

The formulation of moisturizing and hydrating cream based on natural ingredients such as chitosan

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ABSTRACT

The purpose of this work is to make moisturizing and hydrating cream for the skin. The ingredients of moisturizing and hydrating cream are based on natural polysaccharides, such as chitosan and extracted from aquatic organisms such as shrimp. Physical and chemical analysis, identification test of the oils in the cream based on gas chromatography instrument have been done in the reference laboratory of Food and Drug Organization of Iran country. Also, non-sensitizing test of the formulated cream have been done by the rabbit at department of pharmaceuticals, school of pharmacy, Shahid Beheshti University of Medical Sciences in Iran country.

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Introduction

A wide range of polymers, especially chitosan, is used as a carrier for skin drug delivery. Chitosan is a polysaccharide that consists of acetylglucosamine units and is created from N-glucosamine and alkaline deacetylation of chitin. Chitin is found in large quantities in crustaceans such as crabs and shrimps, insects, fungi and some algae. Chitosan units have a first-type amine group and two free hydroxyl groups that can establish hydrogen and ionic bonds, and for this reason, they have good bioadhesive and mucosal properties (1). The presence of these active groups has made the chitosan molecule undergo chemical changes easily. This phenomenon has created various biological properties for chitosan such as biocompatibility, biodegradability, antibacterial and antifungal, hemostatic, immunoadjuvant, lipid and cholesterol reducing (2-4). For this reason, it is used in many fields such as pharmaceuticals, medicine, chemical engineering, nutrition and agriculture (2). Polymers used for skin formulations should not cause damage and inflammation in the skin. Chitosan is a polymer that does not show any toxic effects and does not cause damage or inflammation (2). On the other hand, it is used as a carrier for skin drug delivery due to its bio adhesion properties, increasing

permeability and having suitable physicochemical properties (5). One of the major applications of chitosan is its use in cosmetics and health industries. Chitosan has a cationic characteristic and the same its characteristic can be caused to be used as a skin and hair protector. Chitosan is compatible with many compounds used in cosmetics and absorbs many ultraviolet rays. A transparent chitosan solution is placed on the skin and hair as a flexible coating, increasing softness and softness it becomes. Both chitin and chitosan are used in shampoos, hair dyes, emulsions, sprays, and hair conditioners (6). Both chitin and chitosan have an accelerating effect on wound healing. Recently, a report about a composite of chitin and silver nanoparticles for wound healing has been published, which shows that chitosan has high antibacterial properties as well as great compatibility with skin (7,8). Chitosan is also considered as a promising candidate for burn treatment. Chitosan can be a durable, water-absorbing and biocompatible coating can be used directly to treat burns. One of the advantages of this type of cover, its high permeability to oxygen accelerates burn healing (9). In this work, the shrimp wastes were brought to the laboratory and the skin and internal organs of the shrimp were separated. The shrimp skin was washed with distilled water and the shrimp skin

was dried. Chitosan was extracted by hydrochloric acid and soda. The obtained chitosan material was dried at ambient temperature.

Materials and Methods

Chitosan, Pomegranate seed oil, Jojoba oil, Avocado oil, Wheat germ oil, Sunflower oil, Glycerin oil, Orand[®] base cream, vitamin c, distilled water, Himalayan salt, Tween 80 as an emulsifier, Sodium benzoate, Potassium sorbate, powdered essential oil of coconut or white grapes (gum bear) were purchased from Sadra Pajohesh company.

Experimental

The Chitin extraction from shrimp shell:

Fresh shrimp shells were used. In the next step, the shells were completely washed with water and soaked in 0.5% caustic soda solution for 4 hours to remove the remains of shrimp meat from the shells. The shells were washed again with water and dried in an oven at 60°C for 2 hours. Then they were turned into powder with a grinder.

The Separation of protein material from the shell:

This procedure was performed using a caustic soda solution at a temperature of 90°C for 2 hours. The weight ratio of shrimp powder to soda solution was 1:20. Then the remains of the shell were filtered and the remaining materials were washed on the filter with distilled water until reaching neutral pH.

The Separation of minerals from the shell:

The residues obtained from the previous step were placed in a 1.4 normal hydrochloric acid solution for one hour. The weight ratio of shell to acid was 1:10. Then the remains of the shell were filtered and the remaining materials were washed on the filter with distilled water until reaching neutral pH. The obtained chitin has a yellow color and must be decolorized.

