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STUDYING OF ENGINEERING OF THE EMULSION CONTAINING RAPE OIL

The influence of consumption of E and A vitamins, essential oil of a lemon and the heat treatment's duration on properties and on resistance to oxidation of rape oil emulsion was researched. The resistance to oxidation is estimated with numbers of peroxide and acid and quantity of malondialdehyde. It's shown that addition of 0.1g A and E vitamins or 0.15 g essential oil of a lemon for 50 g emulsion decreases the quantity of acid products and reduced the acid accumulation during heat treatment. The emulsions containing emulsifying bases of Lipoderm 4/1, the refined deodorized rape oil, tsetilpalmitat, water and antioxidants meets to STB 1673-2006 requirements.

Introduction. The important place among cosmetic products is taken by emulsion systems as a part of which oil phase there are various vegetable oils. Thanks to the nonsaturated fatty acids containing in them, vitamins and other active components they have the softening and regenerating effect on skin, reduce loss by skin of water [1]. However by production, storage and processing of oils oxidizing processes proceed. As a result of oxidation of vegetable oils hydroperoxides, peroxides, the carbonyl and carboxyl connections which are negatively influencing quality of the oils and products received with their use are formed [2].

For prevention and decrease in intensity of course of oxidizing processes in cosmetic emulsions use natural antioxidants (vitamins, essential oils, etc.) which owing to biological activity positively influence and a condition of skin of the person. Thus the essential oils having a pleasant smell can act and as component of a fragrance of the cosmetics.

The purpose of work was studying of properties and resistance to oxidation of the emulsion containing rape oil.

Main part. At the first stage of work on the techniques presented in [3] the main physical and chemical indicators of rape oil (refined deodorized brand P) various period of storage (a sample of 1–1.5 month, a sample of 2–7 months) which are given in the table were defined. From the presented data it is visible that the studied oil on color number and index of refraction corresponds to the data provided in literature [3]. However the second sample has values of acid and peroxide numbers which exceed the demanded values [4] therefore for further researches used the first sample of oil.

With use of a method of a gazoliquid chromatography according to [5] on the chromatograph the Crystal 5000.1 the content of fatty acids of the first sample of rape oil is defined 20 fatty acids that made 97.92% are identified.

The analysis showed that the main quantity among fatty acids of oil is necessary on unsaturated oleic (58.8%), linoleic (18.6%), linolenoic (9.7%) and sated palmic (4.2%), vaccenic (2.8%) and stearic (1.8%) acids that will be coordinated with the data provided in literature [6]. A large amount of unsaturated acids confirms considerable susceptibility of rape oil to oxidizing influences. Therefore use it as a part of emulsions demands obligatory introduction of antioxidants.

Indicators of rape oil

Name indicator	Value of an indicator		
	experimental for samples		the literary [3, 4]
	1	2	
Index of refraction (20°C)	1.4747	1.4759	1.4720–1.4760
Color number, J_2 mg	4.98	5.02	No more 12
Acid number, mg KOH/g	0.35	0.53	No more 0.4
Peroxide number, mmol ½ O/kg	2.5	12.5	No more 10

At the second stage a job as a dispergatsionny method on the way "the hot / hot" [7] were got and analyzed samples of an emulsion of structure: the self-emulsifying Lipoderm 4/1 basis (10%), rape oil (5%), water (to 100%). As antioxidants in an emulsion used mix of vitamins E and A (a ratio 3 : 1) or essential oil of a lemon. A consumption of mix of vitamins or essential oil of a lemon varied 0.05–0.35 in the range of 0.13–0.51 / 50 g of an emulsion. Antioxidants entered after cooling of samples to 30–35°C and carried out their additional dispergating (1 min.).

