

Research Article



Formulation and Evaluation of Skin Invigorating Caffeine Face Mask

Anakha Narayanan, Fahidha K. S, Godwin Babu, Nandana V, Raji M K, Anu Abraham, Neeba Babu*

Department of Pharmaceutics, Chemists College of Pharmaceutical Sciences and Research, Varikoli P. O, Ernakulam, TN, India.

*Corresponding author's E-mail: roneeba@gmail.com

Received: 12-05-2022; Revised: 23-07-2022; Accepted: 31-07-2022; Published on: 15-08-2022.

ABSTRACT

Skin health is important in providing an aesthetic appeal and also in personal health. Facial cosmetics keep skin hydrated and remove sebum and impurities from skin thus maintaining proper skin health. It imparts a psychosocial effect on people. Cosmetics intended especially for facial application protects the facial skin, which can be cream, lotion, face mask etc. The use of suitable face masks according to the facial skin types result in healthy skin. Hydrogel masks provide cooling and soothing effects to sensitive skin. Hydrogels have high-water content and their hydrophilic base creates a matrix to the skin, thus allows high efficacy in delivering active ingredients into the skin, thus suitable as facial mask ingredient. Caffeine hydrogel face mask containing caffeine and sodium alginate can be useful for multi-purpose. In this study 1.5% caffeine was formulated with a concentration of 4% sodium alginate to form the hydrogel face mask. Caffeine is being increasingly used in cosmetics due to its anti-aging, anti-oxidant and wound healing properties. It helps protect cell against UV radiation and slows down the process of photo aging. The physical stability of hydrogel face mask was evaluated by organoleptic observation, viscosity, pH, spreadability, hydrogel mask acidity and drying time measurements. The results showed that the hydrogel face mask remained stable in colour and odor for 12 weeks. The study revealed that the hydrogel face mask containing caffeine is stable and has good physical characteristics which makes the hydrogel face mask satisfactory for use as a nutracosmeceutical product. The hydrogel mask tested in this study is very effective in improving skin hydration and skin radiance, encouraging an even skin tone, reducing skin pigmentation and promote young looking skin, reducing the signs of aging.

Keywords: Hydrogel face mask; anti-aging; anti-oxidant; wound healing; physical stability; nutracosmeceutical; hydration; caffeine; skin; cell; UV radiation.

QUICK RESPONSE CODE →

DOI:

10.47583/ijpsrr.2022.v75i02.014



DOI link: <http://dx.doi.org/10.47583/ijpsrr.2022.v75i02.014>

INTRODUCTION

The word cosmetics originates from a Greek word “kosmeticos” which means to ‘adorn’. Cosmetics are external preparations which are applied on the external parts of body like skin, hair, nail, lips etc. to improve the outward show of the body and also mask bad odour of the body. It protects skin and keeps it in good condition. Cosmetics are broadly classified into: Skin Cosmetics, Hair Cosmetics, Nail Cosmetics, and Cosmetics for hygiene purpose¹.

Nutracosmetics are an emerging class of health- and skin-care products that combine the benefits of nutracosmetical ingredients, as compared with synthetic cosmetic products, herbal products are mild, biodegradable, and have low toxicity profile. Using herbal ingredients, different skin care products have proven to exhibit some beneficial properties, such as sunscreen, anti-aging, moisturizing, antioxidant, anti-cellulite, and antimicrobial effects².

The skin water content plays a significant role in skin health, aesthetics and glow. Skin delicacy can be affected by ultraviolet (UV) exposure (sun damage), senescence, dehydration, stress, medication and regime type. Masks help hydrate skin, remove excess oils and help improve the appearance of pores, while providing a relaxing spa -like experience at home. Facial mask has recently undergone a makeover with innovative ingredients. The application site and amount applied largely determine the rheological properties of facial mask. They are formulated to resemble viscous gels, paste or thick emulsions. The main cosmetic objectives of facial mask are to provide: fast, deep moisturization, skin replenishment and restitution, Skin rejuvenation, Sebum absorption and elimination. There are different types of face masks such as Sheet Mask, Peel-out mask, Hydrogel mask, Rinse-off mask³.

Hydrogels are 3D networks of polymers in which water can be absorbed several times the gel weight. Hydrogel masks not only have a superior moisturizing and regenerative effect on the skin but are also able to control skin temperature and enhance physiological activity. Hydrogels are often chosen as facial mask ingredients because of their high water content and their hydrophilic base which creates a matrix to the skin, thus allows high efficacy in delivering active ingredients into the skin. Hydrogel masks not only have a superior moisturizing and regenerative effect on the skin, but are also able to control skin temperature and enhance physiological activity.



