DEVELOPMENT OF COMPOSITION AND RESEARCH OF EMULSION CREAM BASED ON AMARANTE OIL AND LACTIC ACID

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Introduction. One of the important stages of treatment of patients with diabetes, chronic dermatitis, xerosis is the use of external therapies designed to eliminate the symptoms of dry skin, which accompanies these diseases and is cyclical.

Comprehensive care for dry skin involves, in addition to topical steroids, the use of equally important drugs and medical and cosmetic products that have a hydrating, emollient, keratolytic effect and facilitate the course of the disease [1, 2].

The therapeutic effect in such products is provided by fats and fat-like substances, which provide softening and restoration of skin elasticity, eliminate moisture loss; moisturizers that retain moisture, as well as substances that provide keratolytic action.

The modern pharmaceutical market of Ukraine is not sufficiently provided with topical agents for the treatment and care of dry skin, which makes relevant the development of the composition and technology of domestic external drugs.

Aim of research. The aim of this work is to develop the composition of the emulsion cream based on amaranth oil and lactic acid, and to study its sensory and pharmacological properties.

Materials and methods.

The object of the study are experimental samples of emulsions, the oil phase of which is from 10 to 20%, it included two types of oils - amaranth and corn, the aqueous phase contains xanthan gum, glycerin, lactic acid; euksil was used as a preservative.

Research methods used were organoleptic (appearance, color, odor, homogeneity), pharmaco-technological (determination of thermal stability, colloidal stability, hydrogen index, structural and mechanical properties).

Experimental samples of emulsions were prepared by the hot method by parallel heating of the aqueous and oil phases to 70 °C and subsequent homogenization. The aqueous phase was prepared in advance: xanthan gum was mixed with glycerol, purified water was added and homogenized to form a gel. 80 % Solution of lactic acid was introduced into the finished emulsion after cooling.

The test for colloidal stability of the samples was performed using a laboratory centrifuge for 5 min at a speed of 100 s^{-1}; thermal stability was tested by dividing the emulsions into fat and oil phase at a temperature of 42 °C in a thermostat according to DSTU 4765: 2007 “Cosmetic creams” after the final formation of the consistency of the samples after 24 hours [3].

Determination of rheological parameters (values of viscosity, shear rate gradient and shear stress) was performed on a viscometer BROOKFIELD HB (USA) in the shear range from 18.6 s^{-1} to 93 s^{-1} (used spindle SC4-21 for the camera volume 8.3 g) at a temperature of 20 °C.

Based on the measurement results, rheograms of shear stress (τ) versus shear rate gradient (Dr) and a graph of structural viscosity (η) versus shear rate (Dr) were constructed. The presence of thixotropic properties of the samples was determined by the appearance of the flowability curve.

Studies of the sensory properties of the samples were performed on respondents with dry skin. Indicators were studied: absorption by the skin, feeling of hydration, speed of distribution, the presence of stickiness, shine, feeling of oiliness, the rest of the film before and after absorption.

Results and discussion

The use of amaranth seed oil is due to its moisturizing, protective, anti-inflammatory, antioxidant, membrane stabilizing and emollient action due to the presence of a unique complex of biologically active substances: phytosterols, tocotrienols, squalene, unsaturated phospholys. Due to these properties, amaranth oil has long been used in pharmacy and folk medicine for the treatment of skin with psoriasis, dry eczema, neurodermatitis, atopic dermatitis, acne, etc. [4, 5].

Corn oil has nourishing, protective properties, is dermatologically neutral, does not cause skin irritation, so it was used as an additional component of the oil phase of emulsions [6].