Resistance to oxidation of samples was defined according to the technique given in [8]. Samples of an emulsion subjected to hashing on a magnetic mixer at a temperature of 60–70°C (1000 min^{-1}, 10–70 min). Intensity of course of oxidizing processes was estimated on peroxide (PN) and acid (KN) to numbers and the maintenance of a malondialdehyde (MDA). Definition them was carried out according to the techniques stated in [3, 8]. The analysis of indicators was carried out in control temporary points – 0, 10, 30, 50, 70 min.

Emulsion samples before heat treatment analyzed also on the main organoleptic indicators (color, a smell, consistence) also defined their thermal (keeping in the thermostat at a temperature 42 ± 2°C) and aggregate (centrifugation of 5 min at 6000 min^{-1}) stability [8].

In Fig. 1 dependences of PN on a consumption of mix of vitamins E and A, essential oil of a lemon and duration of thermal influence are presented.

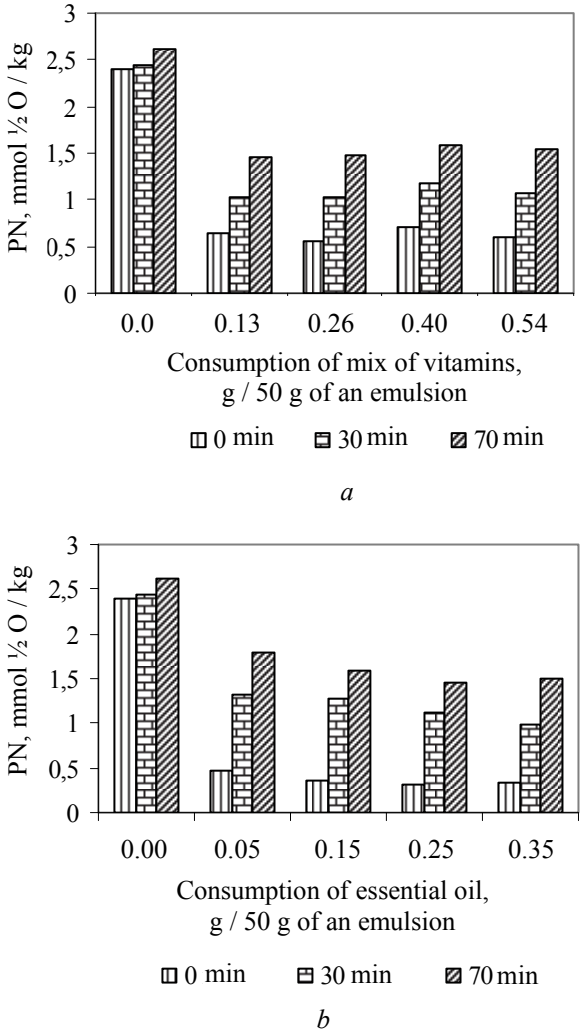


Fig. 1. Influence of duration heat treatments, consumption of mix of vitamins (*a*) and essential oil of a lemon (*b*) on peroxide number of samples of an emulsion

From the presented data it is visible that introduction to system of mix of vitamins E and A in quantity to 0.13 g / 50 g of an emulsion (Fig. 1, *a*) or essential oil of a lemon to 0.05 g / 50 g of an emulsion (Fig. 1, *b*) leads to reduction of PN in samples without heat treatment to 0.50 and 0.53 mmol ½ O / kg respectively.

The further increase in quantity of the antioxidants entered into system practically doesn't influence value of PN. Such regularity is characteristic for emulsion samples with various duration of heat treatment and without it.

However, apparently from the presented data, the more duration of thermal influence, the decrease in PN with introduction to an emulsion of antioxidants is less considerable. For example, in the systems containing vitamins E and A in number of 0.13 g / 50 g of an emulsion and duration of influence of 30 min PN makes 0.13 mmol ½ O / kg, and at influence of 70 min – 1.8 mmol ½ O / kg. In the samples of an emulsion containing essential oil in number of 0.05 g / 50 g lasting thermal influence 30 and 70 min this indicator makes respectively 1.05 and 1.45 mmol ½ O / kg.

