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The study of saponins of the raspberry cake alcoholic extract by HPLC

Aim. To study saponins of the raspberry cake ethanol extract.

Materials and methods. The object of the study was the extract obtained from the cake of *Rubus idaeus* fruit. The study of saponin compounds was carried out by HPLC.

Results and discussion. The following saponins were found in the extract: euscaptic acid (0.24 %), tormentic acid (0.14 %), lupeol (0.65 %). These compounds are of interest to pharmacy and medicine as substances with the oncoprotective and hepatoprotective activity.

Conclusions. The qualitative and quantitative composition of saponins in the cake extract of raspberry fruits has been studied. The results indicate the prospects of creating new drugs based on biologically active substances of the raspberry fruit cake, as well as necessity of more profound study of phenolic compounds of this type of the raw material.

Key words: raspberry; HPLC; extract; saponins

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Дослідження сапонінів спиртового екстракту зі жмиху плодів малини звичайної методом ВЕРХ

Мета. Метою даної роботи стало дослідження сапонінів етанольного екстракту зі жмиху плодів малини звичайної.

Матеріали та методи. Об'єктом дослідження був екстракт, отриманий зі жмиху плодів *R. idaeus*. Дослідження сапонінових сполук проводили методом ВЕРХ.

Результати та їх обговорення. В екстракті були виявлені такі сапоніни: еускапова кислота (0,24 %), торментинова кислота (0,14 %), лупеол (0,65 %). Ці сполуки становлять інтерес для фармації і медицини як речовини з онкопротекторною і гепатопротекторною активністю.

Висновки. Вивчений якісний і кількісний склад сапонінів екстракту зі жмиху плодів малини. Результати вказують на перспективність створення нових лікарських засобів на основі біологічно активних речовин зі жмиху плодів малини, а також на необхідність більш глибокого вивчення фенольних сполук даного виду сировини.

Ключові слова: малина звичайна; ВЕРХ; екстракт; сапоніни

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Исследование сапонинов спиртового экстракта из жмыха плодов малины обыкновенной методом ВЭЖХ

Цель. Целью данной работы было исследование сапонинов этанольного экстракта из жмыха плодов малины обыкновенной.

Материалы и методы. Объектом исследования был экстракт, полученный из жмыха плодов *R. idaeus*. Исследование сапониновых соединений проводили методом ВЭЖХ.

Результаты и их обсуждение. В экстракте были обнаружены такие сапонины: эускаповая кислота (0,24 %), торментиновая кислота (0,14 %), лупеол (0,65 %). Эти соединения представляют интерес для фармации и медицины как вещества с онкопротекторной и гепатопротекторной активностью.

Выводы. Изучен качественный и количественный состав сапонинов экстракта из жмыха плодов малины. Результаты указывают на перспективность создания новых лекарственных средств на основе биологически активных веществ из жмыха плодов малины, а также на необходимость более глубокого изучения фенольных соединений данного вида сырья.

Ключевые слова: малина обыкновенная; ВЭЖХ; экстракт; сапонины

Raspberry is a subshrub of *Rosaceae* family, it has a long rhizome and erect cylindrical stem. The plant is about 50-200 cm height. In the first year of life shoots are green, tomentose, with spines. In the second year they become stiff, lose spines, blossom, fructify and dry after fruiting, and new shoots are formed from the rhizomes. Raspberry rhizomes are woody, sinuate, creep in the 10-20 centimeter layer of soil. Leaves are alternate,

the lower ones are unpaired, with 5-7 leaflets on the petioles, the upper ones are ternate with broad adnate to the stem stipules. Flowers are white with a pubescent greenish-gray cup, which particles are bent downward, collected in small inflorescences, originating from the sinuses of the leaves. The petals are white, spatulate, erect.

Fruits are raspberry-red, a spherical-oval polyacheneum with the length of 12-13 mm and the width of

10-14 mm, easily removed from a white cylindrical-conical receptacle; stone fruits are small (approximately 3 mm), juicy, velvety-fluffy.

