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Evaluation of selected quality features of creams with addition of jojoba oil designed for dry skin

Ocena wybranych wyróżników jakości kremów z dodatkiem oleju jojoba przeznaczonych do suchej skóry

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Wprowadzenie. Olej jojoba jest obecnie cenionym składnikiem kosmetyków wytwarzanych w formie emulsji. Ten ciekły wosk charakteryzuje się składem zbliżonym do ludzkiego sebum. Ze względu na bogatą zawartość składników aktywnych wykazuje działanie: nawilżające, natłuszczające, regenerujące, bakteriostatyczne i łagodzące stany zapalne skóry.

Cel. Celem pracy była ocena wpływu stężenia oleju jojoba na wybrane właściwości użytkowe i fizykochemiczne kremów tłustych przeznaczonych do cery suchej.

Materiał i metody. Materiał badawczy stanowiły emulsje zaprojektowane w oparciu o dane literaturowe i doświadczenia własne. Dyskutowano wpływ stężenia oleju jojoba na: stabilność (test termiczny i obciążeniowy), lepkość (wiskozymetr rotacyjny Brookfield DV-I+) i właściwości nawilżające (Corneometer CM 825 Courage Khazaka) oryginalnych kremów. Przeprowadzono także ocenę sensoryczną (metodyka własna) badanych emulsji. Punktem odniesienia w ocenie było porównanie rezultatów badań z otrzymanymi dla wysokiej jakości produktu handlowego.

Wyniki. Olej jojoba w proponowanych stężeniach (c=1,5-7,5 %wt.) nie powoduje utraty stabilności wytworzonych emulsji. W funkcji rosnącego stężenia dodatku wzrasta także lepkość otrzymanych kosmetyków i ich działanie nawilżające. Oryginalne kremy wykazują korzystne parametry sensoryczne, szczególnie w przypadku udziału oleju jojoba na poziomie 6,0 i 7,5% wag.

Wnioski. Istnieje ścisły związek między stężeniem oleju jojoba a finalnymi właściwościami fizykochemicznymi i użytkowymi tłustych kremów przeznaczonych do cery suchej. Wprowadzenie tego wosku do receptury kremu wpływa korzystnie na charakterystyki zaprojektowanych kosmetyków. Wyniki pracy mogą stanowić podstawę do praktycznych zastosowań przy komponowaniu składu kosmetyków w formie emulsji.

Słowa kluczowe: *olej jojoba, kremy do suchej skóry, jakość*

Introduction. Jojoba oil is now a valued component of the cosmetics produced in form of emulsion. That liquid wax has a composition similar to human sebum. Due to the rich content of active ingredients it displays moisturizing, re-fatting, regenerating, bacteriostatic action and the effect of soothing the skin inflammation.

Aim. The aim of the study was to evaluate the effect of concentration of jojoba oil on the selected physico-chemical properties of rich creams for dry skin.

Materials and methods. The research material consisted in emulsions designed on the basis of the literature and own experience. The impact of jojoba oil concentration on: stability (thermal and load test), viscosity test (rotational viscometer, DV-I+ Brookfield) and moisturizing properties (CM 825 Corneometer, Courage Khazaka) on the original creams was discussed. A sensory evaluation of tested emulsions was also conducted (methodology invented). The point of reference in the evaluation was to compare the results of the research with those obtained of high-quality commercial product.

Results. Jojoba oil in the proposed concentrations (c=1,5-7,5% wt.) does not result in a loss of stability of the emulsion produced. The function of the increasing concentration of the additive the viscosity of the cosmetics and their moisturizing effect also increases. Original creams exhibit favorable sensory parameters, especially in the case of participation of the jojoba oil at the level of 6.0 % and 7.5%.

Conclusions. There is a close relationship between the concentration of jojoba oil and the final physicochemical and functional properties of greasy creams for dry skin. The introduction of this wax to the cream recipe has a beneficial effect on the characteristics of the designed cosmetics. The results of the work may give rise to practical applications in formulating the composition of cosmetic products in the form of an emulsion.

