А. А. Чахирова [A. A. Chakhirova][1]
Е. В. Ковтун [E. V. Kovtun][1]
М. А. Огай [M. A. Ogai][1]
Э. Ф. Степанова [E. F. Stepanova][1]
Н. Л. Нам [N. L. Nam][2]

УДК
15.451.16:582.573.16].
014.24:579.61

ИЗУЧЕНИЕ ВОЗМОЖНОСТИ ИСПОЛЬЗОВАНИЯ МАСЛЯНЫХ ЭКСТРАКТОВ ЛУКА РЕПЧАТОГО И ЧЕСНОКА ДЛЯ СОЗДАНИЯ ИНТРАНАЗАЛЬНОЙ ЛЕКАРСТВЕННОЙ ФОРМЫ

STUDY THE POSSIBILITY OF USING OIL EXTRACTS OF ONION AND GARLIC TO CREATE THE INTRANASAL DOSAGE FORM

[1] Пятигорский медико-фармацевтический институт-филиал ФГБОУ ВО ВолгГМУ Минздрава России, 357532, Россия, пр. Калинина, 11
[2] Российский Государственный Аграрный Университет-МСХА имени К. А.Тимирязева

Аннотация. *Изучена возможность создания инновационной лекарственной формы, с использованием масляных растительных экстрактов. Обоснована технология получения.*

Материалы и методы, результаты. *Рассмотрена технология получения масляных экстрактов. Технология позволяет извлечь максимальный комплекс ценных фармакологических веществ и свести их потери к минимуму. Использовали метод репрессования для чего, применили непрерывное противоточное, равновесное экстрагирование. А также применяли метод мацерации. Для оценки качества полученной лекарственной формы использовали метод окраски и парафиновой пластинки. Результат – получена эффективная и безопасная инновационная лекарственная форма.*

Заключение. *Изучена возможность использования овощных культур для получения ценных биологически активных комплексов, для применения их в качестве компонентов лекарственной формы. Получены масляные экстракты и соки свежих растений, методами, позволяющими извлечь максимальный комплекс биологически –активных веществ. Проведена их оценка качества.*

Ключевые слова: плоды рябины обыкновенной, лук, чеснок, каланхоэ, масляные экстракты, капли назальные.

Abstract. *The possibility of creating an innovative dosage form using oil-based plant extracts was studied. The technology of production has been substantiated.*

Materials and methods, results. *The technology of obtaining oil extracts is considered. The technology allows you to extract the maximum complex of valuable pharmacological substances and minimize their loss to a minimum. We used the repression method for what, we applied continuous countercurrent, equilibrium extraction. And also used the method of maceration. To assess the quality of the obtained dosage form used the method of staining and paraffin plate. The result is an effective and safe innovative dosage form.*

Conclusion. *The possibility of using vegetable crops to obtain valuable biologically active complexes for their use as components of a dosage form has been studied. Oil extracts and juices of fresh plants have been obtained using methods that make it possible to extract the maximum complex of biologically active substances. Their quality assessment is carried out.*

Key words: Rowan fruits (fruits of mountain ash mountain ash), onion, garlic, Kalanchoe, oil extracts, nasal drops.

Introduction. Valuable sources of biologically active substances with a wide spectrum of pharmacological action are the fruits of mountain ash (*Rowan fruits*), garlic, onions, Kalanchoe juice, tincture of calendula, which are widely used in folk medicine for diseases of the upper respiratory tract [1].

Quite urgent is the problem of finding compositions of medicinal plant materials that are less toxic, economically viable, have a wider spectrum of action than synthetic drugs, combining vitamins A, E, C, carotenoids, fatty acids, flavonoids and phytoncides and providing antimicrobial, anti-inflammatory, antioxidant and wound healing effects [2].

In official medicine, plant objects are used only to obtain such dosage forms as extracts, tinctures, suppositories, ointments. At the same time, using them in the form of nasal drops containing biologically active substances in the composition of the latter will settle on the mucous membrane of the nasal cavity and have a local prolonged therapeutic effect.