Raspberry fruits have long been used in various areas of the national economy: in medicine, pharmaceutical and food industries, etc. According to the literary sources raspberries have a rich chemical composition [1, 2, 3, 4].

Despite the widespread use of this plant in medical practice, its chemical composition has been insufficiently studied. In available sources of scientific literature there is no data about the content of saponins in the raspberry fruit cake.

Saponins are polycyclic naturally occurring compounds, mainly of vegetable origin used in the light, food, cosmetic and pharmaceutical industries as natural surface-active substances. They have a diverse pharmacological activity, most of them increase the secretory activity of the glands, promote the absorption of other substances, cause the expectorant activity, some of them have the diuretic, antiallergic, antiviral action, regulate the water-salt metabolism. Saponins also stimulate the activity of the central nervous system, show the antihypertensive, anti-inflammatory, antimicrobial, antiallergic and corticosteroid effects [5]. In the sources of scientific literature there is also information concerning the adaptogenic, anti-sclerotic and hypoglycemic activity of saponins [6, 7].

The aim of this work was to study saponins of the raspberry cake ethanol extract.

Materials and methods

The object of the study was the extract obtained from the cake of *Rubus idaeus* fruit collected in the places of its cultivation. The collection of the raw material was carried out in 2017 during the fruiting period near Ternova village, the Kharkiv region. The juice was squeezed from the fruits, the resulting cake was dried, and

80 % alcohol was added in the ratio of 1 : 5 taking into account the absorption coefficient. The extraction was carried out within 24 hours, then settled, filtered and dried to a dry extract. The HPLC studies were performed on a Shimadzu LC20 Prominence liquid chromatograph in a modular system equipped with a four-channel LC20AD pump, a thermostat of columns CTO20A, an automatic sampler SIL20A, a diode-matrix detector SPDM20A and a ChemStation LC20 under the following conditions:

- X-Bridge C18 column, 150 mm * 4.6 mm in size with a grain size of 5 μm (Waters company);
- column temperature – 30 $^{\circ}\text{C}$;
- detection wavelength – 205 nm;
- flow rate of the mobile phase – 1.0 ml/min;
- volume of the test sample introduced – 20 μl .

Mobile phase: methanol for HPLC: 0.2 % solution of ammonium acetate (pH 6.75) in the ratio (80 : 20).

Elution mode: isocratic.

The components were identified by the retention time and compliance of the UV spectra with standards.

The spectra of triterpene saponins have the absorption maximum at 200-210 nm; therefore, this group of compounds was detected at 205 nm.

The quantitative determination of the individual components of the extract was carried out using the working reference standards of oleanolic acid, ursolic acid and standardized extracts of the saponin-containing plant raw material – birch bark (*Betulae pendulae cortex extract*) and garden sage leaves (*Salviae off. foliae extract*). Extracts from these plants were characterized by the exact content of betulin, betulinic acid and lupeol [8, 9, 10].

Results and discussion

The following saponins were found in the extract: euscaptic acid (0.24 %), tormentic acid (0.14 %), lupeol (0.65 %). These compounds are of interest to pharmacy