Key words: *jojoba oil, creams for dry skin, quality*

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Introduction

The most common type of care cosmetics are creams. Their function is to maintain the hydrophilic-lipophilic balance of the skin, smooth it out, and deliver active ingredients. Creams are prepared in the form of emulsion. It is a homogenous system, which may consist of the ingredients mutually immiscible. Thus the formulation can be incorporated into both fat-soluble non-polar compounds and water-soluble components. In terms of applications, emulsions are classified as:

nutritional, semi-rich, rich, moisturizing. The ones that are particularly important in protecting against harmful weather conditions, i. e. the wind, low and high temperatures, are the greasy creams. Their efficacy and the care effect depends largely on the composition of the oil phase. All materials included in the oil phase of the emulsion act as so-called cream base. They form protective a film of occlusive action on the skin surface, which prevents the loss of water from the deeper layers. They are therefore a suitable type of cosmetic product in the case for dry skin. The ingredients commonly used in the oil phase are the following: petrolatum, silicone oils, beeswax, esters, for example: myristate, isopropyl palmitate, oil macerates with herbs. A strong trend to use in cosmetic creams fat materials of natural origin, mainly vegetable oils and waxes has been observed recently. This is due not only to their nutritional properties (presence of EFAs, vitamins, phytosterols), but also to the introduction of biodegradable plant components into the recipes [1-5].

Numerous reports in the literature indicate the cosmetic advantages of the use of jojoba oil. The current knowledge on the impact of this component on the physicochemical properties of the emulsion is, however, insufficient. Therefore, the overriding objective of this paper is to evaluate the effect of concentration of jojoba oil on selected physicochemical and utility properties in rich creams for dry skin.

Jojoba oil in cosmetics

Jojoba oil is a liquid wax, gold-yellow in color, without odor. It solidifies at a temperature below 8° C, may be heated up to 300° C. It is resistant to oxidation. It consists of squalene, vitamins (A, E, F), saturated and unsaturated alcohols, fatty acids and their esters, phytosterols [6-9].

The use of jojoba oil as a component in cosmetics affect: elasticity of the skin, shortness of the surface lines and wrinkles. It causes the skin to become more elastic and smooth. It can be used even for very sensitive skin because it does not clog pores. It is also hypoallergenic and well absorbed through the skin. Jojoba oil has a chemical composition similar to the composition of sebum produced by human skin. Dry skin produces too small amount of sebum, therefore jojoba oil perfectly complements its deficiencies. It is interesting that in the case of excessive secretion of sebum (greasy skin) jojoba oil inhibits its production. Using the wax as a component of creams, cosmetics manufacturers receive products leaving no greasy film on the skin [10-13].

Jojoba oil can be a natural sunscreen with SPF of about 4. In addition, using jojoba oil, one can even achieve olive colour tan. It also plays a major role in the treatment of acne, psoriasis, and even dandruff. In the case of acne it regulates sebum production and soothes inflammations. In contrast, in the presence of: dandruff, psoriasis and egzema it has a moisturizing and soothing effect. In addition, it has a bacteriostatic effect and added to the formulation it prolongs its life [14-16].

Analysis of the market of dry skin creams containing vegetable oils

An analysis of the market for 50 dry skin creams available on the Polish market in 2014 from March to June has been performed. The market analysis was carried out in large-area stores, drug stores, perfumeries and pharmacies in Radom. The research was carried out in terms of the following rates of the cream: price, the capacity of the package, and the presence of vegetable fat in the formulation. Figure 1 shows the analysis of pricing of the preparations calculated per 100 ml of product.

