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HYDROGELS CONTEINING THE RED CLAY OF GOMI MOUNTAIN OBTAINED IN THE TERRITORY OF GEORGIA

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ABSTRACT

Clay gained great popularity after the discovery of its ability to restore tissues, absorb salts, toxins, gases, unpleasant odors, etc. To reveal antitoxic, antiseptic, bactericidal, conservation properties. The chemical and mineral composition and unique properties of clay make it an attractive raw material in a number of fields, including cosmetology. **Objectives:** Unexplored clays of different regions obtained in the territory of Georgia - blue clay - Lentekhi district, Chukuli village, Fishkhori river bank and red clay - Ozurgeti district, Gomi mountain should be conducted. **Methods:** Properties and composition of samples are determined by physical and chemical methods of research: gravimetric, photometric, volumetric and atomic-absorption methods. **Results:** A comparative study of the granulometric composition of particles, elemental composition, sorption properties, competition coefficient and colloidity was established. From the examined clays, the red clay of Gomi Mountain was chosen and based on it, the base hydrogel recipe was created. Some of their physicochemical properties have been studied: colloidability, thermostability, organoleptic parameters, pH has been determined and rheological research has been carried out. The percentage of red clay fraction

(particle size < 0.16 mm) of Gomi mountain is almost 2.5 times higher than the same fraction of blue clay of Lentekhi region.The red clay of Gomi mountain is a good adsorbent with its physico-chemical properties, it is characterized by a high absorption coefficient and the ability to create hydrogels. It can be used in cosmetics both in its native, powdery form and in the form of hydrogel of various concentrations. Lentekhi blue clay contains up to 50% silt, so its use in cosmetics is complicated. **Conclusion and Recommendation:** Based on the obtained base hydrogel, a lotion recipe for the care of oily and problematic skin has been developed.

KEYWORDS: Cosmetic products, blue clay, red clay, colloidability, thermostability, organoleptic parameters, hydrogel, lotion.

1. INTRODUCTION - The cosmetics market is one of the most stable and rapidly growing in the world, because the beauty of the skin, face, hair and body, the desire to look effective is always relevant. Its development is mainly due to the use of innovative technologies, unique methods and forms of skin health restoration. At the same time, the alignment of forces and trends and consumer demand are changing.

Clay gained great popularity after the discovery of its ability to restore tissues, absorb salts, toxins, gases, unpleasant odors, etc. To reveal antitoxic, antiseptic, bactericidal, conservation properties. Clay is characterized by weak alkaline properties (pH 7.8 - 8.0) and normalizes the acid-alkaline balance in the body, which is important when there is an excess of free radicals with acidic properties. Along with this, there is a selective ion exchange: the body receives the necessary elements and gives out those that are in excess.

The chemical and mineral composition and unique properties of clay make it an attractive raw material in a number of fields, including cosmetology. Its use in pharmaceutical and cosmetic products is made even more attractive by the cheap price of raw materials, eco-friendliness (the processed clay remaining as a result of the technological process is easily disposed of and does not harm the environment). Therefore, the study of previously unknown clays is constantly relevant.

The results of the research proved that one of the distinguishing features of bentonite clay is its harmlessness to the human body. Oral administration of bentonite clay does not cause physiological changes. One of the important directions of work on the study of compositions

with bentonite clay is carried out in the field of creating such forms as lotions along with gels and ointments.

2. MATERIALS AND METHODS

Modern production of natural cosmetic products is based on extensive use of natural raw materials to create cosmetics. Clay is one such promising mineral raw material, which, like sea water and mineral mud, is a source of various trace elements necessary for the skin. The effectiveness of clays containing a complex of microelements on the skin is higher than that of individual minerals.

Georgia is rich in natural resources and new natural raw materials are constantly being researched. Two unstudied clays obtained in Georgia were selected - the native form of the blue clay of Fishkor river in the village of Chukuli, Lentekhi district (Svaneti) and the native form of the red clay of the Gomi mountain in Ozurgeti district (Guria).

Clay samples were dried, cleaned, ground, suspended and decanted under the same conditions, according to the same technological scheme.

Granulometric study of blue clay (sample 1) and red clay (sample 2) samples

Clay samples were dried at 900C, large, foreign, solid particles were removed and ground mechanically. The clay was suspended in water in a ratio of 1:5, left for 2 days and nights. We obtained purified fractions of native clay samples by decantation.

1. Organoleptic examination of purified fractions 1 and 2 of native samples of both clays was conducted;
2. Granulometric composition of particles of cleaned samples according to international standard GOST 28177-89 Molding bentonite clays. In accordance with the General specifications, it was determined by the sieve analysis method. According to norms, sieves with 5 mm, 2.5 mm and 0.16 mm holes were used during the analysis.

Medical and cosmetic clay is a very finely dispersed powder, the fraction of both samples with a particle size < 0.16 mm was chosen for the study.

The percentage of red clay fraction (particle size < 0.16 mm) of Gomi mountain is almost 2.5 times higher than the percentage of the same fraction of blue clay of Lentekhi region.

