslubiy ko'rsatmalarga muvofiq amalga oshirildi [11].

Natijalarni qayta ishlash: sinov namunasidagi azotning (X) massa ulushi ammiakni sulfat kislotaga distillash paytida uning massasiga nisbatan foizda formula bo'yicha hisoblab chiqilgan.

$$X = \frac{(V_1 - V_0) \times K \times 0{,}0014 \times 100}{M},$$

Bu erda; V_0 ±nazorat tajribasida 0,05 mol/l sulfat kislota titrlash uchun sarflangan 0,1 mol/l natriy gidroksid eritmasi hajmi (ml);

V_1 ±tekshiriluvchi eritmadagi sulfat kislotani titrlash uchun sarflangan 0,1 mol/l natriy gidroksid eritmasi hajmi (ml);

K ±0,1 mol/l natriy gidroksid eritmasining titriga tuzatish;

0,0014 ±1 ml 0,05 mol/l sulfat kislota eritmasiga ekvivalent azot miqdori;

M - namunaning massasi, (g). Natijalar uchinchi kasrgacha hisoblab chiqilgan va ikkinchi kasrgacha yaxlitlangan.

Azotning mahsulotning quruq moddasi bo'yicha massa ulushi (X_3), foizda quyidagi formula bo'yicha hisoblab chiqilgan:

$$X_3 = \frac{X_1 \times 100}{100 - W},$$

Bu erda;X_1 ±tekshirilayotgan namunadagi azotning massa ulushi, (%);

W ±sinov namunasining namligi, (%).

Proteinning massa ulushi (Y) foiz sifatida quyidagi formula bo'yicha hisoblangan:

Y = K XX, bu erda K azotning oqsilga o'tish koeffitsienti:

o'rtacha lipid miqdori bilan - 6,38;

NATIJALAR VA MUHOKAMA

X- R µ T L P LTQhklda vomida komponentlarning chiqish vaqti (retensiya

Y D T W L Q L N R µ U V D W D GPLD ¶+ODXUP EELLUU FPKRRQµGTDJLD SPLRNV

Y- R µ T L P $'8H W H N W R U V L J Q D O L Q W H Q V L Y O L J

yutilishi), bu moddaning miqdorini ifodalaydi.

+DU ELU FKRµTTLGDJL NRPSRQHQWODUQLQJ maydonini va unug taxminiy miqdorini bildiradi.

Asosiy cho‘qqilar (piklar)

(QJ EDODQG FKRµTTLEX˝ KˇHOPDQXWXJµL WDU ELUNPD PDVDODQ VDSRQLQ IODYRQRLG \RNL %RVKTD \LULN FKRµTTLODU 24,994 va 27,615 minutlar atrofida): Bular boshqa muhim birikmalarni ifodalaydi. Ularning balandligi moddaning nisbiy NRQVHQWUDWVL\DVLQL NRµUVDWDGL

Dastlabki 5 ± GDTLTDGD PD\GD SLNODU PDYMXG ega yoki tez chiqadigan birikmalarga mos keladi (masalan, oddiy aminokislotalar).

10 ± GDTLTDODU RUDOLJµLG asosiy komponentlarning chiqishi kuzatiladi. Bu RTVLOODU IUDJPHQWODUL \RNL PXUDNNDE PRGG

Yakuniy qism (30 daqiqadan keyin) yirik molekulalar yoki qoldiq moddalarga WHJLVKOL ERµOLVKL PXPNLQ

+DU ELU FKRµTTLQLQJ identifikatsiyasini aniqlash uchun standartar moddalardan foydalanish yoki massaspektrometriya bilan birgalikda tahlil qilish zarur.

%DODQG FKRµTTLODU 27,615 konsentratsiyasi yuqori PRGGDODUJD PRV NHOGDGL XYQD DXKODPL QLWXLQVLRµO ERµODGL

6SHNWUGD DVRVL\ FKRµTTLODU joylashgan. %X FKRµTTLODU KHOED XUXJµLGDJL PXk (masalan, flavonoidlar, saponinlar, va alkaloidlar) mos kelishi mumkin.

