Development of the methods for the quantitative determination of fusidic acid and panthenol in the composition of “Fuzipam-derma” dermatological gel

Aim. To develop and validate the methods for the quantitative determination of fusidic acid and panthenol in “Fuzipam-derma” gel.

Materials and methods. The determination was performed by high performance liquid chromatography (HPLC) according to the requirements of the State Pharmacopoeia of Ukraine (SPhU) 1.0 on a Prostar-210 liquid chromatograph, (Varian Chromatography System, USA).

Results and discussion. The methods for the quantitative determination of fusidic acid and panthenol in “Fuzipam-derma” gel have been developed. The appropriate chromatographic conditions have been chosen, due to them the peaks of fusidic acid and panthenol are completely separated from other gel components. The validation of the methods for the quantitative determination of fusidic acid and panthenol has been performed. The data obtained have shown that the methods are stable and reproducible in different days.

Conclusions. The methods for the quantitative determination of fusidic acid and panthenol in the composition of the new dermatological gel “Fuzipam-derma” for the treatment of grade I-II acne has been developed using the HPLC method.

Key words: acne; gel; chromatogram; panthenol; fusidic acid

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Розробка методик колірного визначення фузідієвої кислоти та пантенолу в складі дерматологічного гелю «Фузипам-дерма»

Мета. Розробити та провести валідацію методик колірного визначення фузідієвої кислоти та пантенолу у гелі «Фузипам-дерма».

Матеріали та методи. Визначення проводили методом високоефективної рідинної хроматографії згідно з вимогами ДФУ 1.0 на рідинному хроматографі Prostar-210 фірми Varian Chromatography System, США.

Результати та їх обговорення. Розроблені методики кількісного визначення фузідієвої кислоти та пантенолу у гелі «Фузипам-дерма». Були підібрани відповідні умови хроматографування, за рахунок яких пики фузідієвої кислоти та пантенолу повністю відокремлюються від інших компонентів гелю. Була проведена валідація методик кількісного визначення фузідієвої кислоти та пантенолу. Отримані дані показали, що методики є стабільними та відтворюються у різні дні.

Висновки. За допомогою методу ВЕЖХ розроблені методики кількісного визначення фузідієвої кислоти та пантенолу в складі нового дерматологічного гелю «Фузипам-дерма» для лікування І-ІІ ступеня вугрової хвороби.

Ключові слова: вугрова хвороба; гель; хроматограма; пантенол; фузідієва кислота

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Разработка методик количественного определения фузидиевой кислоты и пантенола в составе дерматологического геля «Фузипам-дерма»

Цель. Разработать и провести валидацию методик количественного определения фузидиевой кислоты и пантенола в геле «Фузипам-дерма».

Материалы и методы. Определение проводили методом высокоэффективной жидкостной хроматографии в соответствии с требованиями ДФУ 1.0 на жидкостном хроматографе Prostar-210 фабрики Varian Chromatography System, США.

Результаты и их обсуждение. Разработаны методики количественного определения фузидиевой кислоты и пантенола в геле «Фузипам-дерма». Были подобраны соответствующие условия хроматографирования, за счет которых пики фузидиевой кислоты и пантенола полностью отделялись от других компонентов геля. Была проведена валидация методик количественного определения фузидиевой кислоты и пантенола. Полученные данные показали, что методики являются стабильными и воспроизводятся в разные дни.

Выводы. С помощью метода ВЭЖХ разработаны методики количественного определения фузидиевой кислоты и пантенола в составе нового дерматологического геля «Фузипам-дерма» для лечения I-II степени угревой болезни.

Ключевые слова: угревая болезнь; гель; хроматограмма; пантенол; фузидиевая кислота
Acne occupies a leading position in the spread of chronic human skin diseases affecting up to 85% of people aged 12-24 years [1, 2]. In the age groups of 25-34 and 35-44 the incidence is 8% and 3%, respectively [3, 4]. At present, unfortunately, there is a tendency to increase the level of acne among people over 40 years old. It should be noted that acne is a medical and social problem. The acne illness requires the systematic treatment and encourages patients to seek help from dermatologists and beauticians [5, 6].

It should be noted that currently when developing modern medicines for the treatment of acne the prescription of gels that provide the most active release of active substances are optimal [7].