Olivem 1000, which allows to obtain stable emulsions in the presence of components capable of diluting the consistency was used as an emulsifier [7]. Lactic acid, which is a component of the skin’s natural moisturizing factor and is involved in the synthesis of ceramides, was used as a moisturizing component [8]. The composition of the experimental samples of emulsions is given in table

Table 1. Composition of emulsions experimental samples

Ingredients	Sample number, concentration of ingredients, %					
	1	2	3	4	5	6
Amarant oil	10	5	15	7,5	20	10
Corn oil	-	5	-	7,5	-	10
Olivem-1000	7	7	7	7	7	7

DOI: 10.5281/zenodo.6350163

Lactic acid (80 % solution)	8	8	8	8	8	8
Glycerol	3	3	3	3	3	3
Euxil	1	1	1	1	1	1
Xanthan gum	0.3	0.3	0.3	0.3	0.3	0.3
Peppermint essential oil	0.1	0.1	0.1	0.1	0.1	0.1
Purified water	up to 100					

The study of structural and mechanical properties of experimental samples of emulsion creams allowed to choose the optimal concentration of ingredients and justify the final composition. In terms of organoleptic, physicochemical and sensory properties, cosmetic samples No. 3, 4 and 5 met the requirements of the regulatory documentation for creams. The pH values are acceptable for products containing lactic acid (table 2).

The rheological properties of emulsions determine their sensory properties and extrusion. Based on the results of the study of the structural and mechanical properties of the experimental samples, complete rheograms of the dependence of the shear rate (Dr) on the shear stress (τ_r) at a temperature of 20 ºC were constructed (Fig. 1).

Table 2. Properties of experimental samples of emulsion bases

Quality indicator	Sample number		
	3	4	5
Colloidal stability	stable	stable	stable
Thermal stability	stable	stable	stable
pH	3.1±0.11	2.9±0.13	3.0±0.12
Structural viscosity Pa·s^{-1} at 3 rpm	9300	11900	12100
Structural viscosity Pa·s^{-1} at 20 rpm	2500	4250	3450
Organoleptic and sensory properties	The color and odor are specific. It spreads well, is absorbed by the skin, leaves no stickiness		

The areas of hysteresis loops on the constructed rheograms testify to the best extrusion and structural-mechanical properties of the emulsion cream sample No. 5 (Fig. 2).

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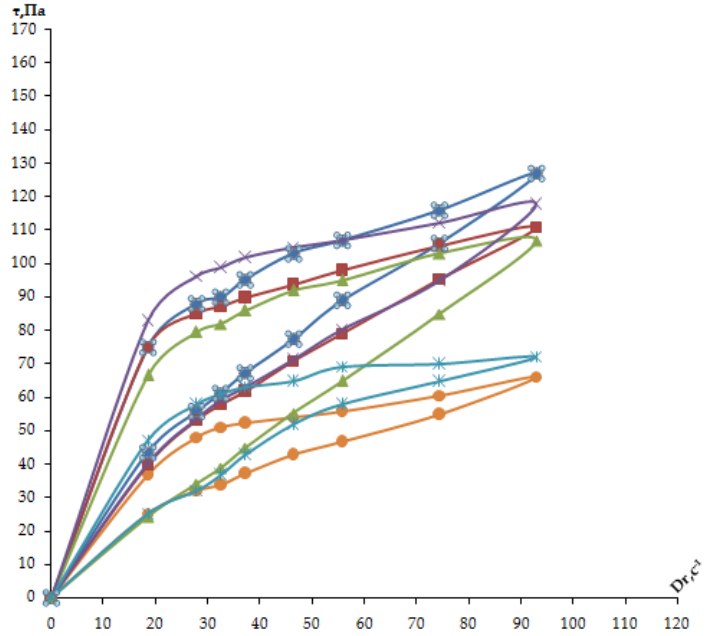