The Decolorization of chitin:

To produce chitin free from carotenoid pigments, chitin was washed with acetone to make the chitin color clear and white.

The Preparation of chitosan from chitin:

In this step, chitosan was obtained by deacetylation of chitin. deacetylation was performed at 100°C for 6 hours in a 50% concentrated soda solution. Then the chitosan materials suspended in soda solution were filtered and washed with distilled water until neutral pH was reached. The obtained chitosan was dried in an oven at 60°C for 1 hour. Figure 1 shows all the necessary items for the physical and chemical analyzes of the active ingredient chitosan in the hydrating cream.

Formulation of the cream based on natural ingredients such as chitosan:

The Orand[®] base cream was stirred for 30 minutes by a mechanical stirrer. Pomegranate seed oil, Jojoba oil, Avocado oil, Wheat germ oil, Sunflower oil and Glycerin oil were added to the base cream. Tween 80 as an emulsifier was added to base

cream. The base cream was stirred for 20 minutes at room temperature. vitamin c was dissolved in Distilled water, then Himalayan salt added to the solution. The solution was slowly added to the cream base. The base cream was stirred for 15 minutes at room temperature. The first, Sodium benzoate as preservative was added to the mixture. The base cream was stirred for 10 minutes at room temperature. The second, Potassium sorbate as preservative was added to the mixture. The base cream was stirred for 10 minutes at room temperature. Chitosan was added to the cream mixture as an active ingredient. The base cream was stirred for 20 minutes at room temperature. Powdered essential oil of coconut or white grapes (gum bear) was added to the cream base as a fragrance. Table 1. shows the percentage of each component for making chitosan cream.

Fatty acid identification:

All of the oils in cream, Pomegranate seed oil, Jojoba oil, Avocado oil, Wheat germ oil, Sunflower oil and Glycerin oil were identified by gas chromatography instrument in Academic Jihad Medicinal Plants Research Institute. Fatty acid identification was characterized method/test reference in NIST & Wiley. All the fatty acids in chitosan moisturizing cream in figures 2&3 were identified by gas chromatography.

Methodology Acute Dermal Irritation/Corrosion:

Good Laboratory Practice compliance statement: This study was conducted in compliance with current OECD Good Laboratory Practices Standards. **Study Title:** Acute Dermal Irritation Study in Rabbits. **Irritation Test:** In Vivo. **Test Animal:** Male Albino Rabbit. **Test Guideline:** Based on OECD Guideline for the Testing of Chemicals. **Performing Laboratory:** Quality Control Laboratory, Department of Pharmaceutics, school of pharmacy, Shahid Beheshti University of Medical Sciences, 2660 Vali-e-Asr Ave., Tehran, Iran.

Results: The sample showed no irritation.

The aim of this study was to evaluate the skin irritation/corrosive potential and the reversibility of dermal effects of the Herbal sea lift following a 4-hour dermal exposure in albino rabbit. The results of the study were used to determine the approximate toxicity classification. Dermal erythema and edema are evaluated and scored at approximately 60 minutes, and 24, 48, and 72 hours following the removal of the test substance at the end of the 4-hour exposure in rabbit. The reversibility of any dermal effects is assessed for up to 14 days. If necessary. Dermal effects are quantified according to the Draize scale (Table 2) (10).

In this study, one male adult New Zealand albino rabbit was obtained from the Animal House of School of Pharmacy, Shahid Beheshti University of Medical Sciences, Tehran, Iran. The rabbit was housed singly in stainless steel, wire-mesh cages and kept under standard animal laboratory conditions, 12 h of light and dark cycles, at controlled temperature 22±2°C, with a relative humidity of 50±5%, and free access to food and water.

Around 24 hours prior to treatment, the four of male New Zealand White rabbit was closely shaved to exposure the skin (approximately 2.5×2.5) from scapular to the lumbar region of the back.