Furthermore, hydrogel masks have good elasticity and are convenient to apply. Thermosensitive hydrogels are especially utilized for localized, controlled and continuous delivery of active compounds, based on a shift in their conformation, solubility and hydrophilic or hydrophobic balance due to thermal stimuli^{4,5}.

Caffeine is 1,3,7-trimethyl xanthine (figure 1) freely soluble in chloroform and in boiling water, sparingly soluble in water and ethanol, slightly soluble in ether⁶. Caffeine does not possess the properties of an ideal skin penetrant as it is a hydrophilic material with a value of -0.007 as Log P⁷. Caffeine is a naturally occurring stimulant with numerous beneficial molecular properties implicated in dermatology such as its ability to act as an antioxidant, phosphodiesterase inhibitor and anti-carcinogen⁸.

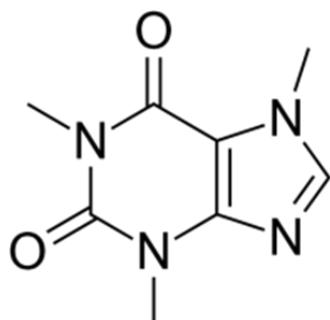


Figure 1: Chemical structure of caffeine

Caffeine has potent antioxidant properties. It helps protect cells against the UV radiation and slows down the process of photoaging of the skin. Caffeine contained in cosmetics raises its protective effect against UV radiation, reduces the formation of free radicals in skin cells, and increases the microcirculation of blood in the skin. Caffeine can effectively reduce swelling of the tissue around the eyes. The commercially available topical formulations of caffeine normally contains 3% caffeine. Caffeine hydrogel face mask show a very efficient effect on the skin⁹.

Water soluble mucilage extracted from flaxseed has excellent hydrocolloid potential in gel formation; moreover, it can become a product of high technological value in the food, pharmaceutical and cosmetic industries because it has high viscosity in aqueous solution. Flaxseed gum could form thermoreversible cold –setting gel. Flaxseed which contains lignans and antioxidants helps in skin tightening and preventing sagging of the skin. They also have fatty acids which keep your skin nourished, hydrated and moisturized¹⁰.

Sodium alginate is a marine polymer that has demonstrated the ability to form hydrogels, an interesting property for the development of cutaneous formulations. Sodium alginate is a biodegradable and biocompatible polysaccharide. It is widely used in the pharmaceutical industry, mainly due to the fact that it can form gels¹¹.

Skin redness and inflammation on face caused by the use of N95 mask are challenges faced by the covid frontiers. An

innovative and effective cosmetic product and facial mask able to ameliorate their appearance and body health, slowing down the stress condition and matching their own skin type and life-style is a need for the hour¹².

In this study, the base gel was prepared using sodium alginate, water and flaxseed by homogenization, then caffeine was incorporated. This formulation produces a skin invigorating hydrogel face mask that has good physical stability and consistency with fast, deep moisturizing, and skinreplenishment properties. The face mask was intended to relieve the skin inflammation and puffiness by the incorporation of caffeine. Physical stability was evaluated using organoleptic observation, hydrogel mask acidity, viscosity, spreadability, pH, and drying time.

MATERIALS AND METHODS

Caffeine (Suvidhinath laboratories), Sodium alginate (Suvidhinath laboratories), Flaxseed gel (Folk stores), Glycerine (Nice chemicals), Propylene glycol (Suvidhinath laboratories), Methyl paraben (Suvidhinath laboratories), Propyl paraben (Suvidhinath laboratories), Aloe Vera (Himalaya Pvt. Ltd), Lemon oil (Yucca enterprises, Mumbai).

Preparation of flaxseed gel

30 gm of flaxseed was weighed into a 250 ml beaker and 120 ml of water was added to it. Then it was boiled in a waterbath until gel of sufficient consistency was formed and immediately strained.

Preparation of caffeine hydrogel mask

Hydrogel mask formulation described by composition and concentration is shown in Table.1. Sodium alginate was dispersed in distilled water and homogenised for 10 minutes.

The prepared flaxseed gel was added to glycerine to produce a mixture. 0.45g caffeine was boiled in distilled water to dissolve. Methyl paraben and propyl paraben were also added to caffeine solution and boiled. The above mixture was added to flaxseed gel - glycerin mixture and a drop of propyleneglycol was added. Then the mixture was added to the alginate gel and homogenized until a semisolid gel is formed.

