THE STUDIES ON DEVELOPMENT OF THE COMPOSITION OF MASKS WITH THE SAPROPEL PASTE

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Sapropel muds, which have a unique composition, effectively affect the functions of the whole organism and, especially the skin. They possess the anti-inflammatory, anti-allergic action, protect the skin from destructive effects of free radicals, give it elasticity, firmness and freshness. They also moisten the horny layer of the epidermis, and improve cellular regeneration [4].

Cosmetic products on the basis of sapropel are presented by different forms, but the most often in the form of masks (37.10%) and the natural raw material (15.70%) [5]. Masks are products of an intensive effect, and it causes exactly the spread of masks among the preparations of sapropel considering the diversity of the chemical composition and the pharmacological and cosmetic effects. To provide masks with plasticity and better organoleptic properties (elimination of a specific soil odour, the presence of small particles, the residues of plant life), as well as to expand the range of sapropel masks with the various pharmacological action (lifting, anti-cellulite, antiseborrheic and anti-acne effect, etc.) it was proposed to use one of the products of sapropel – the sapropel paste for the base of masks.

The sapropel paste is a paste-like product of the natural origin made of the lake sapropel, it contains biologically active substances, and the complex of macro- and microelements [6].

By appearance the sapropel paste is a homogenous pasty mass of a dark brown colour with pH – 6.7, the moisture content – 83%, and the content of organic substances – 76.63% [6].

However, the sapropel paste is a medium for development of microorganisms, including anaerobic ones. Therefore, the aim of our study was to substantiate experimentally the choice of an effective preservative in the composition of cosmetic masks with the sapropel paste to prevent microbiological contamination and ensure their stability.

Materials and Methods

The objects of the research were experimental samples of the sapropel paste taken from the Prybych deposit of the Volyn region: Sample 1 (paste of sapropel); Sample 2 (paste of sapropel, 0.1% of nizin); Sample 3 (paste of sapropel, 0.01% of nizin, 0.8% of germaben); Sample 4 (paste of sapropel, 0.01 of nizin, 0.1% of euxyl K 100).

The experimental samples of the sapropel paste obtained from the sapropel powder (the dry anhydrous product obtained from the native (natural) sapropel) and water by the method of cavitation with the speed from 100 to 3500 rpm for 30 min at the temperature of 50°C. Then they were cooled to the temperature of 35-40°C, and the preservatives were added.

For the sapropel paste the structural and mechanical (rheologic) parameters were determined according to the requirements of the SPhU (1.0, 2.2.10). The studies were carried out on a Brookfield HB DV-PRO II rotary viscometer (USA) using the adapter of the rotatory type with coaxial cylinders (the spindle SS4-21 for the chamber with the volume of 8.3 g) in the range of the gradient of the shear rates from 3.0 to 93.0 c⁻¹ [1].

For the comparative study of the effectiveness of preservatives of the experimental samples of the sapropel paste in the conditions in vitro the reference strains from the American standard collection of the cultures of microorganisms such as Staphylococcus aureus ATSS 6538, Pseudomonas aeruginosa ATSS 9027, Candida albicans ATSS 10231 were used as the test-strains. In addition, the studies of the effectiveness of preservatives against sulphite reductive Clostridium perfringens ATSS 13124 were conducted. The purity of each culture of the microorganism was confirmed by the typical morphological, tinctorial, cultural and biochemical properties.

In the experiments the one-day cultures of the abovementioned microorganisms grown on the solid media –
meat-and-peptone agar (for bacteria), Wilson-Blair agar (individually for clostridia) and Sabouraud agar (for *Candida albicans* fungi) were used.

Each container with the test sample was inoculated by the suspension that contained one of the test-strains providing the microbial load of 10⁵-10⁶ CFU per 1 ml. The samples were selected immediately after the inoculation and at certain intervals indicated in the SPhU: in 2 days, 7 days, 14 days and 28 days. The effectiveness of preservatives was studied according to the standard methods of the SPhU by the logarithmic reduction value of viable counts for the specific period after the inoculation of samples [2].

**Results and Discussion**

According to the results of the rheological studies the sapropel paste is a plastic mass, it has the ability to a certain dilution in the physical effect (Fig. 1, 2) and good adhesive properties.