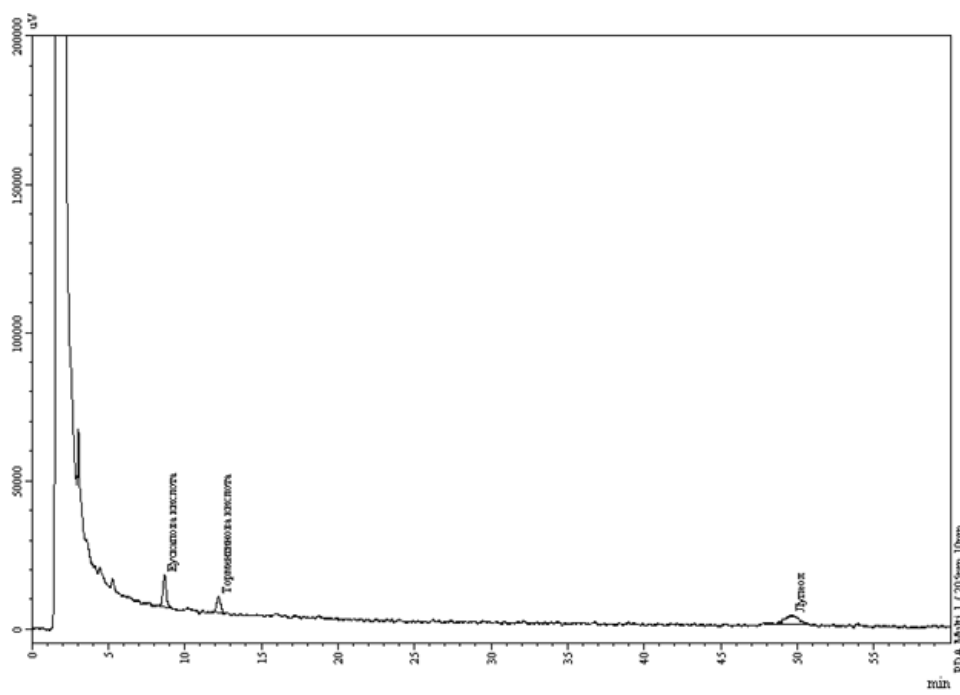


Fig. The chromatogram of saponins of the raspberry cake ethanol extract

and medicine as substances with the oncoprotective and hepatoprotective activity. The chromatogram of saponins of the raspberry cake ethanol extract is given in Fig.

CONCLUSIONS

The qualitative and quantitative composition of saponins in the cake extract of raspberry fruits has been studied. The content of euscaptic acid was 0.24 %, tormentic acid –

0.14 %, lupeol – 0.65 %. The results indicate the prospects of creating new drugs based on biologically active substances of the raspberry fruit cake, as well as necessity of more profound study of phenolic compounds of this type of the raw material. The data obtained can be used for the extract standardization.

Conflict of Interests: authors have no conflict of interests to declare.

REFERENCES

- ГОСТ 3525-75. Плоды малины. – М., 1975.
- The study of phenolic compounds and the antimicrobial action of the alcoholic extract from the cake of the red raspberry fruit / I. Polischuk, O. Koshovyi, T. Osolodchenko, M. Komissarenko // *Visnik Farmacii*. – 2018. – № 3 (95). – P. 30–33. <https://doi.org/10.24959/nphj.18.2220>
- Растительные ресурсы СССР : цветковые растения, их химический состав, использование; семейство Hydrangeaceae – Haloragaceae. – Ленинград : Наука, 1987. – 326 с.
- Тараховский, Ю. С. Флавоноиды : биохимия, биофизика, медицина / Ю. С. Тараховский. – Пуццоно : Synchronbook, 2013. – 310 с.
- Особенности выделения сапонинов из корнеплодов растения *Beta vulgaris* L. / Т. А. Брежнева, С. А. Атаманова, А. И. Сливкин и др. // *Вестник ВГУ*. – 2004. – № 1. – С. 152–155.
- Белай, І. М. Дослідження протиатеросклеротичного ефекту рослинних засобів, що містять сапоніни в експерименті / І. М. Белай // *Вісник наук. досліджень*. – 1999. – № 2. – С. 45–47.
- Дроздова, І. Л. Тритерпеновые соединения травы икотника серого / І. Л. Дроздова, Т. І. Лупилина // *Матер. II междунар. науч.-практ. интернет-конф. «Лекарственное растениеводство : от опыта прошлого к современным технологиям»*. Полтава, 2013.
- Leng, G. Determination of oleanolic acid and ursolic acid in different parts of *Mesona Chinensis* Benth by RP–HPLC / G. Leng, J. Chin // *Spectrosc. Lab.* – 2011. – № 28. – P. 2111–2114.
- Cen, J. H. High–performance liquid chromatographic analysis of bioactive triterpenes in *Perilla frutescens* / J. H. Cen, Z. H. Xia, R. X. Tan // *Pharm. Biomed. Anal.* – 2003. – № 32. – P. 1175–1179.
- Pentacyclic Triterpene Distribution in Various Plants – Rich Sources for a New Group of Multi-Potent Plant Extracts / S. Jäger, H. Trojan, T. Kopp et al. // *Molecules*. – 2009. – № 14 (6). – P. 2016–2031. <https://doi.org/10.3390/molecules14062016>
- Hepatoprotective effects of *Rubus aleaefolius* Poir. and identification of its active constituents / Z. Hong, W. Chen, J. Zhao et al. // *J. of Ethnopharmacol.* – 2010. – Vol. 129, № 2. – С. 267–272.
- Tormentic acid derivatives: synthesis and apoptotic activity / R. Csuk, B. Siewert, C. Dressel, R. Schäfer // *Eur. J. of Med. Chem.* – 2012. – Vol. 56. – P. 237–245. <https://doi.org/10.1016/j.ejmech.2012.08.032>