Evaluation

Organoleptic test

The prepared gel was evaluated for its color and odour.

Hydrogel mask acidity

The mask was dipped in 10 ml of distilled water for 2 hours at room temperature. The hydrogel mask acidity was then measured with pH meter. Measurements were repeated 3 times and the mean values were used.

Viscosity

The viscosity of the sample gel were determined using Brookfield viscometer (DV-E model) and the readings

were taken.

Spreadability

The sample was put on the glass sized 20× 20 cm which is placed on the graphical sheet, left for 60 seconds then the diameter of formed shape was measured. Afterward the sample was closed with mica plastic and given load until the strength reached 125 g and left for 60 seconds. Then the diameter of formed shape was measured.

pH

The sample was diluted into 1 % concentration by weight of the gel and dissolved in 100 ml of distilled water and pH was measured using pH meter.

Drying time

The drying time test was performed by observing the time needed by the gel to dry, which starting from the gel application on the skin of the face until dry layer was created¹³.

RESULTS AND DISCUSSIONS

In this study 1.5% of caffeine was formulated with 4% sodium alginate, 46.6% flaxseed gel, 6.6% of glycerine, 2.6% methyl paraben, 1.3% propyl paraben and 16.6% aloe vera which produced a hydrogel mask with a good consistency. The results of evaluation is given in Table.2.

Table 1: Hydrogel mask formulation

Composition	F1	F2	F3	F4	F5	F6
Caffeine	0.45 g	0.45 g	0.45g	0.45 g	0.45 g	0.45 g
Sodium alginate	0.8 g	0.8 g	1 g	1 g	1.2 g	1.2g
Flaxseed gel	14g	16 g	14 g	16 g	14 g	16 g
Glycerin	2g	2 g	2 g	2 g	2 g	2g
Propylene glycol	1.5 g	1 g	0.15 g	0.15 g	0.15 g	0.1 g
Methylparaben	0.8g	0.8 g	0.8 g	0.8 g	0.8 g	0.8 g
Propyl paraben	0.4g	0.4 g	0.4 g	0.4 g	0.4 g	0.4 g
Aloe Vera	5g	5 g	5 g	5 g	5 g	5 g
Distilled water	q.s	q.s	q.s	q.s	q.s	q.s
Lemon oil	0.1g	0.1 g	0.1g	0.1 g	0.1 g	0.1 g

Table 2: Evaluation of Face Mask

Evaluation	F1	F2	F3	F4	F5	F6
Color	Cream	Cream	Cream	Cream	Cream	Cream
Odor	Lemon	Lemon	Lemon	Lemon	Lemon	Lemon
Hydrogel mask acidity	5.2 ± 0.06	6 ± 0.2	6.1 ± 0.15	5.9 ± 0.1	6.2 ± 0.25	6.6 ± 0.26
Viscosity (cps)	2326.67±2.08	2429±2	2544.67 ± 3.51	2545±3.6	2525.33± 1.53	2606± 3.6
Spreadability	21.93± 0.07	22.2± 0.35	20.37± 0.64	21.3±0.28	22.17± 0.21	21.43± 0.21
pH	4.8± 0.25	5.1± 0.15	6.1± 0.35	6.3± 0.06	6.2± 0.3	6.4± 0.26
Drying time (min)	11.3± 0.58	13.2± 0.76	15.3± 1.53	14.5± 0.5	15.8± 0.29	15.2± 0.76

Organoleptic Test

The physical evaluation of the mask showed that all the six formulae gave the same cream color and specific odor.

Hydrogel mask acidity: The six formulae of mask showed hydrogel mask acidity ranging from 5.2 ± 0.06 to 6.6 ± 0.26. The acidity of the skin is pH 4.5 to 6.5. The acidity value of the skin was appropriate (pH between 4.5 and 6.5); therefore, the hydrogel mask was convenient to be used as a skin care product. Therefore, all the formulae have acidity convenient for skin.

Viscosity: The viscosity of six formulae of face mask was between 2326.67±2.08 to 2606± 3.6 cps at 100 rpm. Viscosity of F6 is the highest. The viscosity of the mask affects the spreadability. Lower the viscosity, lower the surface tension and more the mask is easily spread. The viscosity of formulation F1 is lowest when compared to other five formulations.