Herbal sea lift was applied as a single dermal dose to the shaved intact skin of the rabbit. The application area was covered with a 2-ply gauze square which was held in place with non-irritating tape. The rabbit was returned to cage after treatment. No other substances were tested on the rabbit. The rabbit was exposed to the test substance for 4 hours after which the test substance was removed. Test sites were evaluated and scored by the method of Draize (Table 2) for erythema, edema, and other evidence of dermal effects approximately 60 minutes, and 24, 48, and 72 hours after test substance removal. Additionally, the rabbit was examined for clinical signs of toxicity at each observation period. The test substance appeared to be stable under the conditions of the study. No evidence of instability, such as a change in color or physical state, was observed. For data analysis and interpretation of the results, values for each lesion (erythema and edema) were calculated

from numerical scores obtained at the 60 minutes, 24, 48, and 72 hour observations. The final results was calculated as a primary irritation index (PII). The mean scores were summed and averaged to obtain the primary irritation index (Table 3). No dermal irritation, erythema and edema was observed at 60 minutes, and 72 hours after removal of the substance in the rabbit. No clinical signs were observed. The dermal scores from rabbit with respect to observation time are presented in Table 4.

Result:

To make the chitosan moisturizing cream with the oils used in the cream, tween as an emulsifier with these oils and with the ratio of water achieves a soft creamy texture. As shows figs 2 & 3, fatty acids palmitic acid, oleic acid, linoleic acid, stearic acid have the highest percentage of abundance in chitosan moisturizing cream. Also, there was not no dermal irritation in Irritation Test in Male Albino Rabbit. No clinical signs were observed. Under the conditions of this study, the Herbal sea lift cream, produced no erythema and no edema when applied to the skin of rabbit. Herbal Sea lift cream showed a negligible irritation response.

شرکت شیمی توان آریا

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Analysis Report

Name: Chitosan

Chemical name : (1,4)-2-Amino-2-desoxy- beta-D-glucan

Test	Standard Limit	Result	
Appearance A	White or almost white	Conform	✓
Appearance B	fine powder	Conform	✓
Appearance of solution	Complies with reference	Conform	✓
Identification A (IR)	Complies with reference	Conform	✓
Identification B (Chloride)	Complies with reference	Conform	✓
Hg	Complies with reference	<0.5	✓
Pb	Complies with reference	<0.1	✓
Cd	Complies with reference	<.05	✓
As	Complies with reference	<1.0	✓
Solubility	Sparingly soluble in acid acetic 0.1%	Conform	✓
Mater Insoluble in Water	NMT 0.5%	0.05%	✓
Loss on Drying (LOD)	Not More Than 10 % (105°C, 3h)	2.17 %	✓
Sulfated ash	Not More Than 1% (600°C, 4h)	0.3 %	✓
Heavy Metals	Not More Than 40 ppm	Conform	✓
Viscosity	Brookfield viscosity 200-800 cP	Conform	✓
pH	4.0 to 6.0 for solution S.	4.82	✓
Chloride	10.0 to 20.0%	17.3%	✓
Degree of Deacetylation	70.0-95.0%	95.3%	✓

Formula : $(C_6H_{11}NO_4)_n$

CAS Number:9012-76-4



آدرس: استان تهران - منطقه ۱۸ - شهرستان ری - بخش کهریزک - دهستان کهریزک - محله محمد آباد چمبورک - کوچه سرخ - خیابان ادیب - جاده سروک - پلاک ۰