Fig. 1. Rheogram of the flow of the studied experimental samples № 1-6

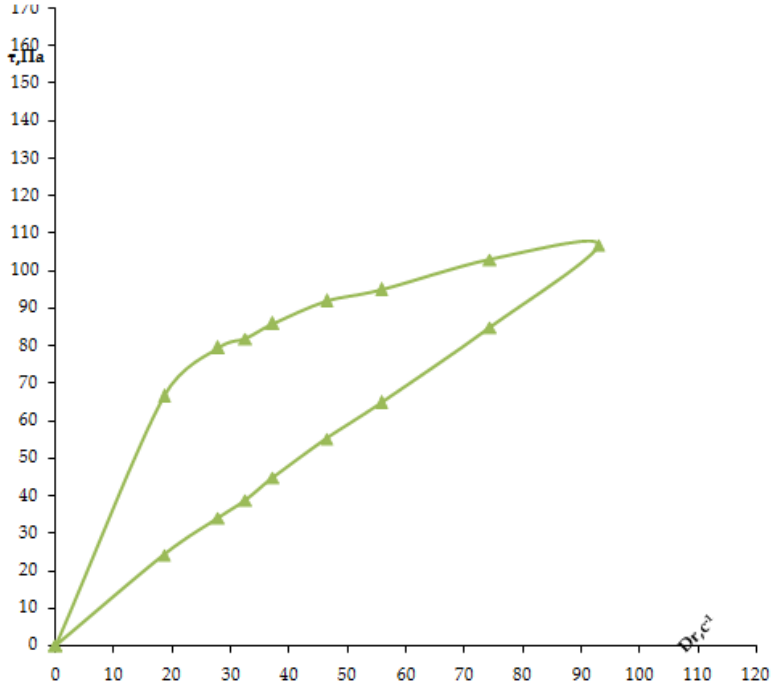

Fig. 2. Rheogram of the flow of the experimental sample No. 5

A study of the dependence of structural viscosity on the shear rate gradient showed that the viscosity decreases with increasing shear rate gradient. The results of determining the structural viscosity of the samples showed that the sample No. 5 with amaranth oil content of 20 % has the biggest value, which was confirmed by tests on the spreadability of the samples (Fig. 3).

According to sensory properties, creams with the lowest oil content (samples No. 1 and No. 2) were well absorbed by the skin, well distributed, did not leave stickiness and film, but did not provide sufficient smoothness.

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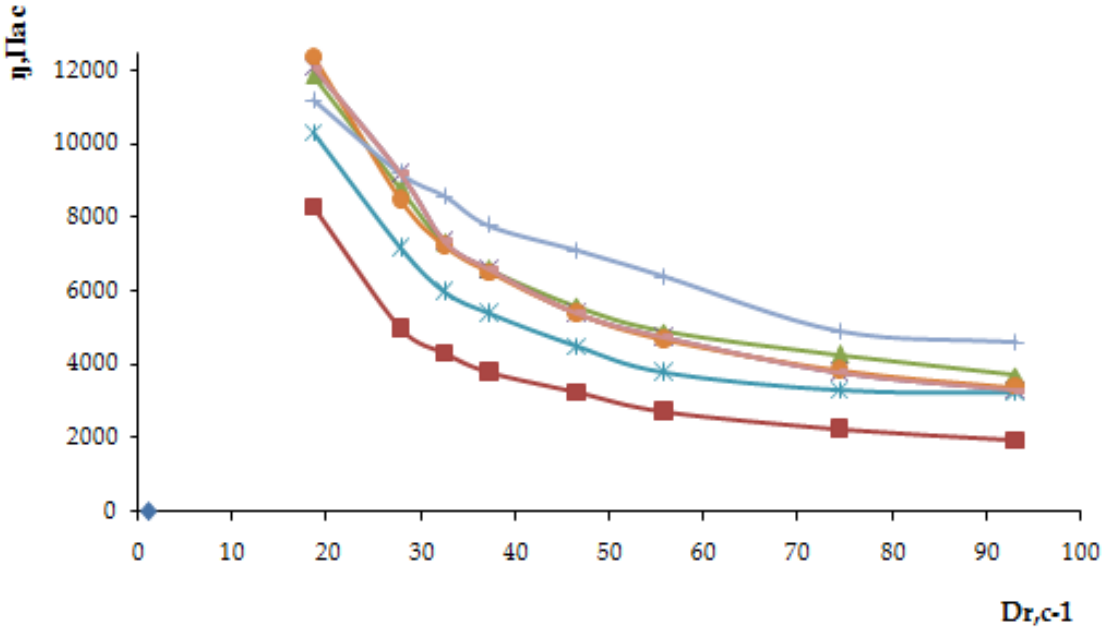