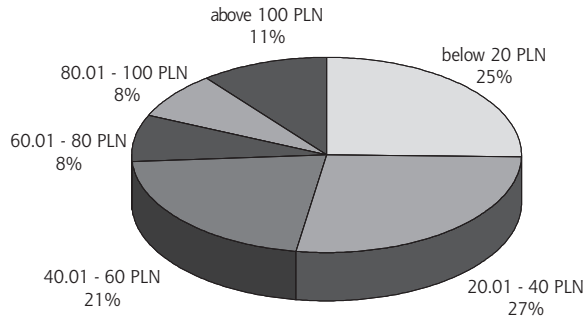

Fig. 1. The prices of dry skin creams calculated per 100 ml

The prices of the creams containing plant derivatives are quite high (Fig. 1). 27% of analyzed cosmetics is a price in the range 20.01-40.00 PLN per 100 ml of the product. The price of a quarter of emulsions is at a level of 20 PLN per 100 ml of the cream. Nearly 20% of the creams are the priced in range from 40.01 to 60.00 PLN. The cosmetics in the range of 80.01-100.00 PLN and 60.01-80.00 PLN per 100 ml constitute 8% share in the market. The analysis shows that a fairly large group of preparations is priced over 100.00 PLN. They represent 11% of the total. The capacity of the packaging of dry skin creams has also been analyzed and the results are shown in Fig. 2.

The analysis in terms of the volume of packages (Fig. 2) shows that the largest number of creams for dry skin (74%) on the market, is available in packs of 50 ml. 12% of the creams are sold in packs of 75 ml. The packaging of 40 ml constitutes 6% of the whole. A small group of emulsions is sold in pots with a capacity of 150 ml (4%). Among the formulations analyzed, 2% of the creams were packaged in 100 ml and 200 ml containers. The market analysis also included the creams for dry skin in relation to the content of vegetable fats (Tab. I).

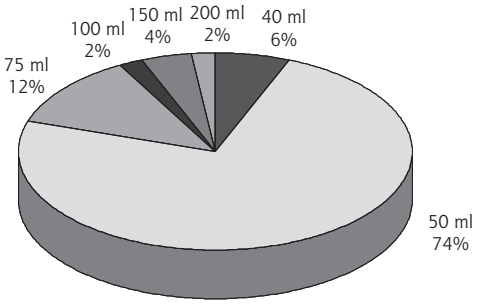

Fig. 2. The capacity of packaging of the analyzed creams for dry skin

Table I. The vegetable fats occurring in the dry skin creams

Vegetable fat name	Number of creams
Wheat germ oil	1
Avocado oil	1
Soybean oil	6
Olive oil	3
Jojoba oil	2
Primrose oil	1
Grape seed oil	2
Sunflower oil	5
Rapeseed oil	1
Sweet almond oil	1
Peach kernel oil	1
Bran oil	1
Groundnut oil	1
Babbasu palm oil	1
Argan oil	1

Table 1 shows the vegetable fats occurring in the analyzed creams. The most frequent were: soybean oil (6) and sunflower oil (5). In three creams the olive oil was used. In contrast, jojoba oil and grape seed oil were the components in two emulsions. Other oils were used each in a single formulation.

The market analysis of the dry skin creams showed that despite many cosmetic advantages of jojoba oil presented in the literature [6-16] this raw material is not a popular component of the emulsion formulations. In addition, it was also found that despite many descriptions of cosmetic benefits of jojoba oil [6-16], there are no data on the impact of this vegetable fat on physicochemical and functional properties of the cosmetic emulsions.

Aim

The aim of the work was to develop original formulas for dry skin creams containing jojoba oil (INCI: Simmondsia Chinensis Seed Oil) at various concentrations and the verification of the quality of the emulsion produced by the evaluation of: stability, viscosity of the creams and skin moisturizing capabilities. The experiment also included a sensory analysis of the cosmetics. The original properties of the lotions with added jojoba oil have been compared with respect to the properties of the base lotion (without the addition of the oil), and the commercial product.

Materials & Methodology

The composition of the rich cream was based on the literature data [5, 10] and own studies [14, 17-19]. The names of the raw materials used are given according to the INCI nomenclature. The obtained lotions differed in the concentration of jojoba oil in the formulation. Table II shows the composition of the original lotions.