The aim of the work was to develop the composition and technology of an intranasal preparation in the form of nasal drops containing a biocomplex of plant origin with antimicrobial, anti-inflammatory, wound healing effects.

To achieve this goal, it was necessary to solve the main tasks:

• justify the choice of dosage form for the treatment of inflammatory diseases of the nasal cavity;

• develop a composition of nasal drops containing a biocomplex of plant origin;

• justify the optimal technological scheme for the production of drops for the nose;

Rowan fruits contain a rich complex of biologically active substances and are a source of vitamins: the amount of ascorbic acid reaches 200 mg%, thiamine -115 mg%, and riboflavin 56-310 mg%. According to the content of P-active substances, mountain ash ranks first in the row of fruit and berry crops. The amount of tannins and dyes in the fruits of mountain ash 170-1453 mg%. The content of carotenoids in the fruits of common Rowan fruits reaches 18–20 mg%, tocopherols over 70 mg%, among which ά-tocopherol is found in the greatest amount, and β-, γ-, and δ-tocopherols are also present in a smaller amount [3, 4,5 6,7,8].

Calendula inflorescences contain essential oil, bitter substances, phytoncides, saponins, mucus, a large amount of carotenoids, as well as saponins, bitterness, tannins. Inflorescences have anti-inflammatory and disinfectant effects [9].

In the composition of thuja essential oil, the main component is thujone. Essential oil is obtained by steam distillation from cones or needles, yield 3-4 kg from 1 ton of raw material. Thuja young shoots in folk medicine used to rub against rheumatism and tea, used as a diuretic. Currently, thuja is used mainly for the manufacture of homeopathic medicines.

Garlic contains essential oil. The peculiar smell of essential oil is mainly characteristic of its component diallyldisulfide. Alliin and allicin are also found - an oily liquid with the smell of garlic containing sulfur. Garlic volatile products have a strong antibiotic property. Garlic contains carotenoids, vitamins B, C, D, phytosterols, polysaccharides, fiber, iodine, etc.

Due to the presence of phytoncides, garlic has a strong bactericidal effect on diphtheria bacilli, tuberculous mycobacteria, staphylococci, streptococci and dysentery pathogens, has a toxic effect on yeast fungi, on diphtheria bacilli, tuberculous mycobacteria, staphylococci, streptococcus dysmenorrhea and microorganisms.

The juice of leaves and stalks of Kalanchoe contains tannins, vitamin P, polysaccharides, as well as micro and macro elements; aluminum, magnesium, iron, calcium, silicon, manganese, copper. Low toxicity, has bactericidal and bacteriostatic properties, promotes the healing of wounds, trophic ulcers and thermal burns, inhibits the development of inflammation, does not irritate the skin and mucous membranes [10].

Currently, in view of the complexity of the formulation of dosage forms, more and more multicomponent preparations are being created with a wide range of pharmacological effects for the treatment of inflammatory diseases of various etiologies at all stages of the process.

In this case, the choice of active ingredients of the dosage form should be theoretically justified from the technological and pharmacological sides.

In this regard, our attention was drawn to the long-standing prescription used in folk medicine, which contained oil extracts of medicinal plants containing volatile and carotenoids, tincture of calendula and Kalanchoe juice [11,12, 13].

Materials and methods. The mountain ash oil extract was prepared by the method of repression according to the method developed at the Department of Drug Technology by Professor V. Pogorelov, Associate Professor A. N. Bogdanov.

The basis of this process is continuous countercurrent, equilibrium extraction in a battery of 3 mass exchangers, with the forced separation of the liquid phase from the solid phase by exposure to high pressure [14, 15, 16, 17]. This method is widely used for raw materials containing thermolabile substances in a complex of biologically active substances, and also significantly increases the yield of fatty oils.

Oil extracts of onion and garlic were obtained by maceration; for this, the onion of garlic and onion was moistened with water in a ratio of 1: 1, then the onions were crushed and infused in soybean oil at a temperature of 50 ° C for 10 hours, with periodic stirring [18, 19, 20].

Results and its discussion. The result was an oil extract enriched in biologically active substances of lipophilic nature.