Figure 1: items for the physical and chemical analyzes of chitosan

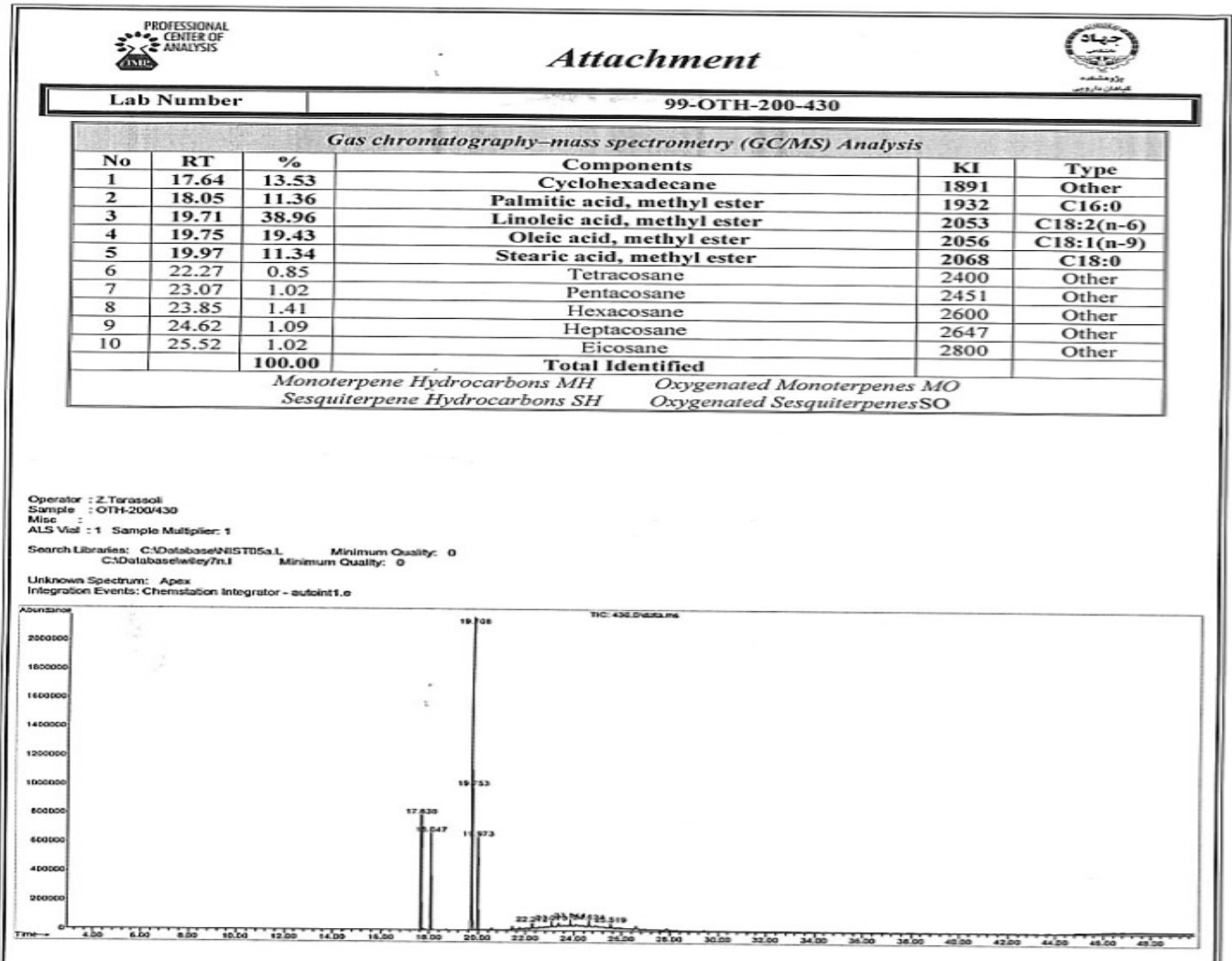


Figure 2. Fatty acids of the first category

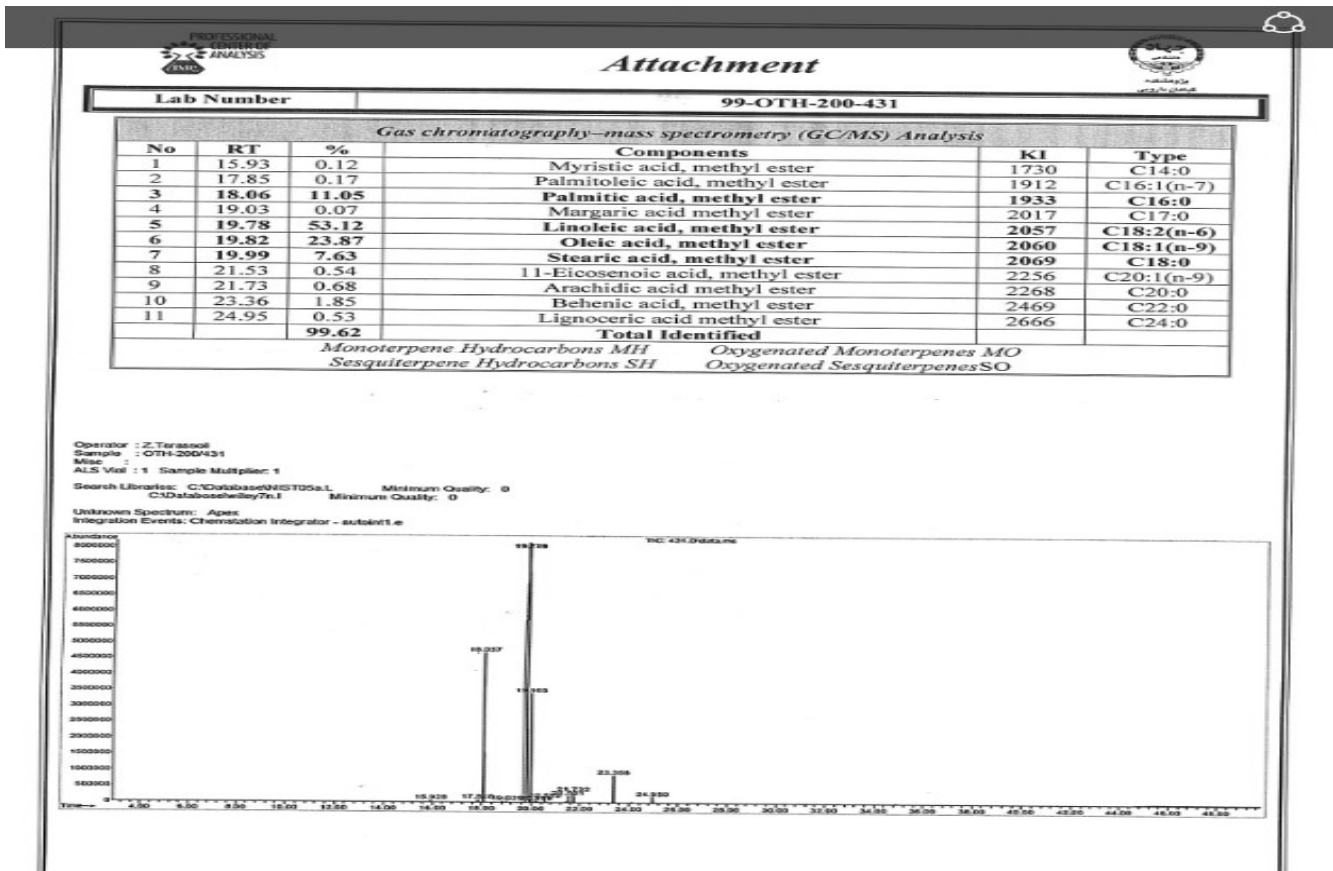


Figure 3. Fatty acids of the second category

Table 1. percentage of each component for making chitosan cream.

Product Name: Herbal Sea Lift		
Entry	Material Name	Amount of material
1	Chitosan	1% base cream by weight
2	Pomegranate seed oil	2 grams in the base cream
3	Jojoba oil	2 grams in the base cream
4	Avocado oil	1 grams in the base cream
5	Wheat germ oil	1 grams in the base cream
6	Sunflower oil	1 grams in the base cream
7	Glycerin oil	1 grams in the base cream
8	Orand [®] base cream	80 grams of cream base
9	vitamin c	1.5% base cream
10	Distilled water	2 grams in the base cream
11	Himalayan salt / Himalayan salt should be dissolved in 2 cc of warm distilled water and vitamin C	1.5% Himalayan salt in the base cream

12	Tween 80 as an emulsifier	3.9 grams in the base cream
13	Sodium benzoate	0.05 grams in the base cream
14	Potassium sorbate	0.05 grams in the base cream
15	Powdered essential oil of coconut or white grapes (gum bear)	0.8 grams in the base cream

Table 2. Dermal effects quantified according to the Draize scale

scores	Arrhythmia rate
0	no erythema
1	Very mild erythema
2	Specific arrhythmia
3	Moderate to severe erythema
4	Severe erythema to scar formation

Table 3: Descriptive rating for mean primary irritation index (PII).

Primary irritation index (PII)	Classification
0	Negligible
$0 < PII \leq 2$	Slight
$0 < PII \leq 5$	Moderate
$5 < PII$	Severe

Table 4: Dermal response observed in Rabbit

	Evaluation after removal of test substance				
	0 minutes	60 minutes	24 hours	48 hours	72 hours
Erythema	0	0	0	0	0
Edema	0	0	0	0	0

Conclusion:

Hydrating and moisturizing cream containing the active ingredient chitosan can be a good cream for moisturizing and softening the skin. This cream can be well homogenized and formulated with a mixture of oily and aqueous phases and polysaccharide compounds with high molecular weight. It seems that this cream, due to the active substance chitosan extracted with high molecular weight from aquatic organisms such as shrimp, will be a good tissue hydration and moisturizer for burns and acute and ultra-acute wounds in the near future.

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