Fig. 3. Dependence of structural viscosity (η) on the shear rate gradient (Dr) at 20 °C

Creams with an oil content of 20 % (samples No. 5 and No. 6) left a sticky film. Samples No. 3 and No. 4 showed the best results, good absorption, distribution, no stickiness. The highest score, according to respondents, was obtained by sample No. 4. Petal diagrams of sensory properties of samples are presented in Fig. 4-9.

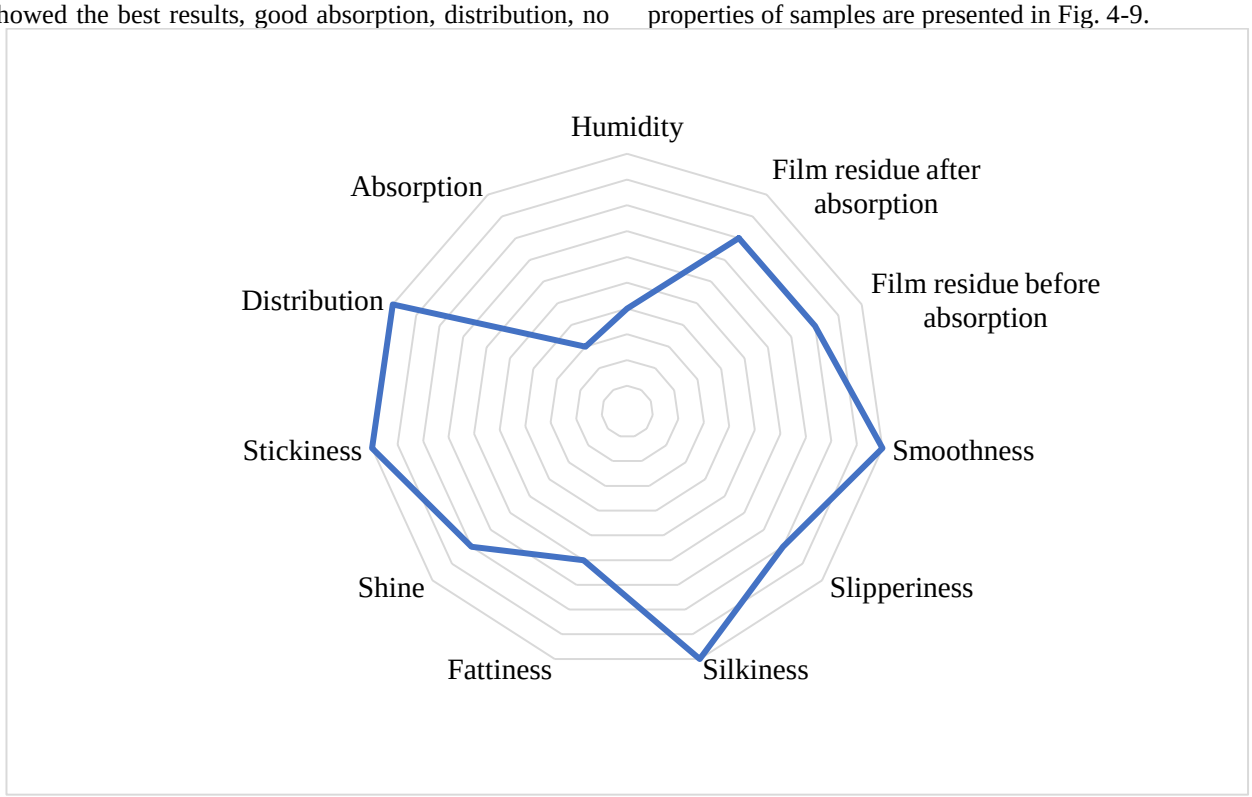

Fig. 4. Diagram of sensory properties of the sample No. 1

DOI: 10.5281/zenodo.6350163

Fig. 5. Diagram of sensory properties of the sample No. 2

Fig. 6. Diagram of sensory properties of the sample No. 3

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Fig. 7. Diagram of sensory properties of the sample No. 4