Table II. Recipes of the original rich creams containing jojoba oil

Phase	Trade name	INCI name	Concentration [% wt.]
Oil	Crodamol PTIS	Pentaerythrityl Tetraisostearate	3.0
	Absorption Base	Paraffinum Liquidum and Lanolin Alcohol and Oleyl Alcohol	3.0
	Cetiol SB45	Butyrospermum Parkii	0.75
	Eumulgin B1	Ceteareth-12	1.5
	Lanette O	Cetearyl Alcohol	9.0
	Eumulgin B2	Ceteareth-20	2.25
	Cithrol GMS	Glyceryl Stearate	6.0
	Jojoba oil	Simmondsia Chinensis Seed Oil	X
Water	Sorbitol	Sorbitol	1.5
	Glycerine	Gliceryn	3.0
	Water	Aqua	do 100
	Preservative	Preservative	0.3
	Glamour 0338	Perfume	0.3

The commercial product contains the following ingredients (INCI): Petrolatum, Aqua (Water), Paraffinum Liquidum (Mineral Oil), Helianthus Annuus (Sunflower) Seed Oil, Olea Europaea (Olive) Fruit Oil, Cetyl Alcohol, Ceresin, Lanolin Alcohol, BHA, Ethylparaben, Methylparaben, Parfum (Fragrance), Linalool, Citronellol, Hexyl Cinnamal, Geraniol, Benzyl Salicylate, Benzyl Alcohol, Limonene, Hydroxycitronellal, Citral, Amyl Cinnamal, Cinnamyl Alcohol, Citric Acid.

Stability evaluation

The stability evaluation consisted in conducting two types of tests: the centrifugal and the thermal. The centrifugal test was performed using a centrifuge MPW-2 type, under the conditions of rotational speed equal to 2000 rpm. The thermal test was carried out by subjecting the preparations alternating to low (t=4°C,

the cooler Amica) and high (t=40°C incubator CL-65 by ELKON) temperatures for a period of 7 days. The observation of the preparations was carried out every 24 hours.

Viscosity

The viscosity measurements were performed on a Brookfield DV-I + viscometer. The indications of the value η was done with the speed of 50 rpm at 22°C. The values η were noted after 3 seconds after the start of the instrument.

Evaluation of the moisturizing capacities

The ability of skin hydrating by the original creams immediately after the application of the cream (0 min.), and at intervals of 15 minutes over a period of one hour after the application of the emulsion (Corneometer CM 825, Courage Khazaka).

Sensory evaluation

In carrying out the tests the following features were taken into account: the traction, the consistency, the uniformity, the pillow effect, the distribution, the absorption, the tackiness, the greasiness, oiling and polishing. Each parameter was scored in a numerical scale of 1 to 5, wherein: 5 – very good, 4 – good, 3 – satisfactory, 2 – poor, 1 – bad. The evaluation procedures of each parameter have been described in the literature [14].

Results

Stability evaluation

Stability is an essential factor which cosmetic creams should meet. On the basis of the conducted study it can be concluded that the addition of jojoba oil, regardless of the percentage, does not adversely affect the stability of the formulation. The formulations have not changed their appearance, and no delamination has been observed.

Viscosity

The viscosity (η) of the emulsion determines their properties, e.g.: absorption, spreadability on the surface of the body or the ease of dispensing from the package. It thus constitutes an important aspect of evaluation of the quality of the cosmetics. The measurement results are shown in Fig. 3.

Based on the results (Fig. 3), it was observed that with increasing concentration of jojoba oil the viscosity of the emulsion increases. The lowest viscosity was displayed by the base formulation (η=12300 mPa•s), while the highest value of η was that of the cream containing 7.5% jojoba oil (η=31750 mPa•s). For comparative purposes, the viscosity of the commercial

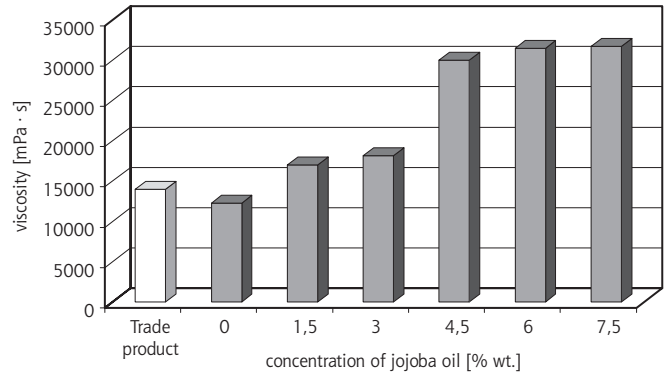

Fig. 3. Viscosity of the original creams containing jojoba oil

product was measured. The η value of the market product was 2-fold less than the maximum, obtained for the original emulsion.