Since the oil extracts of mountain ash, garlic, onion and arborvitae oil are lipophilic, and the Kalanchoe juice and calendula tincture are substances of a hydrophilic nature, it was necessary to decide on the method of their introduction to obtain a homogeneous system.

Since, when mixing the ingredients of the recipe, an emulsion formed, it was necessary to establish the type of emulsion and choose the most effective emulsifier for this combination of components [21].

To establish the type of emulsion, well-known techniques were carried out:

• Paraffin plate method - a drop of the tested emulsion was applied to a glass slide coated with a thin layer of paraffin. A drop spreading, this indicated that the dispersion medium is oil (emulsion).

• Staining method - several grains of methylene blue were applied to a drop of the test emulsion and observed under a microscope. Grains of dye remained to lie on the surface of the droplet.

Thus, our methods for determining the type of emulsion proved that this object belongs to the second kind of emulsion.

When choosing and evaluating emulsifiers, we were guided by such indicators as solubility, availability, cost, and pharmacological indifference. In this connection, emulsifiers No. 1, T1 and T2 were widely used in the food and pharmaceutical industries [11, 22, 23].

The quality, stability and pharmacological effectiveness of drugs depends on various pharmaceutical factors. Therefore, in the development of new drugs, a reasonable careful selection of excipients is necessary.

To conduct a biopharmaceutical analysis of the nasal drops that we developed with an oil extract of mountain ash, we used a method for releasing lipophilic substances under model conditions. Studies conducted earlier at the Department of Drug Technology (Kovalskaya G.N., 1987) showed that generally accepted methods for evaluating the release of biologically active substances are unacceptable for lipophilic substances due to the physicochemical properties of the latter, and therefore, the authors of [24, 25] proposed a technique based on the properties and structural features of a living cell, which we used to develop drops for the nose with a phytocomplex.

As a model medium characterizing the hydrophilic-lipophilic balance of body structures and optimally approaching the properties of living tissue, we used a medium consisting of equal parts of direct and reverse type emulsions of the following composition:

1. Vaseline – 87 parts,
purified water – 10 parts,
emulsifier T – 2-3 parts.

In a water bath, 3 parts of T-2 emulsifier was melted, vaseline was melted for 87 parts, 10 parts of hot purified water was added and homogenized until completely cooled.

2. Vaseline 85 parts,
purified water 10 parts,
gelatose 5 parts.

5 parts of gelatose were poured into 10 parts of purified water and left to swell, then 85 parts of vaseline were partially administered and emulsified thoroughly.

Emulsions of 2 types were mixed in a 1:1 ratio and a homogeneous white mass was obtained, which did not stratify at room temperature for 15 days. The finished model medium was introduced into a glass cylinder (20 cm^3), previously dried to an exact mass and weighed.

The study of the release of carotenoids from the drug was carried out in a thermostat at a temperature of 37 ° C; for this, 0.5 g of the samples under study were placed in the center of the medium formed in the cylinder and kept for an hour.

The ability to release carotenoids from preparations prepared with the addition of various emulsifiers was evaluated by the size of the colored zone of the model medium (Figure 1).

For a more accurate analysis of the release of carotenoids from the drug, a quantitative determination was made by spectrophotometric method. For this, the model medium was cooled, the carotenoids that were diffused were extracted with hexane and the optical density was determined on a spectrophotometer in the range from 400 to 600 nm, and the optical density of hexane extraction from the model medium was simultaneously determined.

The results of the quantitative determination of diffused carotenoids confirmed the data obtained by determining the degree of diffusion of carotenoids from the preparation by the size of the colored zone of the model medium. The results are presented in table 1.