Based on the complex research the composition of a new medicine – “Fuzipam-derma” gel with fusidic acid and panthenol for the treatment of grade I-II acne has been developed [8, 9]. It should be noted that a high therapeutic activity of the medicine can be achieved only with the correct combination of active ingredients and the base. The composition of the medicine should be substantiated on the basis of scientific experiments on the choice of active and excipients, their required concentration [10, 11].

The aim was to develop and validate the methods for the quantitative determination of fusidic acid and panthenol in “Fuzipam-derma” dermatological gel.

Materials and methods
As the study object the samples of the combined dermatological gel “Fuzipam-derma” with fusidic acid and panthenol in its composition were chosen.

The following reagents and solvents were used in this work: fusidic acid Reference Standard (RS) and panthenol RS; 96% ethanol, purified water. Chromatography was carried out on a liquid chromatograph “Prostar-210” (Varian Chromatography System, USA); a “Precisa XT 220А” electronic balance, measuring glassware of class A were used.

The determination was performed by high performance liquid chromatography (HPLC) according to the requirements of the State Pharmacopoeia of Ukraine (SPhU) 1.0 (sections 2.2.29 and 2.2.46N) [12].

Results and discussion
The quantitative determination of fusidic acid was carried out on a liquid chromatograph under the following conditions:

- column – μ-Porasil, 300 mm × 4 mm, filled with the sorbent with the particle size of 5 μm or similar;
- pre-Column – μ-Porasil, 60 mm × 4 mm, filled with the sorbent with the particle size of 5 μm or similar;
- mobile phase – hexane – methylene chloride – 96% ethanol (69 : 25 : 6) degassed in a convenient way;
- temperature of the column thermostat – 30.0 °C;
- the speed of the mobile phase – 1.5 ml/min;
- detection – at a wavelength of 254 nm.

The chromatographic system is considered to be suitable if the following conditions are met [13-15]: the efficiency of the chromatographic system calculated on the basis of the fusidic acid peak should be at least 1000 t.; the symmetry factor of the fusidic acid peak should be not more than 2.0; the relative standard deviation of the fusidic acid peak area should be in accordance with the requirements of the SPhU 1.2 [16].

Under these conditions the peak of fusidic acid is completely separated from other components of the gel.

Fig. 1 and 2 show the chromatograms of the test solution and the reference solution for identification of fusidic acid. The chromatogram of fusidic acid RS solution – Fig. 3.

The content of fusidic acid in milligrams per 1 g of the gel is calculated by the formula:

\[ Y = \frac{S \cdot m_0 \cdot P \cdot 100}{S_c \cdot 100 \cdot 100 \cdot m} = \frac{S \cdot m_0 \cdot P \cdot 0.01}{S_c \cdot m} \]

where: \( S \) – is the average value of fusidic acid peak areas calculated from the chromatograms of the test solution; \( S_c \) – is the average value of fusidic acid peak areas calculated from the chromatograms of the reference solution; \( m_0 \) – is the sample weight of fusidic acid RS, mg; \( P \) – is the amount of the active substance in fusidic acid RS.

The content of fusidic acid in 1 g of the gel should be from 14.25 mg to 15.75 mg.

The validation of the method for the quantitative determination of fusidic acid was performed [17]. The data
The content of panthenol in milligrams per 1 g of the gel is calculated by the formula:

\[ Y = \frac{S \cdot m_0 \cdot P \cdot 100}{S_r \cdot 100 \cdot m} = \frac{S \cdot m_0 \cdot P \cdot 0.01}{S_r \cdot m} , \]

where: \( S \) – is the average value of panthenol peak areas calculated from the chromatograms of the test solution; \( S_r \) – is the average value of panthenol peak areas calculated from the chromatograms of the reference solution; \( m_0 \) – is the sample weight of panthenol RS, mg; \( P \) – is the amount of the active substance in panthenol RS.

The content of panthenol in 1 g of the gel should be from 47.5 to 52.5 mg.

The validation of the method for the quantitative determination of panthenol was also performed [17]. The data obtained showed that the method was stable and reproducible in different days. The norms for the “System Suitability Test” were introduced to the method developed.

CONCLUSIONS

1. The methods for the quantitative determination of fusidic acid and panthenol in the composition of the new dermatological gel “Fuzipam-derma” for the treatment of grade I-II acne has been developed using the HPLC method.

2. The validation of the methods developed has been performed. It has been proven that the validation criteria meet the requirements of the SPhU for the methods of the quantitative determination with tolerances of the content of the active pharmaceutical ingredient of ± 5 %.

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