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RESEARCH ON THE INFLUENCE OF THE PHYSICAL AND CHEMICAL INDICATORS OF THE CREAM IN THE PRODUCTION OF COSMETIC CREAMS

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Abstract

The article presents the results of the analysis of the physicochemical parameters of local non-traditional oils that can be used in cosmetic cream recipes. The physicochemical parameters and fatty acid compositions of non-traditional oils grown in Uzbekistan: grape, apricot, peach, pumpkin, watermelon and almond oils are presented. All the studied oils meet the requirements for oils that can be used in cosmetic cream recipes in terms of their physicochemical parameters. While almond and apricot oils have high skin absorption, grape oil showed the best results when applied to the skin. It was observed in this study that the smoothness of the cream does not always depend on its viscosity. It was found that a cream with optimal results in all parameters can be prepared on the basis of watermelon oil.

Keywords: *grape seed oil, apricot seed oil, peach seed oil, pumpkin seed oil, watermelon seed oil, almond seed oil, cosmetic cream, viscosity, lubricity, skin absorption*

Introduction

Cosmetic creams are oil-in-water or water-in-oil emulsions, consisting of an oily and an aqueous phase. The functional properties of creams are improved by enriching the oily phase or the aqueous phase in their formulation. Which phase is improved depends on the solubility of the functional additive in polar or non-polar solvents. Enrichment of the oily phase is usually achieved by incorporating oils containing functional ingredients into the formulation (Khakimova Z. A., Usmanova F. Q., Ruzibaev A. T., 2020; Khakimova Z. A., Ruzibaev A. T., Gaipova Sh. S., Salijanova Sh. D., 2021).

In recent years, as a result of the increasing demand for naturalness and functionality in cosmetic products, local non-traditional oil raw materials have become one of the main components of cosmetic products. In particular, oil plants such as sesame, black cumin, flax, and olive grown in Uzbekistan are not only economically viable, but also allow for effective use in cosmetic products due to the biologically active substances they contain. Rocha-Filho et al. studied the effect

of sesame oil on skin hydration and restoration of the epidermal barrier and found that the use of this substance as the main oil component in creams increased the skin's ability to retain moisture (Rocha-Filho, P.A., Maruno, M. 2025). Other studies have shown that black cumin oil (Nigella sativa) has antibacterial and antioxidant effects (Forouzanfar F., Bazzaz B. S., Hosseinzadeh H., 2014). However, the main problem with the direct use of these oils in the preparation of beauty products is that they do not completely transform into stable emulsions and require balance in terms of odor and color (Liu, J. K., 2022). In a study by Lee et al., it was noted that an emulsion prepared based on linseed oil separated within 72 hours (Lee, Pei-En & Choo, Wee-Sim. 2014).

The process of selecting an emulsifier that ensures the effective combination of oily raw materials with the water phase in the composition of cosmetic creams is an important stage. Although traditional emulsifiers such as cetearyl alcohol, glyceryl stearate, PEG-100 stearate are widely used in creams in the industry, their effectiveness may be low when working with local non-traditional oily raw materials. For example, it has been noted that phase separation and thermostability problems were observed when PEG emulsifiers were used in emulsions prepared based on vegetable oils (Ibrahim, Mohamed & Shimizu, Taro & Ando, Hidenori & Ishima, Yu & Elgarhy, Omar & Sarhan, Hatem & Hussein, Amal & Ishida, Tatsuhiro. 2023; Vasiljević, Dragana & Djekic, Ljiljana & Primorac, Marija. 2012). To solve this problem, researchers are turning to natural emulsifiers. In particular, scientists have successfully prepared an emulsion based on linseed oil using lecithin, saponin, and mixed natural gel emulsifiers. They achieved a thermostable and optically uniform cream using soy lecithin. Also, the selection of emulsifiers, taking into account the acidity level of the skin (pH ~5.5), resulted in the biocompatibility of the cream (Díaz-Cruces, Eliana & Tom, Thara & Gómez-López, Vicente & Negrete-Bolagay, Daniela & Hermoso-Gil, Javier & Miró, Pablo & Troconis, Jorge & Toro-Mendoza, Jhoan & Narváez Muñoz, Christian & Zamora Ledezma, Ezequiel & Alexis, Frank & Zamora-Ledezma, Camilo. 2025). Recently, the use of waxes, particularly beeswax, as emulsifiers has become increasingly popular (Junita Hakim, Rusnia & Nugrahani, Ratri & Fithriyah, Nurul. 2020).