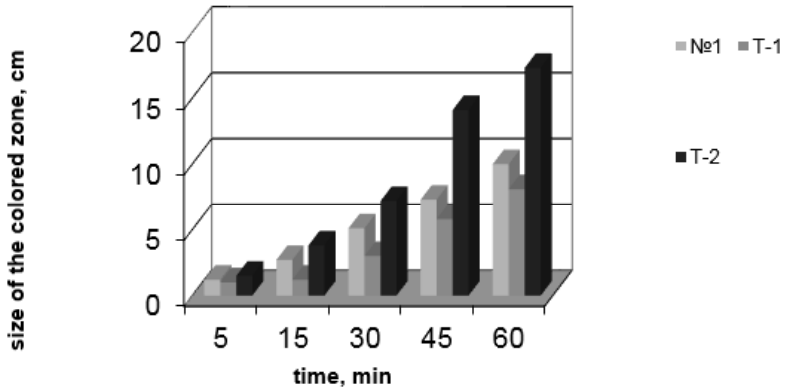

Fig. 1. Effect of emulsifiers on the release of carotenoids from developed nasal drops with a phytocomplex

Table 1

Quantification of the degree of release of carotenoids from nasal drops with a phytocomplex

The base	The optical density of the solution
emulsifier № 1	0,375±0,002
emulsifier T_1	0,122±0,0019
emulsifier T_2	0,581±0,003

Based on studies of the release of carotenoids in in vitro experiments, it was found that the maximum release of carotenoids is observed from a preparation prepared using a T2 emulsifier.

The results of determining the physical, chemical and microbiological stability of the drug using T2 emulsifier in various concentrations are presented in table 2.

Table 2

Determination of the stability of the drug prepared using the emulsifier T2

Emulsifier concentration, %	Microbiological stability	Physical stability	Chemical stability
0,5	+	-	-
1,0	+	-	-
1,5	+	-	+
2,0	+	+	+
2,5	+	-	+

The determination of physical stability was carried out visually, chemical spectrophotometrically according to the content of the main active substances, microbiological - according to the standard methodology of the State Pharmacopoeia of XI edition.

The results of the experiment showed that drops with a content of T2 emulsifier at a concentration of 2% possess physical, chemical, and microbiological stability.

Conclusion. Thus, the use of oil extracts of vegetable crops and medicinal plants in the composition of the nasal dosage form for the treatment of inflammatory diseases of the nasal cavity is justified. A composition of nasal drops containing a biocomplex of plant origin has been developed. The optimal technological scheme for the production of nose drops has been substantiated.

The prescription of the developed dosage form had the following composition:
garlic and onion oil extracts - 15 parts,
common mountain ash oil extract - 20 parts,
thuja oil - 16 parts,
calendula tincture - 15 parts,
kalanchoe juice - 17 parts.

The amount of emulsifier T2 used is 2 parts.

ЛИТЕРАТУРА

1. Жиры, полиненасыщенные жирные кислоты, фосфолипиды: биологическая роль и применение в профилактической и клинической медицине. // Введение в частную микронутриентологию / под ред. Ю. П. Гичева и Э. Огановой. Новосибирск, 1999. С. 264-284.

2. Хасанов С. А. Распространённость хронического тонзиллита в семье и его профилактика / С. А. Хасанов, А. А. Асоров, У. Н. Вохидов // Вестн. Оториноларингологии. 2006. № 4. С.3 8-40.

3. Кудрицкая С. Е. Каротиноиды плодов и ягод. Киев: Выща шк., 1990. 210 с.

4. Матющенко Н. В. Стандартизация плодов рябины / Н. В. Матющенко, Т. А. Степанова // Фармация. 2003. № 5. С. 16-18.

5. Garrido Fernandes, Por.L. Minguer Pigmentos carotenoides / Por. L. Garrido Fernandes, M. I. Mosquero // Grasas Y aceites. 1983. Vol.34, №5. P.197-202.

6. Isler O. History and industrial application of carotenoids and vitamin A // Pure Appl. Chen. 1979. Vol. 51. P. 447-462.

7. Kikugawa, Kiyomi. β-carotene effectively scavenges toxic nitrogen oxides: Nitrogen dioxide and peroxynitrous acid / Kikugawa Kiyomi, Hiramoto Kazuyuki, Tomiyama Susumu // Lett.- 1997. Vol. 404, №2-3. P.175-178.

8. Wamer W. G. Beta-carotene uptake, metabolism and distribution in BALB / 3T3 cells. // Nutr Cancer. 1993. Vol. 19, №1. P. 1-8.