+DU ELU FKRµTTLQLQJ EDODQGOLJL VLJQDO bildiradi. Masalan: yuqori intensivlikka ega, bu birikmaning asosiy komponentlardan biri ekanligini anglatadi. 27,615 minutdagi FKRµTTLODU konsentr DWVL\DVL \XTRUL ERµOJDQ PRGGDQL

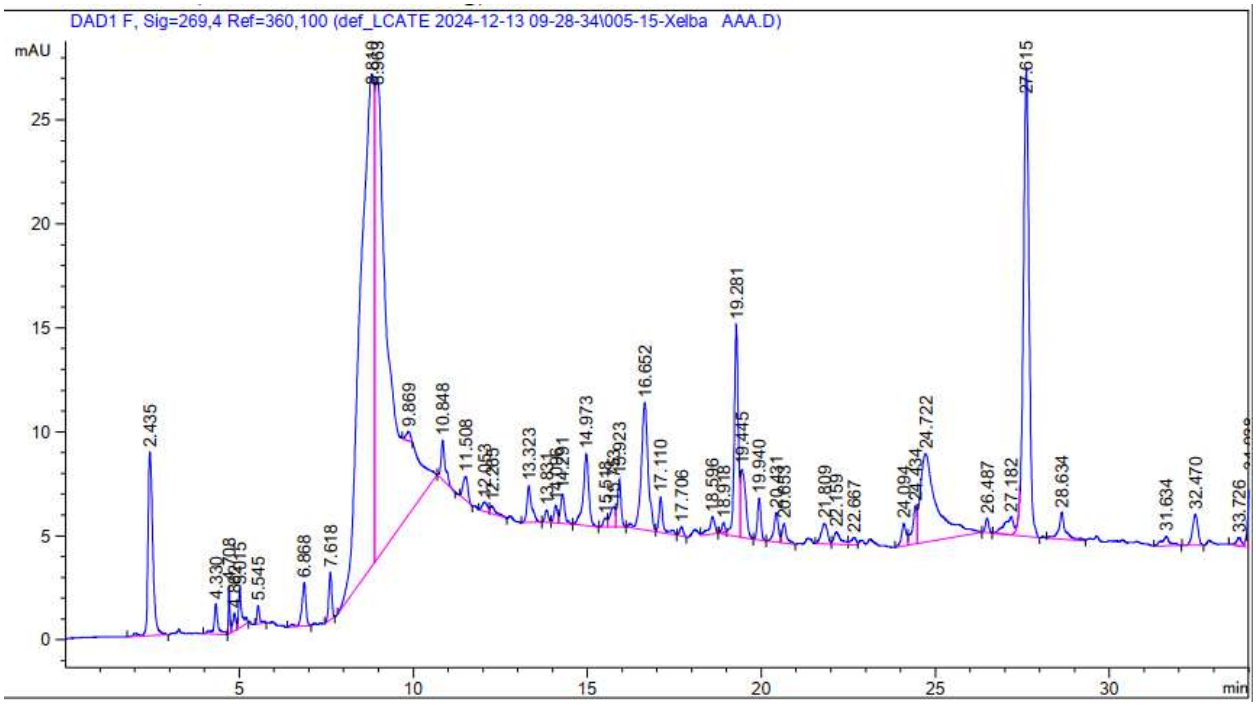
Biologik faol moddalarning tahlili: Agar standart tarkibida flavonoidlar (masalan, kvercetin), saponinlar yoki oqsil JLGURO]DWODUL ERµOV piklarini standart bilan solishtirib, aynan qaysi komponent ekani aniqlanishi PXPNLQ 5HWHQVL\D YDTWL PRV ERµOJDQ SLNOD

Analitik usulni aniqlash 'HWHNWRUQLQJ WRµOTLQ NRµUVDWLOJDQ %X 8-DURDL GH WHEWRH \RUG RµOFKDPL YKOD QDVD %XQGD \ WRµOTLQ X]XQOLNGL yaxshi yutiladi.