Studying of influence of an expense of antioxidants and duration of heat treatment on KN showed that this indicator depends on duration of heat treatment a little and in systems without antioxidants the KOH / g changes from 2.70 to 2.95 mg.

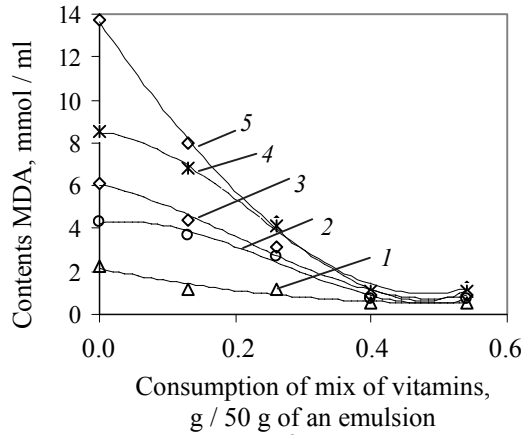
Introduction to system of mix of vitamins E and A in number of 0.13 g / 50 g or essential oil of a lemon in number of 0.05 g / 50 g of an emulsion leads to decrease in this indicator from 2.70–2.95 to 1.85–2.10 and 1.41–1.76 mg the KOH / g respectively. The increase in an expense of antioxidants over the specified quantities practically doesn't influence an indicator.

In fig. 2 influence of an expense of antioxidants and duration of heat treatment on the contents MDA in emulsion samples is shown.

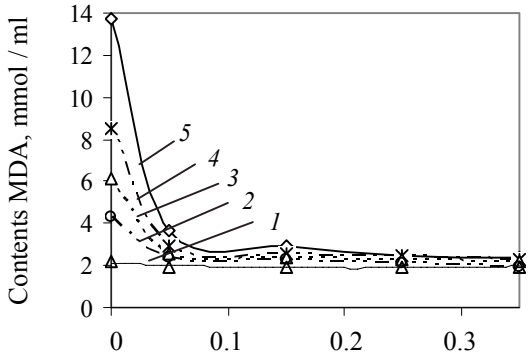
Apparently from the presented data (fig. 2, *a*), at introduction to samples of vitamins B number of 0.4 g / 50 g of an emulsion the contents MDA decreases depending on heat treatment duration at 5–14 times. At further increase in a consumption of vitamins the indicator practically doesn't change.

Influence of essential oil of a lemon on the contents MDA (Fig. 2, *b*) is similar to effect of vitamins. However for achievement of the minimum contents MDA 0.05 mmol / ml the consumption of vitamins has to make 0.4 g / 50 g of an emulsion, and when using essential oil minimum content MDA (1.9 mmol / ml) it is observed at its expense of 0.05 g / 50 g of an emulsion.

The analysis of stability of samples of an emulsion showed that all of them are thermally steady (42 ± 2°C, 24 h) and steady against centrifugation (6000 min^{-1}, 5 min). On color and a consistence emulsion samples with antioxidants were comparable to samples without antioxidants. Introduction of essential oil of a lemon quantity 0.15 g and more on 50 g of an emulsion gave to samples pleasant citrus aroma, i.e. essential oil executed function of a fragrance.



a



b

Fig. 2. The contents MDA depending on a consumption of mix of vitamins (*a*) and essential oil (*b*). Duration of heat treatment, min: *1* – 0; *2* – 10; *3* – 30; *4* – 50; *5* – 70

Conclusion. The conducted researches showed that introduction of vitamins E and A in number of 0.4 g or essential oil in number of 0.05 g on 50 g of an emulsion leads to reduction of the contents in system of products of oxidation and slows down their accumulation in heat treatment process. The emulsions containing Lipoderm 4/1 basis, rape oil, water and antioxidant in the specified quantities on organoleptic and physico-chemikal indicators conform to requirements of STB 1673-2006 “Creams cosmetic. General specifications”.

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