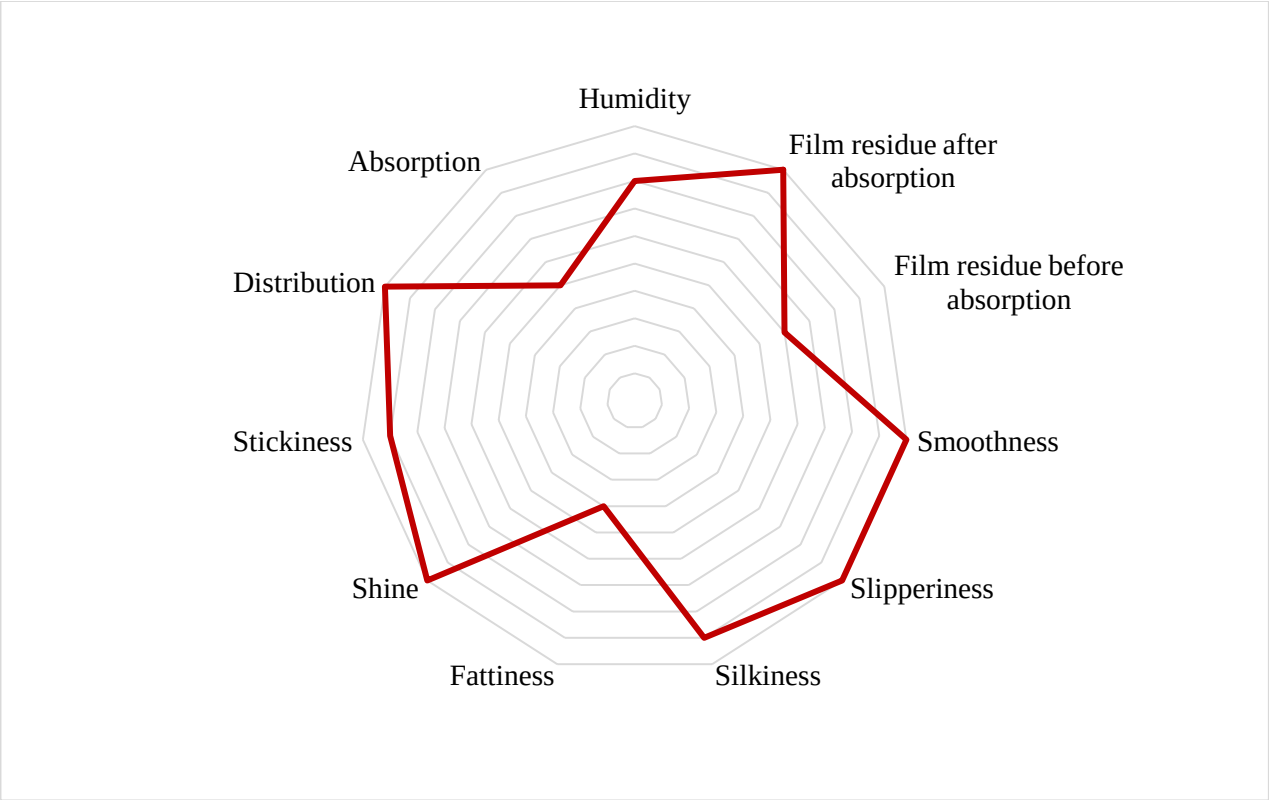

Fig. 8. Diagram of sensory properties of the sample No. 5

DOI: 10.5281/zenodo.6350163

Fig. 9. Diagram of sensory properties of the sample No. 6

The results of the conducted structural-mechanical and consumer properties of the processed experimental samples of emulsion cream showed that the composition No. 4 is optimal in terms of thixotropic, sensory characteristics.