One of the important factors determining the quality, long-term storage and consumer perception of a cream product is its viscosity and rheological properties. When working with local oils, creams can quickly break down and have an unstable structure. In studies, creams prepared with sesame and linseed oils were not properly stabilized. They managed to maintain the viscosity of the cream at 5.1 Pa s by using a 1:1 mixture of guar gum and xanthan gum to maintain the cream structure. The use of ultrasonic homogenizer technology further stabilized the cream structure. As a result of scientific studies, the optimal viscosity of a cream based on linseed oil was determined in the range of 4.8–5.3 Pa s. This allows the cream to spread and form a thin layer on the skin (Sita Devi Sarma, Twahira Begum, Mohan Lal, 2024).

The use of antioxidants, vitamins, essential oils, and antibacterial substances is of great importance in increasing the preventive properties of cosmetic creams. However, the presence of such substances in the cream with local oils can have the opposite effect. For example, a 30% decrease in antioxidant activity was observed in a cream prepared on the basis of tea tree oil and vitamin E after 10 days. This is because the vitamins remain in the open phase and do not completely combine with the oil. To solve this problem, researchers have proposed encapsulation technology. Currently, technologies such as microemulsion and nanostructured lipids are used to enrich creams based on local raw materials with effective active ingredients. The absorption, distribution, and long-term effect of each component on the skin are important aspects of the cream recipe (. Ghelichi, Sakhi & Hajfathalian, Mona & Yeşiltaş, Betül & Sørensen, Ann-Dorit & García-Moreno, Pedro & Jacobsen, Charlotte. 2023).

Analysis of the physicochemical properties of fats and oils: Determination of saponification number, determination of peroxide number, determination of oil density, determination of refractive index, determination of iodine number, determination of acid number (Kadirov Y., 2005):

Materials and methods

1. Analysis of the physicochemical properties of the cream

Within the framework of this study, a comprehensive analysis of the physicochemical and organoleptic properties of cosmetic creams produced on the basis of local raw materials was carried out. The structural, technological and consumer-oriented quality indicators of the cream were evaluated in accordance with international standards (ASTM E1490–19).

1.1. Determination of the viscosity of the cream

The viscosity index was measured using a rotational viscometer (Brookfield DV-E) to assess the plastic and thixotropic properties of the cream. Measurements were carried out at a temperature of 25±0.5 °C, at different rotor rotation speeds. The data obtained served to assess the consistency and structural and mechanical properties of the cream (Umirova Z. Sh, Khakimova. Z. A, Akhmedov A. N, Ruzibaev. A. T., 2025).

1.2. Determination of the lubricity of the cream

The lubricity of the test samples was determined using the following technique: 0.5 g of the test sample was placed in a circle, a glass plate was placed. The 500 g sample was placed on a high glass plate for 5 minutes. Spreadability is the area covered by a specified amount of cream sample after uniform spreading of the sample on a glass slide. The increase in diameter due to spreading of the test sample was recorded. The average value of three determinations was recorded (Umirova.Z.Sh., Akhmedov.A.N.. Hakimova Z. A., Ruzibayev A. T., 2025).

1.3. Organoleptic assessment of cream quality

The organoleptic assessment covered the appearance, smell, spread on the skin, viscosity and effect of the cream. This assessment was carried out by a group of 10 sensory experts on a 10-point scale. Here, 1 point was defined as the worst, and 10 points as the highest quality. The results of the analysis were combined with subjective assessments and precise measurements (Umirova Z. Sh, Khakimova. Z. A, Akhmedov A. N, Ruzibaev. A. T., 2025).