Elemental analysis of blue clay (sample 1) and red clay (sample 2) samples Elemental analysis of clay samples 1 and 2 was carried out - by gravimetric, photometric, volumetric and atomic absorption methods.

The results of a comparative study of clay samples showed that they are almost identical in their qualitative elemental composition, with some differences in the quantitative content of some elements.

The study of the mineral composition of the clay samples showed that in the research sample 1 50% is quartz, that is, 50% of the research sample is sand particles, which limits its further use in cosmetology; And the clay of sample 2 represents the calcium form of bentonite. The amount of quartz is insignificant, therefore this clay can be used in the composition of cosmetics.

Study of adsorption capacity of blue clay (sample 1) and red clay (sample 2) samples

Adsorption capacity of sample 1 and 2 clays for dyeing was determined using methylene blue according to international standard GOST 28177-89 Molding bentonite clays. in accordance with General specifications.

Adsorption activity is calculated by the formula

$$X = \frac{(C_1 - C_2 K) \cdot 0.025}{m},$$

where, C_1 - the concentration of the initial dye solution, mg/ml;

C_2 - concentration of dye solution after contact with clay, mg/l;

K - dilution coefficient;

m - weight of clay, g;

25 - volume of coloring solution, ml.

The adsorption capacity of bentonite clay is higher than that of blue clay, which means that bentonite clay has stronger adsorption properties.

Study of Competition index and colloid index of blue clay (sample 1) and red clay (sample 2) samples

Within the scope of the research, the clay samples' compaction index and colloidity were determined.

The water resistance index of the clay test samples was determined according to the ASTMD5890-95 method.

The colloidal index of clay research samples was determined according to the international standard GOST 3594.10-93 Molding refractory clays. Method for determination of colloidal state according to the guidelines.

Colloidity (in K%) is calculated by the formula:

$K=Vx \cdot 100/30$

where, K -colloidy, %;

V - volume of generated clay sediment, ml;

30 - total volume of clay and water, ml.

Standardization of clay samples was practically carried out.

The following equipment was used during the analysis:

- Atomic absorption spectrophotometer Analyst – 200
- Ugaf=0.054mg/dm³;
- Photocolorimeter кфк-2;
- general purpose X-ray diffractometer ДРОН-2 with copper anode;
- Electronic scale # 5034/120 max 120g d=0.1mg.

The percentage of red clay fraction (particle size < 0.16 mm) of Gomi mountain is almost 2.5 times higher than the same fraction of blue clay of Lentekhi region.

The red clay of Gomi mountain is a good adsorbent with its physico-chemical properties, it is characterized by a high absorption coefficient and the ability to create hydrogels. It can be used in cosmetics both in its native, powdery form and in the form of hydrogel of various concentrations.

Lentekhi blue clay contains up to 50% silt, so its use in cosmetics is complicated.

Hydrogel recipes based on the red clay of Gomi mountain

A gel containing no clay was prepared as a standard sample. The qualitative and quantitative composition of hydrogels of different concentrations based on the red clay of Gomi Mountain has been developed. (Table 1-3).

Table 1: Qualitative and quantitative composition of clay hydrogel of different concentrations.

№	Name of the component	Concentration of components			
		Standard sample (clay 0%)	clay 1%	clay 3%	clay 5%
1	30% water-alcohol solution (ml)	94,2 94,0 93,9	93,2 93,0 92,9	91,2 91,0 90,9	89,2 89,0 88,9
2	Glycerin (ml)	5,0	5,0	5,0	5,0
3	Carbomer 940 (g)	0,8 1,0 1,1	0,8 1,0 1,1	0,8 1,0 1,1	0,8 1,0 1,1
4	10% NaOH (dr)	1 1 2	1 1 2	1 1 2	1 1 2
5	Clay (g)	0	1,0	3,0	5,0

Table 2: Qualitative and quantitative composition of clay hydrogel of different concentrations.

№	Name of the component	Concentration of components			
		standard sample (clay 0%)	clay 1%	clay 3%	clay 5%
1	30% water-alcohol solution (ml)	91,2 91,0 90,9	90,2 90,0 89,9	88,2 88,0 87,9	86,2 86,0 85,9
2	Glycerin (ml)	8,0	8,0	8,0	8,0
3	Carbomer 940 (g)	0,8 1,0 1,1	0,8 1,0 1,1	0,8 1,0 1,1	0,8 1,0 1,1
4	10% NaOH (dr)	1 1 1	1 1 1	1 1 1	1 1 1
5	Clay (g)	0	1,0	3,0	5,0

Table 3: Qualitative and quantitative composition of clay hydrogel of different concentrations.

№	Name of the component	Concentration of components			
		standard sample (clay 0%)	clay 1%	clay 3%	clay 5%
1	30% water-alcohol solution (ml)	89,2 89,0 88,9	88,2 88,0 87,9	86,2 86,0 85,9	84,2 84,0 83,9
2	Glycerin (ml)	10,0	10,0	10,0	10,0
3	Carbomer 940 (g)	0,8 1,0 1,1	0,8 1,0 1,1	0,8 1,0 1,1	0,8 1,0 1,1

4	**10% NaOH (dr)**	1 1 1	1 1 1	1 1 1	1 1 1
5	**Clay (g)**	0	1,0	3,0	5,0

Samples of the resulting gels were left standing for a week, resulting in the separation of several samples. 4 samples were selected for the next studies, the composition of which is given in Table 4.