The microbiological studies have shown that the sample that does not contain antimicrobial preservatives (Sample 1) has no antimicrobial action. It is proven by either the increase in the number of viable cells (the *Candida* genus fungi), or their constant level (*Staphylococcus aureus*, *Pseudomonas aeruginosa*, *Clostridium perfringens*) for 28 days of the study (Table). Introduction of nisin as a preservative into the composition of samples provided the effective antimicrobial action against bacteria of *Staphylococcus aureus* and *Clostridium perfringens*. At the same time introduction of nisin did not provide protection of the samples against the *Candida* genus fungi, and the efficiency against *Pseudomonas aeruginosa* was low (Sample 2).

A comparative study of the antimicrobial action of the combinations of nisin and germaben, and nisin and euxyl showed practically the absence of the difference in the manifestation of the antimicrobial effect (Samples 3, 4). The combination of these preservatives provides the synergic effect of the antimicrobial action in relation to the test-strains of bacteria (*Staphylococcus aureus, Pseudomonas aeruginosa, Clostridium perfrin-
gens) and protection from the Candida genus fungi. Therefore, these samples of the sapropel paste can be promising for developing the composition of the masks.

According to the analysis of the literary data concerning the use in cosmetology and the results of studying the chemical composition of sapropel the sapropel paste is a promising raw material for creating masks with the lifting, anti-cellulite, tonic, antiseborrheic and anti-acne action.

To intensify the effectiveness of masks from the sapropel paste a number of active substances, such as vegetable oils (wheatgerm, apricot, castor, avocado, jojoba), essential oils (orange, grapefruit, lemon, sage, rosemary, pine, ylang ylang, bergamot, tea tree oil, verbena, myrrh, peppermint), the extracts (flowers of chamomile, yarrow, daisies, marigold, balm, nettle, ivy, cocoa, horse chestnut, eucalyptus, ginkgo, calamus, sticktight, aloe vera, hops, burdock) the extract of pepper, sodium hyaluronate, proteins of wheat soy, triclosan, kaolin, zinc oxide, glycerol, tocopheryl acetate, D-panthenol, were introduced to their composition [3, 7].

CONCLUSIONS
1. The results of the study of rheological properties have shown that the sapropel paste has a plastic structure that is capable to rarefy with the physical impact and recover, and it indicates the presence of thixotropic properties.

2. To provide the conformity of the requirements of the current normative documents for microbiological purity and stability of the sapropel paste and masks during the storage it is necessary to use the complex of preservatives – 0.01% of nisin with 0.8% of germaben or 0.01% of nisin with 0.1% of euxyl K 100.

REFERENCES
1. Державна фармакопея України / Державне підприємство «Науково-експертний центр». – 1-е вид. – Х.: РІРЕГ, 2001. – 556 с.
2. Державна фармакопея України / Державне підприємство «Науково-експертний фармакопейний центр». – 1-е вид., 4 доп. – Х.: РІРЕГ, 2011. – 540 с.
3. Марголина А.А., Эрнандес Е.И. Новая косметология: Практическое пособие. – Т. 1. – М.: Изд-во «Косметика и медицина», 2005. – 395 с.
4. Стоянов Н.А., Козминский Е.Б., Карпенко Т.А., Меджидова Х.М. // Сб. тр. Санатория-профилактория ООО «Таманьтранссыль», ОАО «ГАЭПРОМ», г. Югорск – С.Пб., 2007. – С. 129-138.
5. Струс О. Є. // Управління, економіка та забезпечення якості у фармації. – 2015. – №1(39). – С. 59-67.
6. Струс О. Є. // Сб. наук. трудов Пятигорского мед.-фарм. института – филиала ГБОУ ВПО ВолгГМУ Минздрава России «Разработка, исследование и маркетинг новой фармацевтической продукции». – Волгоград, 2015. – Вип. 70. – С. 185-189.
7. Струс О. Є., Положко Н.П. // Матер. міжнар. наук.-практ. конф. «Сучасні проблеми світової медицини та її роль у забезпеченні здоров'я світового співтовариства». – Одеса, 2015. – С. 10-13.