In general, the research methods were based on international standards and scientific sources widely used in the evaluation of modern cosmetic products, which allowed for a comprehensive assessment of the quality and effectiveness of the cream.

Results

Cosmetic creams differ from each other in their functional components and additives. The multifunctionality of creams depends on the different composition of the components included in their recipe. However, any cream consists of an oily and aqueous phase. The functional additive included in the cream recipe is either water-soluble or fat-soluble. In this regard, the additive is added to the oily phase or to the aqueous phase. Today, local cream manufacturers import most of the recipe components from abroad. In particular, emulsifiers, fillers, plasticizers, antioxidants, preservatives and fatty base components are also imported. The research work aimed to reduce the amount of imported fat in the cream recipe using local fatty raw materials. For this, the physicochemical parameters of local fatty raw materials were initially analyzed (Table 1) (Umirova Z. Sh, Khakimova Z. A, Akhmedov A. N, Ruzibaev. A. T., 2025).

Table 1. *Physicochemical characteristics of oils obtained from unconventional oil raw materials available in Uzbekistan*

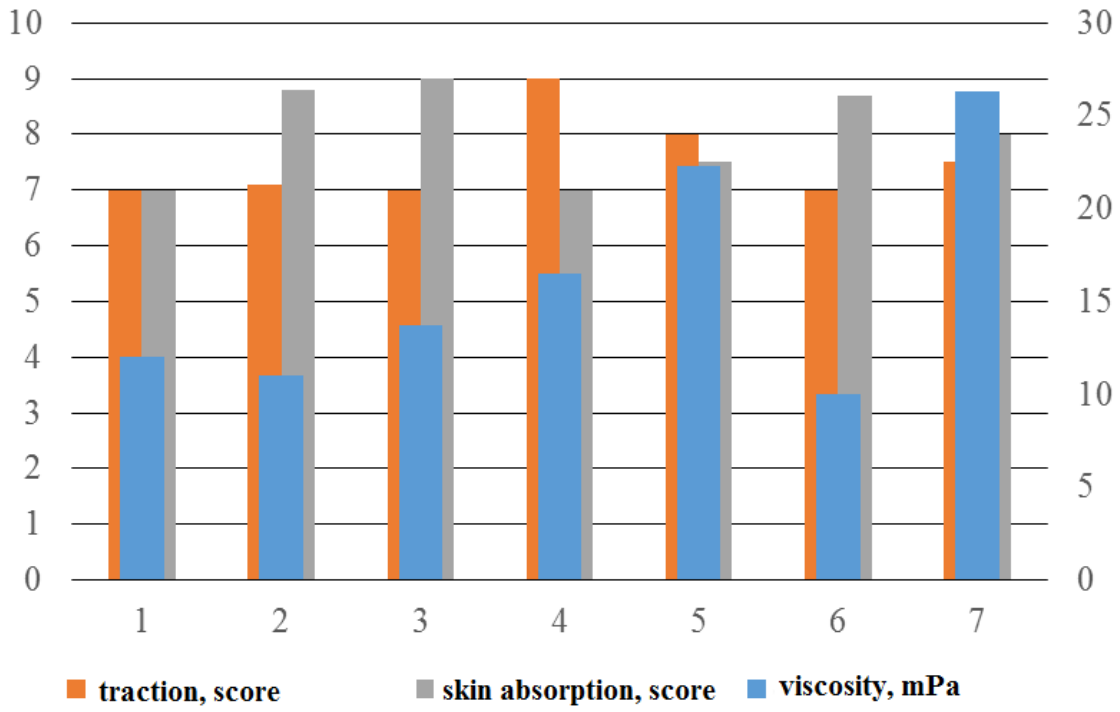
No.	Index name	Amount					
		Apricot oil	Almond oil	Grape oil	Watermelon oil	Peach oil	Pumpkin oil
1	Saponification number, mg KOH/g	190	190	191	196	190	188
2	Density, g/cm^3	918	916	922	912	912	915