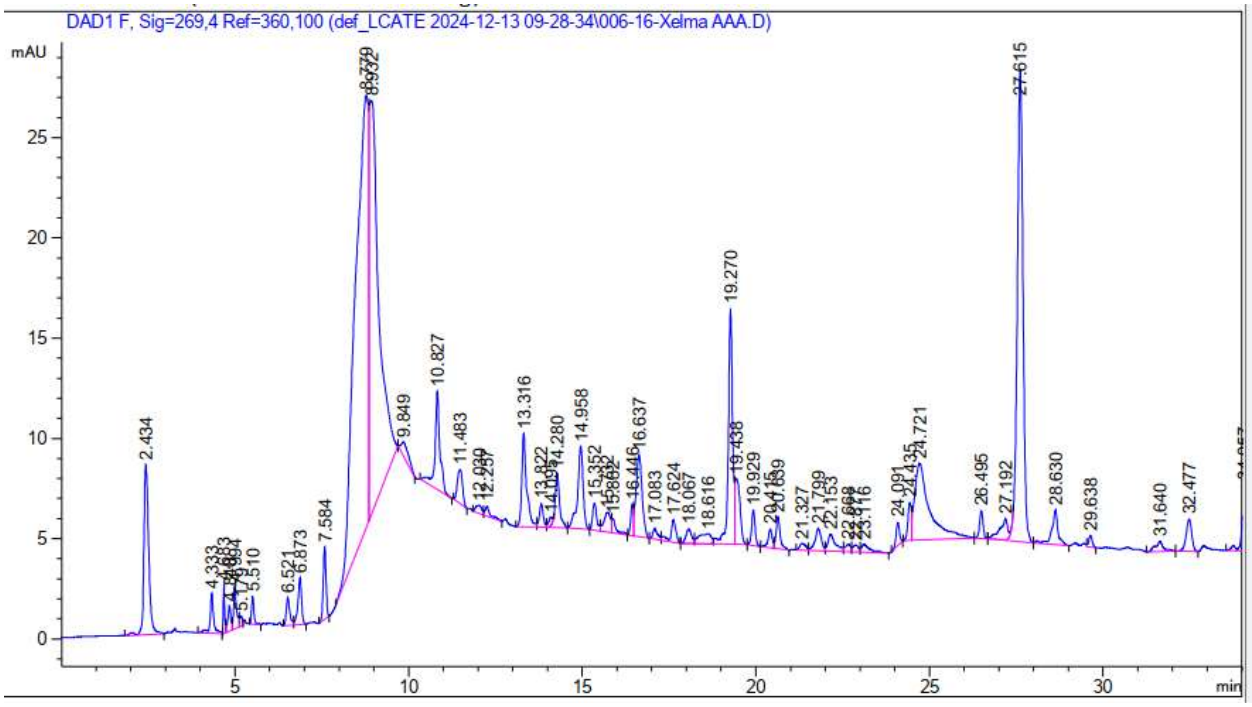
Tahlil davomiyligi: Yakuniy piklar (30 daqiqadan keyin) yuqori molekulyar o JµLUOLNGDJL NRPSRQHQW past konsentratsi \DGDJL NLFKLN ELULNPDODUQLQJ PDYM

8VKEX VSHNWUQLQJ DVRVL\ FKRµTTLODUL KH
ekanligini NRµUVDWDGL 6WDQGDUW ELODQ WRµOLT
ravishda:

- +DU ELU SLNQL VWDQGDUW HRO\VKLWPDODUL ELO
- +DU ELU PRGGDQLQJ NLP\RYL\ WDUNL PDVVDVSHNWURPHWUL\D RUTDOL WDODE HW
- <XTRULGDJL PDHTOEXDPRWOXJµLQLQJ ELRDNW LGHQWLILNDWVL\D TLOLVKGD PXKLP TDGDP E



1 – rasm. Helba o‘simligi urug‘i tarkibidagi oqsillar miqdorini YSSXsi.



2 – rasm. Xelma o‘simligi urug‘i tarkibidagi oqsillar miqdorini YSSXsi.

1 – jadval.

Helma va Helba o‘simligi urug‘i tarkibidagi oqsillar miqdori.

№	Na’muna	Азот (%)	Oqsil (%)
1	Xelba	4,8	30,65
2	Xelma	5,02	32,02

Nazorat usullari. Kimyoviy omillar. Biologik faol oziq-ovqat qo'shimchalarining sifati va xavfsizligini nazorat qilish usullari bo'yicha qo'llanma.

XULOSA

Helba (*Trigonella foenum-graecum* XUXJµLQLQJ NLP\RYL\ W tahlili a VRVLGD ROLQJDQ QDWLMDODU VKXQL NRµUV jumladan flavonoidlar, saponinlar va boshqa ikkilamchi metabolitlarga boy hisoblanadi. HPLC yordamida amalga oshirilgan tahlil natijalari har bir birikmaning retensiya vaqti va konsentratsiyasini aniqlash imkonini berdi. Ushbu tahlil natijalari RµVLPOLNQLQJ IDUPDNRORJLN\D RJLTDY\L\TL\P yaratdi.