Evaluation of the moisturizing capacities.

An important element for the proper functioning of the epidermis as the barrier is the appropriate content of water in the stratum corneum. With the proper moisture, the epidermis is flexible and resilient. The results are shown in Fig. 4.

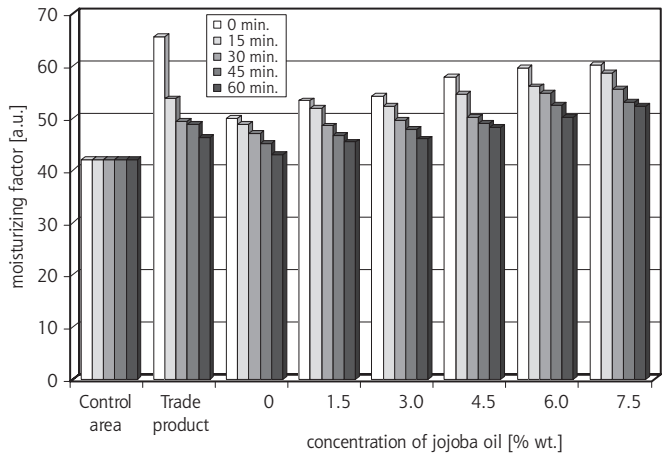

Fig. 4 Moisturizing factor of the skin after using the original creams containing jojoba oil

Based on the results of the skin moisturization after the application of creams containing jojoba oil (Fig. 4) an increase was found in the efficiency of the skin moisturization as a function of increasing concentration of the additive in the recipe. The lowest degree of moisturizing was reported for the control field that was not treated with any cosmetic (42 a.u.). Using the base emulsion caused an increase in the skin moisturizing by 8 units of measure. Even the introduction of the smallest oil concentration (c=1.5%) immediately after application of the cream resulted in an increase in the measured value of 13.3 a.u. relative to the control area.

The maximum proposed addition of the wax (c=7.5%) improved the skin hydration to the value of 60 a.u. The most preferred moisturizing immediately after application was recorded for the commercial cream (65.5 a.u.).

For all of the emulsion it was also observed that the passing time reduces the value of the skin's moisture. It should be noted, however, that after 60 minutes after application of cosmetics the most favorable moisture levels persisted after using the cream with the addition of 7.5% jojoba oil (52.3 a.u.), and this value was higher both in comparison with the control field (42 a.u.) as and the base formula (43 a.u.) and the commercial product (46.3 a.u.).

Sensory evaluation

Sensory testing was performed to evaluate the acceptability of the products by the consumer and to compare various characteristics of the formulations. Sensory evaluation is also helpful in improving the products and the quality control. The results of tests are shown in Fig. 5a-5g.

Analyzing the sensory profiles (Fig. 5a-5g) revealed that both the base recipe and the recipes containing vegetable wax, received high marks of their sensory parameters at levels equal to or close to the maximum (5 points). The creams formulated with jojoba oil at a concentration of c=1.5% and c=3% have been rated identically. As regards the indicated cosmetics, anointment, greasiness and the absorption of fat obtained 4 points. The maximal marks (5 points) for all evaluated parameters were awarded to the commercial emulsion: and the ones with 6% and 7.5% addition of jojoba oil.