Table 4: Composition of research samples of hydrogels.

№	Name of the component	Concentration of components			
		sample 1	**Sample 2**	**sample 3**	**sample4**
1	**30% water-alcohol solution (ml)**	88,2	86,0	86,2	85,9
2	**Glycerin (ml)**	10,0	10,0	8,0	8,0
3	**Carbomer 940 (g)**	0,8	1,0	0,8	1,1
4	**10% NaOH (dr.)**	1	1	1	1
5	**Clay (g)**	1	3	5	5

Organoleptic study of research samples of hydrogels

Organoleptic research was conducted according to the international standard - GOST31695—2012 Cosmetic gels. According to Generals requirements.

Visual inspection of parameters such as appearance, texture, color and odor of the gel was performed. In addition, a sensory test was performed on tactile sensations after applying the gel to the skin. The results of the organoleptic examination are given in Table 5.

Table 5: Organoleptic indicators of hydrogel research samples.

№	Hydrogel sample name	Color	smell	external appearance	sensory indicator
1	**standard sample clay 0%**	colorless + + +	without smell + + +	Homogeneous, transparent + + +	Softness and cooling down + + +
2	**Sample 1 1% gel**	light brown	without smell	Homogeneous	Softness and cooling down
3	**Sample 2 3% gel**	coffee color	without smell	Homogeneous	Softness and cooling down
4	**Sample 3 5% gel**	dark-brown	without smell	Homogeneous	Softness and cooling down
5	**Sample 4 5% gel**	dark-brown	without smell	Homogeneous	Softness and cooling down

As can be seen from the table, all samples are proud of the requirements of the standard.

Stability study of hydrogels research samples

To determine the colloidal stability, we used a laboratory centrifuge.The "Faithful" laboratory thermostat model was used to determine thermostability.

The indicators of colloidity and thermostability of the research samples are given in Table 6.

Table 6: Colloidal and thermostability indicators of the research samples.

№	Research samples	Colloidal stability	Thermostability
1	**standard sample clay 0%**	+ + + +	+ + + +
2	**Sample 1 1% gel**	+	+
3	**Sample 2 3% gel**	It separated slightly in the middle segment of the sample	+
4	**Sample 3 5% gel**	+	+
5	**Sample 4 5% gel**	+	+

The tests showed that all the samples are thermostable, and samples 1, 3 and 4 are colloidally stable, and sample 2 slightly separated in the middle segment of the sample and meets the requirements of the relevant standard.

Determination of pH of research samples of hydrogels

Determining the pH of cosmetic products is very important, because a change in this indicator can indicate the oxidation of one or more ingredients, which in turn can lead to a change in the external appearance of the product, as well as a deterioration of its consumer properties.

The pH of each sample was measured in triplicate. The arithmetic mean pH values of each sample are presented in **Table 7**.

Table 7: pH indicators of hydrogel research samples.

№	Research samples	Arithmetic mean value of pH
1	Standardsample clay, 0%	5,79 ± 0,091 5,81 ± 0,089 5,82 ± 0091
2	Sample 1, 1% gel	5,94 ± 0,096
3	Sample 2, 3% gel	5,98 ± 0,076
4	Sample 3, 5% gel	5,96 ± 0, 062
5	Sample 4, 5% gel	5,97 ± 0, 081

The pH value of all hydrogel test samples is within the acceptable range and meets the requirement of the relevant standard.

3. RESULTS AND DISCUSSION

1. The percentage of the fraction (particle size < 0.16 mm) of the red clay of Gomi mountain is almost 2.5 times higher than the same fraction of the blue clay of Lentekhi region.
2. According to the comparative study of the elemental and mineral composition of clay samples, the red clay sample of Gomi mountain of Ozurgeti region is superior to the blue clay sample of Lashkheti river from Chukuli village of Lentekhi district by all the indicators of interest to us, and therefore it can be used in the composition of cosmetics, both in native, powdery form and in the form of hydrogel of various concentrations. Both in native, powdery form and in the form of hydrogel of various concentrations.
3. According to the study of adsorption capacity of clay samples, it was found that the capacity of bentonite clay is higher than the capacity of blue clay, which means that bentonite clay is characterized by stronger adsorption properties.
4. On the basis of research, the red bentonite clay of Ca form obtained in the Gomi mountain area of Ozurgeti district was used to create the hydrogel base of cosmetic products.
5. A visual inspection of the indicators of the base-hydrogel obtained from the clay was carried out - the appearance, texture, color and smell of the gel. In addition, a sensory test was performed on tactile sensations after applying the gel to the skin. The results of the organoleptic inspection showed that all samples are proud of the requirements of the standard.
6. The colloidity and thermostability of the base-hydrogel research samples obtained from clay were studied, the obtained results showed that all the samples meet the requirements of the standard.

7. According to the studies, the pH value of all hydrogel test samples is within the acceptable range and meets the requirement of the relevant standard.

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