9. Химия биологически активных природных соединений / под ред. Н. А. Преображенского, Р. П. Евтисгнеевой. М.: Химия, 1976. 455 с.

10. Методические указания по экспериментальному (доклиническому) изучению нестероидных противовоспалительных веществ. М., 1963. 16 с.

11. Булдаков А. С. Пищевые добавки: справочник. СПб.: Ut, 1996. 240 с.

12. Витамины и витаминные препараты / под ред. В. А. Яковлева. М.: Медицина, 1973. С.210-223.

13. Деренько С. А. О содержании и накоплении биологически активных веществ в плодах рябины обыкновенной / С. А. Деренько, Н. И. Супрунов // Всесоюз. съезд фарацевтов (3; 1980: Кишинёв): тез. докл. Кишинёв, 1980. С. 204-205.

14. Муравьев И. А. Теоретические основы производства жидких экстрактов методом реперколяции с законченным циклом: методич. рекомендаци / И. А. Муравьев, Ю. Г. Пшуков. Пятигорск, 1985. 48 с.

15. Погорелов В. И. О новом способе получения облепихового масла репрессованием / Погорелов В. И., Муравьёв И. А., Пинчук В. А. // III Всесоюзный съезд фармацевтов (тезисы докладов) 14-17 октября. Кишинёв, 1980. 115 с.

16. Промышленная технология лекарств: уч. в 2 Т., Т №2. / В.И. Чуешов [и др.]. Харьков: Книга, 2002. 716 с.

17. Химия и технология процессов производства и переработки растительных масел и жиров: сб. науч. тр. / ВНИИ жиров. Л.: ВНИИЖ, 1986. 150 с.

18. Гавриленко И. В. Оборудование для производства растительных масел. М.: Пищевая пром.-сть, 1972. 748 с.

19. Лабораторный практикум по технологии производства растительных масел: учеб. пособие / В. М. Копейковский [и др.]. М.: Агропромиздат, 1990. 190 с.

20. Чахирова А. А. Технологические исследования по разработке масляного экстракта из плодов рябины обыкновенной и перспективы его использования: автореф. дис… канд. фармац. наук: 15.00.01 / Чахирова Анна Анатольевна. Пятигорск., 2008. 24 с.

21. Журавлёв М. А. Оборудование жироперерабатывающих предприятий / М. А. Журавлёв, Л. Д. Гозенпут. М.: Пищ. пром.-сть, 1976. 327 с.

22. Арутюнян И. С. Технология переработки жиров. М.: Пищепромиздат, 1998. С. 8-15

23. Ленцова Л. В. Пищевые жиры: значение и проблемы. Владивосток: ДВГАЭУ, 2001. 128 с.

24. Ковальская Г. Н. Биофармацевтическое и технологическое исследование мазей и суппозиториев с микробиологическим каротином: автореф. дис…. канд. фармац. наук: 15.00.01 / Ковальская Галина Николаевна. Пятигорск, 1987. 21 с.

25. Калошин Ю. А. Технология и оборудование масложировых предприятий. М.: Академия, 2002. С.115-117.

REFERENCES

1. Zhiry, polinenasyshchennye zhirnye kisloty, fosfolipidy: biologicheskaya rol′ i primenenie v profilakticheskoy i klinicheskoy meditsine // Vvedenie v chastnuyu mikronutrientologiyu / pod red. Yu. P. Gicheva i Eh. Oganovoy. Novosibirsk, 1999. S. 264-284.

2. Khasanov S. A. Rasprostranyonnost′ khronicheskogo tonzillita v sem′e i ego profilaktika / S. A. Khasanov, A. A. Asorov, U. N. Vokhidov // Vestn. Otorinolaringologii. 2006. № 4. S.3 8-40.

3. Kudritskaya S. E. Karotinoidy plodov i yagod. Kiev: Vyshcha shk., 1990. 210 s.

4. Matyushchenko N. V. Standartizatsiya plodov ryabiny / N. V. Matyushchenko, T. A. Stepanova // Farmatsiya. 2003. № 5. S. 16-18.