Tahlilda asosiy piklar flavonoidlar va saponinlarning mavjudligini tasdiqladi, bu HVD KHOLEDL QXXVRµJµOLTQL VDTODVK VRKDVLGDJL

- **Flavonoidlar** ¸ 8VKEX ELULNPDODUIDNRORQLDQWRµUL HVD \XEQWRPLU NDVDOOLNODUL YD \DOOLJ NDWWD DKDPL\DWJD HJD
- **Saponinlar** ¸ SRQLQODU JRUPRQDO EDUTDURUG GDUDMDVLQL WXVKLULV+K3G& WDX KDPNUPDEXRµQ \XTRUL NRQVHQWUDWVL\DGD HNDQOLJLQL N
- **Oqsillar va aminokislotalar** ¸ +HOEDXUXJµLGDJL SUR R]LTDYPDWLQL RVKLUDGL YD XORYTQLWJVDQ LVKODWLOLVKJD LPNRQ EHUDGL

Shuningdek, HPLC detektorini QJ WRµOTLQ X]XQOLJL komponentlarning eng yaxshi sezgirlikda aniqlanishini ta'minladi. Bu usulning yuqori aniqligi va takro UODQXYFKDQOLJL RµVLPOLN WDU WH[QRORJL\DVLQLQJ VDPDUDOL HNDQOLJLQL NR

ADABIYOTLAR RO‘YXATI

0 <X ,VPRLORY 6R\D FKLTLQGL³VLGDQ IDQOL VDQRDWLQLQJ GRO]DUE PXDPPRODUPDOLDY DQMXPDQ PDVHUµRQOOOU˘LQR\DEU

,VPRLORY 0XPLQMRQ <XVXSRYLFK $EGXTR
Urtica dioica TLFKLWTL RµW RµVLPOLJLWQLGTNLP\
)DU'8 LOPL\ [ÐEDUQ±D‰ ± K ˇ**DOI: 10.56292/SJFSU/vol29_iss3/a143**

M.Y.Ismoilov, Sh.V.Inobiddinova *Peganum harmala* RµVLPOLJLQL
YD PLNPURWOODU'8 LOPL\ ÐEED±‰DUK ˇ·
ˇ **DOI: 10.56292/SJFSU/vol30_iss3_2t/a358**

,VPRLORY 0XPLQMRQ <XVXSRY\LF7KROEMRQR
=DQMDELO]LQJLEHU RIILFLQDOH URVH R
RµUJDQLVPKR OVLP¶ IDQ YD LVKODE FKLTD
PDY]XVLGDOJIDUROPLOPL\\ DQMXPD4QRPTRVHULD
\LO PD\
ˇ ,VPRLORY 0XPLQMRQ <XVXSRYLFK 2EOD\RUY
TLÐLDQMDELO]LQJLEHUROVLQLNVPROL\ WDU
TLOL³VKP\R WD¶OLPL IDQ YD LVKODE F
PDY]XVLGDOJIDUROPLOPL\\ DQMXPD4QRPTRVHULD
\LO PD\
ˇ 1DRXDO %HQD\DG $EGHOKDILG 1RXUHGGLQ
JUDHFXPDV D VRXUFH RI ELRDFWLYH SK\W
Reviews ″ KWWSV¸GRL RUJ″ˇ ^ V
^ 6 6 .DGDP - . 0DKUDGGLNDU. 4XD3QWLILFDWL
IHQXJUHHN 7ULJRQHOFXP IRHHQXGHHXVHQQFK
OLTXLG FKURPDWRJUDSK\ ˇ
KWWSV¸GRLVRUJ^
· / 6 'HYL 5 . 6KDUPD 6LPXOWDQHRXV G
7ULJHRQHOOD IRHQXPJUDHFXP VHHGV E\ 3
^ KWWSV¸GRL RUJ″ ^· ˜ˇ
″ 0 6DMLG 0 . 1D]DO $ UHYLHZ RQ GH
FKURPDWRJUDSKLF *Trends in Analytical Chemistry* ·
KWWSV¸GRL RUJ ˇ M WUDF ·
- : 'RHDQHFWLRQ RI GHWHFWLRQ ZLWKHOHC
North America
4R OODQPD 5 0 ˇ^5RVVL\D 6RJ OLTQL VD
'DYODW VHSLWHDRLLRDRJL\D QD]RUDWL IHGHU