No.	Index name	Amount					
		Apricot oil	Almond oil	Grape oil	Watermel-on oil	Peach oil	Pump-kin oil
3	Refractive index	1,470	1,472	1,475	1,466	1,470	1,466
4	Iodine number, mg J_2/g	103	99	139	114	100	104
5	Peroxide number, mmol O_2	8,0	6,2	5,7	3,4	3,2	4,1
6	Acid number, mg KOH/g	1,6	1,1	1,2	2,6	1,1	1,4

Table 2. *Recipes for moisturizing and nourishing creams*

No.	Name of ingredients	Quantity (%)
1	Stearic acid	12,0
2	Liquid paraffin	5,0
3	Glyceryl monostearate	3,0
4	Oil	20,0
5	Glycerin	3,0
6	Propylene glycol	3,0
7	Isopropyl myristate	2,0
8	Triethanolamine	0,2
9	Propyl paraben	0,1
10	Fragrance	0,03
11	Water	51,67%

Figure 1. *Viscosity, spreadability, and skin absorption of creams depending on the type of oil*



All of the oils studied above meet the requirements for an oil that can be used in a cosmetic cream recipe in terms of their physicochemical characteristics. The high mass fraction of unsaturated fatty acids ensures good absorption of creams based on these oils by human skin, while saturated fatty acids ensure the consistency of the cream and its smoothness on the skin (Umirova Z. Sh., Akhmedov A. N., 2025).

Separate creams were prepared from each of the 6 types of oils analyzed above (Table 3). Here, 1- sunflower oil (sample cream), 2- cream with apricot oil, 3- cream with almond oil, 4- cream with grape oil, 5- cream with watermelon oil, 6- cream with peach oil, 7- cream with pumpkin oil.

Although the amount of oil in the cream recipes is the same, the physicochemical properties of the oils directly significantly affect the properties of the cream. Therefore, the viscosity, spreadability and skin absorption of the creams were analyzed. The results obtained are presented in Figure 1.

Discussion and Conclusion

From the data in Table 1, it can be seen that the physicochemical parameters of apricot, almond, grape, apricot, peach and pumpkin oils are very close and similar to each other. The saponification number of the oils is from 188 mg KOH/g to 196 mg KOH/g, the density is from 915 g/cm3 to 922 g/cm^3, the refractive index is from 1.466 to 1.475, the iodine number is from 99 mg J_2/g to 139 mg J2/g, the peroxide number is from 3.2 mmol O2 to 8.0 mmol O_2, and the acid number is from 1.1 mg KOH/g to 2.6 mg KOH/g. Although all oils are close to each other in terms of aggregate state and organoleptic parameters, they differ in fatty acid composition. This can also be seen from the data in Table 2.

Table 2 shows that the fat phase of the cream is more than 40%, of which 20% is liquid oil and 12% is stearic acid. The mass fraction of the fat phase in this recipe is relatively high, which is suitable for a nourishing and caring cream.

Figure 1 shows that the creams had different viscosity, spreadability, and skin absorption. Their values were directly dependent on the type of oil used in the cream recipe. The highest cream viscosity was observed in cream 7, and the lowest in cream 6. The highest cream spreadability was observed in cream 4, and the lowest in cream 6. The best skin absorption of the cream was observed in cream 3 and the lowest in cream 4. The optimal indicators for all indicators were observed in cream 5. This cream recipe included watermelon oil, and among the oils studied, watermelon oil was found to be the most optimal choice for the cream.

Summary

The results of the study on the use of non-traditional oils available in Uzbekistan in cosmetic cream recipes show that high-quality cosmetic creams can be obtained from all oils. All creams had quality indicators not inferior to the sample cream prepared on the basis of sunflower oil. While almond and apricot oils had high skin absorption, grape seed oil showed the best results when applied to the skin. It was observed in this study that the spreadability of the cream does not always depend on its viscosity. It was found that a cream with optimal results in all indicators can be prepared on the basis of watermelon oil.

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