Results

1. The structural and mechanical properties of experimental samples of emulsions, which showed sufficient thixotropic and satisfactory sensory properties, were studied.
2. As a result of the conducted researches the composition of emulsion cream with amaranth oil and lactic acid is substantiated.
3. According to the results of research of sensory and organoleptic indicators of model samples of cream, the sample with the best consumer properties was selected. The technology of making cosmetic cream was substantiated and developed.

Development of composition and research of emulsion cream based on amarante oil and lactic acid

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Introduction. One of the important stages of treatment of patients with diabetes, chronic dermatosis, xerosis is the use of external therapies designed to eliminate the symptoms of dry skin, which accompanies these diseases and is cyclical. Comprehensive care for dry skin involves, in addition to topical steroids, the use of drugs that have hydrating, emollient, keratolytic action. It is provided by fats and fat-like substances that soften and restore skin elasticity, eliminate moisture loss; moisturizers, as well as substances that provide keratolytic action. The modern pharmaceutical market of Ukraine is not sufficiently provided with topical agents for the treatment and care of dry skin, which makes relevant the development of the composition and technology of domestic foreign drugs. **Aim of research.** The aim of this work is to develop the composition of the emulsion cream based on amaranth oil and lactic acid, and to study of its sensory and pharmacological properties. **Materials and methods.** The object of the study are experimental samples of emulsions, the oil phase of which is from 10 to 20%, it included two types of oils - amaranth and corn, the aqueous phase contains xanthan gum, glycerin, lactic acid. Research methods used were organoleptic (appearance, color, odor, homogeneity) and pharmaco-technological (determination of thermal stability, colloid. The rheological parameters of the samples were determined, flow rheograms were constructed, according to which the thixotropic properties and extrusion of the samples were determined. Sensory parameters were studied in respondents with dry skin: absorption by the skin, feeling of hydration, speed of distribution, the presence of stickiness, shine, feeling of oiliness, the remainder of the film before and after absorption. **Results**

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and discussion. The use of amaranth seed oil is due to its moisturizing, protective, anti-inflammatory, antioxidant, membrane stabilizing and emollient effect due to the presence of a unique complex of biologically active substances: phytosterols, tocotrienols, squalene, phospholysic acid and phospholipids. Corn oil has nourishing, protective properties, is dermatologically neutral, does not irritate the skin, so it was used as an additional component of the oil phase of emulsions. Olivem 1000, which allows to obtain stable emulsions in the presence of components capable of diluting the consistency was used as an emulsifier. Lactic acid, which is a component of the skin's natural moisturizing factor, was used as a moisturizing ingredient. The study of structural and mechanical properties of experimental samples of emulsion creams allowed to choose the optimal concentration of ingredients and justify the final composition. The established pH values are acceptable for products containing lactic acid. The result of the study of the structural and mechanical properties of the experimental samples were rheograms of the dependence of the shear rate on the shear stress. The areas of hysteresis loops on the rheograms allowed to choose the composition with the best extrusion and structural-mechanical properties. According to sensory properties, samples were selected that showed the best results, good absorption, distribution, no stickiness. **Conclusion**. The structural and mechanical properties of experimental samples of emulsions, which showed sufficient thixotropic and satisfactory sensory properties, were studied. As a result of the research, the composition of the emulsion cream with amaranth oil and lactic acid was substantiated. According to the results of research of sensory and organoleptic parameters of the model samples of the cream, the sample with the best consumer properties was selected. The technology of making cosmetic cream was substantiated and developed.

Keywords: symptom complex of dry skin, emulsion cream, moisturizing effect, amaranth seed oil, lactic acid.

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DOI: 10.5281/zenodo.6350163