5. Garrido Fernandes, Por.L. Minguer Pigmentos carotenoides / Por. L. Garrido Fernandes, M. I. Mosquero // Grasas Y aceites.-1983.-Vol.34, №5.-P.197-202.

6. Isler, O. History and industrial application of carotenoids and vitamin A / O. Isler // Pure Appl. Chen. - 1979. Vol. 51. P. 447-462.

7. Kikugawa, Kiyomi. β-carotene effectively scavenges toxic nitrogen oxides: Nitrogen dioxide and peroxynitrous acid / Kikugawa Kiyomi, Hiramoto Kazuyuki, Tomiyama Susumu // Lett. 1997. Vol. 404, №2-3. P.175-178.

8. Wamer W. G. Beta-carotene uptake, metabolism and distribution in BALB / 3T3 cells. // Nutr Cancer. 1993. Vol. 19, №1. P. 1-8.

9. Khimiya biologicheski aktivnykh prirodnykh soedineniy / pod red. N. A. Preobrazhenskogo, R. P. Evtisgneevoy. M.: Khimiya, 1976. 455 s.

10. Metodicheskie ukazaniya po ehksperimental′nomu (doklinicheskomu) izucheniyu nesteroidnykh protivovospalitel′nykh veshchestv. M., 1963. 16 s.

11. Buldakov A. S. Pishchevye dobavki: spravochnik. SPb.: Ut, 1996. 240 s.

12. Vitaminy i vitaminnye preparaty / pod red. V. A. Yakovleva. M.: Meditsina, 1973. S. 210-223.

13. Deren′ko S. A. O soderzhanii i nakoplenii biologicheski aktivnykh veshchestv v plodakh ryabiny obyknovennoy / S. A. Deren′ko, N. I. Suprunov // Vsesoyuz. s″ezd faratsevtov (3; 1980: Kishinyov): tez. dokl.- Kishinyov, 1980. S. 204-205.

14. Murav′ev I. A. Teoreticheskie osnovy proizvodstva zhidkikh ehkstraktov metodom reperkolyatsii s zakonchennym tsiklom: metodich. rekomendatsi / I. A. Murav′ev, Yu. G. Pshukov. Pyatigorsk, 1985. 48 s.

15. Pogorelov V. I. O novom sposobe polucheniya oblepikhovogo masla repressovaniem / Pogorelov V. I., Murav′yov I. A., Pinchuk V. A. // III Vsesoyuznyy s″ezd farmatsevtov (tezisy dokladov) 14-17 oktyabrya. Kishinyov, 1980. 115 s.

16. Promyshlennaya tekhnologiya lekarstv: uch. v 2 T., T №2. / V.I. Chueshov [i dr.]. Khar′kov: Kniga, 2002. 716 s.

17. Khimiya i tekhnologiya protsessov proizvodstva i pererabotki rastitel′nykh masel i zhirov: sb. nauch. tr. / VNII zhirov. L.:VNIIZH, 1986. 150 s.

18. Gavrilenko I. V. Oborudovanie dlya proizvodstva rastitel′nykh masel. M.: Pishchevaya prom.-st′, 1972. 748 s.

19. Laboratornyy praktikum po tekhnologii proizvodstva rastitel′nykh masel: ucheb. posobie / V. M. Kopeykovskiy [i dr.]. M.: Agropromizdat, 1990. 190 s.

20. Chakhirova A. A. Tekhnologicheskie issledovaniya po razrabotke maslyanogo ehkstrakta iz plodov ryabiny obyknovennoy i perspektivy ego ispol′zovaniya: avtoref. dis… kand. farmats. nauk: 15.00.01 / Chakhirova Anna Anatol′evna. Pyatigorsk., 2008. 24 s.

21. Zhuravlyov M. A. Oborudovanie zhiropererabatyvayushchikh predpriyatiy / M. A. Zhuravlyov, L. D. Gozenput. M.: Pishch. prom.-st′, 1976. 327 s.