REFERENCES

- GOST 3525-75. (1975). *Plody maliny*.
- Polischuk, I. M., Koshovyi, O. M., Osolodchenko, T. P., & Komissarenko, M. A. (2018). The study of phenolic compounds and the antimicrobial action of the alcoholic extract from the cake of the red raspberry fruit. *Visnik farmacii*, 3 (95), 30–33. <https://doi.org/10.24959/nphj.18.2220>
- Rastitelnye resursy SSSR : cvetkovye rasteniia, ikh khimicheskii sostav, ispolzovanie ; semeistvo Hydrangeaceae – Haloragaceae*. (1987). St: Petersburg: Nauka, 326 .
- Tarakhovskii, Yu. S. (2013.) *Flavonoidy: biokhimiia, biofizika, meditsina*. Pushchino: Synchronbook, 310.
- Brezhneva, T. A., Atamanova, S. A., Slivkin, A. I., Selemenev, V. F., Safonova, E. F., Turygina, N. E. (2004). *Vestnik VGU*, 1, 152–155.
- Belai, I. M. (1999). *Visnyk naukovykh doslidzhen*, 2, 45–47.
- Drozдова, I. L., Lupilina, T. I. (2013). *Materialy vtoroi Mezhdunarodnoi nauchno-rakticheskoi internet-konferentcii “Lekarstvennoe rastenievodstvo: ot opyta proshlogo k sovremennym tekhnologiiam”*. Poltava.
- Leng, G., Chin, J. (2011). Determination of oleanolic acid and ursolic acid in different parts of *Mesona Chinensis* Benth by RP–HPLC. *Spectrosc. Lab.*, 28, 2111–2114.
- Chen, J. H., Xia, Z. H., & Tan, R. X. (2003). High-performance liquid chromatographic analysis of bioactive triterpenes in *Perilla frutescens*. *Journal of Pharmaceutical and Biomedical Analysis*, 32 (6), 1175–1179. [https://doi.org/10.1016/s0731-7085\(03\)00160-2](https://doi.org/10.1016/s0731-7085(03)00160-2)
- Jäger, S., Trojan, H., Kopp, T., Laszczyk, M., & Scheffler, A. (2009). Pentacyclic Triterpene Distribution in Various Plants – Rich Sources for a New Group of Multi-Potent Plant Extracts. *Molecules*, 14 (6), 2016–2031. <https://doi.org/10.3390/molecules14062016>
- Hong, Z., Chen, W., Zhao, J., Wu, Z., Zhou, J., Li, T., & Hu, J. (2010). Hepatoprotective effects of *Rubus aleaefolius* Poir. and identification of its active constituents. *Journal of Ethnopharmacology*, 129 (2), 267–272. <https://doi.org/10.1016/j.jep.2010.03.025>
- Csuk, R., Siewert, B., Dressel, C., & Schäfer, R. (2012). Tormentic acid derivatives: Synthesis and apoptotic activity. *European Journal of Medicinal Chemistry*, 56, 237–245. <https://doi.org/10.1016/j.ejmech.2012.08.032>

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