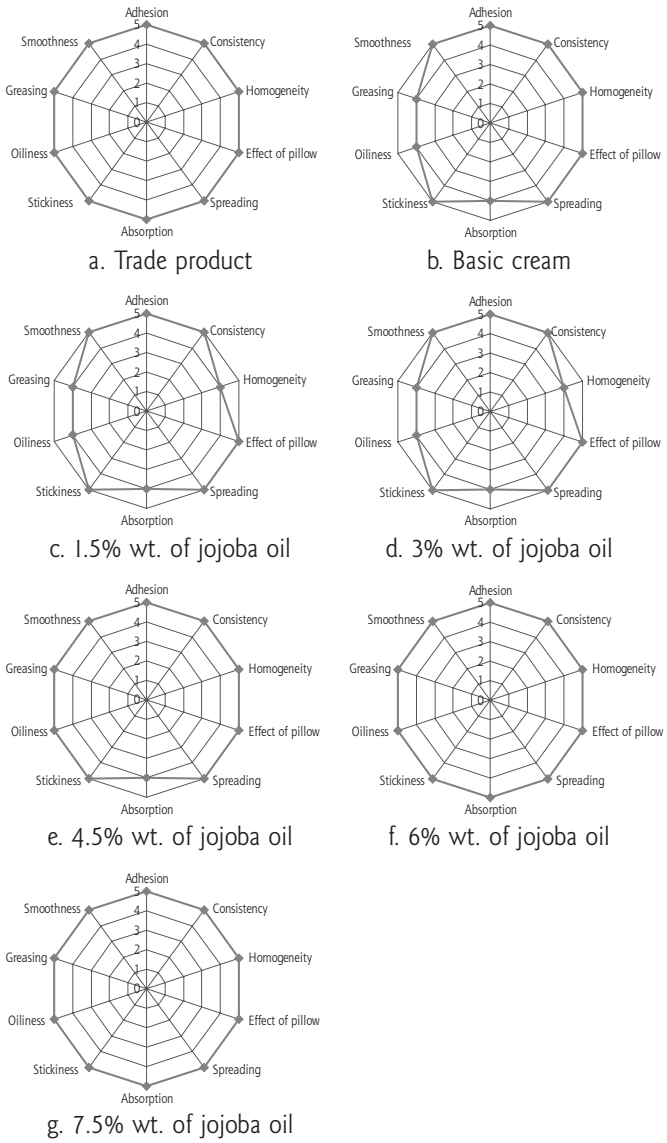

Fig. 5. The sensory evaluation of the original creams containing jojoba oil

Conclusions

Formation of quality of skin care cosmetics, including the ones received in the form of an emulsion, is carried out by quantitative and qualitative selection of ingredients in a formulation that meet specific functions. Currently, a trend has been observed to replace synthetic hydrophobic components of the emulsion (e.g. silicone oils and mineral oils) with ingredients of natural origin. Particularly noteworthy are the extracts, oils and vegetable butters and waxes. Thanks to many active substances they exhibit multifunctional operation and beneficial effect on the skin. However, the introduction of new materials into such thermodynamically unstable systems as emulsions, requires detailed cognitive and application studies.

The purpose of this study was to determine the effect of the concentration of jojoba oil on the selected discriminants of the quality of creams for dry skin. The obtained results were compared with the results for the formulation without the addition of jojoba oil and for the commercial product.

As discriminants of the quality of the greasy creams the following factors were suggested: the emulsion stability, the viscosity, the moisturizing abilities and the sensory evaluation of the creams. Based on the conducted laboratory tests it was found that:

- introduction of jojoba oil supplement to the cream does not change its stability.

Regardless of the concentration of the added oil the manufactured formulations remained the stability of their form. Similar results were also obtained for the commercial cosmetic;

- jojoba oil increases the viscosity of the emulsion, up to 2.5-fold relative to the cream without oil. The commercial cream was also characterized by a lower η value in comparison with creams produced;

- Simmondsia Chinensis Seed Oil is an effective moisturizing raw material. With the increase in the share of the proposed component increased the degree of hydration of the skin, and the best results were obtained after an hour of application for the cream with 7.5% jojoba oil content. This result was also better than the one obtained for the commercial emulsion;
- the original formulations were awarded high marks in sensory parameters, at 4-5 points, which is associated with high consumer acceptability.

Summing up the research performed a generalization can be formulated that the purpose of the work has been achieved. Original cream formulations may be a prerequisite for further research on modifying the recipes of cosmetic emulsions containing vegetable fats. It has been demonstrated that by the addition of jojoba oil to the creams for dry skin their properties may be favorably designed.

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