22. Arutyunyan I. S. Tekhnologiya pererabotki zhirov. M.: Pishchepromizdat, 1998. S. 8-15.

23. Lentsova L. V. Pishchevye zhiry: znachenie i problemy. Vladivostok: DVGAEHU, 2001. 128 s.

24. Koval′skaya G. N. Biofarmatsevticheskoe i tekhnologicheskoe issledovanie mazey i suppozitoriev s mikrobiologicheskim karotinom: avtoref. dis…. kand. farmats. nauk: 15.00.01 / Koval′skaya Galina Nikolaevna. Pyatigorsk, 1987. 21 s.

25. Kaloshin Yu. A. Tekhnologiya i oborudovanie maslozhirovykh predpriyatiy. M.: Akademiya, 2002. S.115-117.

ОБ АВТОРАХ

Чахирова Анна Анатольевна, кандидат фармацевтических наук, доцент кафедры фармацевтической технологии с курсом медицинской биотехнологии Пятигорского медико-фармацевтического института филиала ВолгГМУ Минздрава России, E-mail: annachaxirova@gmail.com, +7(961)460-34-22

Chakhirova Anna Anatolievna, Candidate of Pharmaceutical Sciences, Associate Professor of Department of Pharmaceutical technology with the course of medical biotechnology of Pyatigorsk medical and pharmaceutical Institute – a branch of the VSMU Ministry of health of Russia, E-mail: annachaxirova@gmail.com, +7(961)460-34-22

Ковтун Елена Владимировна, кандидат фармацевтических наук, старший преподаватель кафедры фармацевтической технологии с курсом медицинской биотехнологии Пятигорского медико-фармацевтического института – филиала ВолгГМУ Минздрава России, E-mail: elena.f.73@mail.ru, +7(962)442-52-46

Kovtun Elena Vladimirovna, Candidate of Pharmaceutical Sciences, Senior lecturer Department of Pharmaceutical technology with the rate of medical biotechnology Pyatigorsk medical-pharmaceutical Institute – a branch of the VSMU Ministry of health of Russia, E-mail:elena.f.73@mail.ru, +7(962)442-52-46

Марина Алексеевна Огай, доктор фармацевтических наук, профессор кафедры фармацевтической технологии с курсом медицинской биотехнологии Пятигорского медико-фармацевтического института филиала ВолгГМУ Минздрава России, E-mail: marinfarm@yandex.ru, +7 (983)621-76-55
Ogai Marina Alexeyevna, Doctor of Pharmacy, Professor of Department of Pharmaceutical technology with the rate of medical biotechnology Pyatigorsk medical-pharmaceutical Institute – a branch of the VSMU Ministry of health of Russia,, E-mail: marinfarm@yandex.ru, +7 (983)621-76-55

Степанова Элеонора Федоровна, доктор фармацевтических наук, профессор кафедры фармацевтической технологии с курсом медицинской биотехнологии Пятигорского медико-фармацевтического института – филиала ВолгГМУ Минздрава России,
E-mail: efstepanova@yandex.ru, +7(928)919-83-35
Stepanova Eleonora Fedorovna, Doctor of Pharmaceutical Sciences, Professor of the Department of pharmaceutical technology with a course of medical biotechnology of the Pyatigorsk medical and pharmaceutical Institute– a branch of the VSMU Ministry of health of Russia,
E-mail: efstepanova@yandex.ru, +7(928)919-83-35

Нам Наталья Леонидовна, кандидат химических наук, доцент кафедры химии Российского Государственного Аграрного Университета -МСХА имени К.А.Тимирязева;127550, г. Москва, ул. Тимирязевская, 49; Российский Государственный Аграрный Университет - МСХА имени К.А. Тимирязева; +7-926-303-08-05; E-mail: namnl@rambler.ru
Nam Natalia Leonidovna, Candidate of Chemical Sciences, Associate Professor of Chemistry Department of the Russian State Agrarian University -Moscow Timiryazev agricultural Academy;49 Timiryazevskaya str., Moscow, 127550; Russian State Agrarian University - Timiryazev Moscow state agrarian University; +7-926-303-08-05; E-mail: namnl@rambler.ru

Дата поступления в редакци: 08.03.2019 г.
После рецензирования: 22.05.2019 г.
Дата принятия к публикации: 5.06.2019 г.