Spreadability: The ability of mask to spread ranged from 20.37 ± 0.64 to 22.17 ± 0.21. Formulation F5 exhibited better spreadability.



pH: The value ranged from 4.8 ± 0.25 to 6.9 ± 0.06 . The formula F1 has lowest pH and F6 has highest pH. The pH of hydrogel face mask is preferably adjusted preferably 4.5 to 7 to relieve irritation to the skin, to absorb moisture and to stabilize the base of the skin.

Drying Time: The drying time of all formulae ranges from 11.3 ± 0.58 to 15.8 ± 0.29 min. F1 has drying time 11 minutes and F3, F5 and F6 have 15 minutes. Leaving the mask too long would not enhance its results on skin. The best drying time should be more preferably between 15-20 minutes, so that formula F3, F5 and F6 is more convenient.

The concentration of caffeine used in all formulas was found to be 1.5 % which gives its cosmetic benefit. The consistency of the first two formulation was not suitable to be used as face mask because of the decreased concentration of sodium alginate. Increase in concentration of propylene glycol gives a profound odour which limit the consumers from using it. Fifth formulation was found to be best among all thus, it is more convenient to use.

F5 was optimized as the best formulation based on the evaluation tests hydrogel mask acidity, pH, viscosity and drying time. The mask showed a good spreadability and it is capable of removing the debris from skin - pores and increasing the cleanliness the skin by removing dead skin cells from the surface. Here, in this study, a herbal ingredient, flaxseed was used as gelling agent. Natural remedies are more acceptable in the belief that they are safer with fewer side effects than synthetic ones.

CONCLUSION

The hydrogel mask containing caffeine was stable with good physical characteristics. A total of 6 formulations were prepared with same concentration of caffeine but varying concentrations of sodium alginate and flaxseed gel. The face mask formulation F5 was optimized as the best formulation based on the evaluation tests. F5 had a viscosity of 2525.33 ± 1.53 cps with a spreadability of 22.17 ± 0.21 . F5 exhibited better spreadability compared to other formulations due to the presence of optimum amounts of sodium alginate and flaxseed gel. F5 has pH value of 6.2 ± 0.3 with drying time of 15.8 ± 0.29 minutes. The presence of caffeine improves skin radiance, promote young looking skin and reduce the signs of ageing. The skin invigorating caffeine face mask is satisfactory for use as a cosmeceutical product.

REFERENCES

1. Chanchal D, Swarnlata S. Novel approaches in herbal cosmetics. J Cosmet Dermatol 2008;7:89-95.
2. Anitha T. Medicinal plants used in skin protection. Asian J Pharm Clin Res 2012;5(3):35-8.
3. Nilforoushzadeh MA, Amirkhani MA, Zarrintaj P, Moghaddam AS, Mehrabi T, Alavi S, Sisakht MM, Skin care and rejuvenation by cosmeceutical face mask, J Cosmet Dermatol, 2018;00:1-10, <https://doi.org/10.1111/jocd.12730>.
4. Quattrone A, Czajka A, Sibilla S. Thermosensitive hydrogel mask significantly improves skin moisture and skin tone; Bilateral clinical trial. Cosmetics 2017;4(17):1-18.
5. Lim KB, Hur W, Kim JY, Lee DH. Patent No. US 2010/0112058 A1. United States; 2010. Tsujihata S. Patent No. US 2010/0239621 A1. United States; 2010.
6. Indian Pharmacopoeia volume 1,224.
7. Luo L, Lane ME, Topical and transdermal delivery of caffeine, Int J Pharmaceut, 2015, <http://dx.doi.org/10.1016/j.ijpharm.2015.05.050>.
8. Visconti MJ, Haidari W, Feldman SR. Therapeutic use of caffeine in dermatology: A literature review. J Dermatol surg. 2020; 24:18-24.
9. Herman, A. P Herman. Caffeine's Mechanisms of Action and its Cosmetic Use; Skin Pharmacology and Physiology. 2013; 26:8-14.
10. Rocha MS, Rocha LC, Feijo MBD, Marotta PLL, Mourao SC. Effect of pH on the Flaxseed (*Linum usitatissimum* L. seed) mucilage extraction process, Acta Scientiarum Technology, 2021;43(1) e50457. <https://doi.org/10.4025/actascitechnol.v43i1.50457>
11. Lee KY, Mooney DJ. Alginate: Properties and Biomedical Applications. Progress in polymer science. 2012;37(1):106-126.
12. Gianluca M, Morganti P. Beauty Mask: Market and Environment: Journal of Clinical and Cosmetic Dermatology.2019;3(2):141.
13. Isnanelly Hanum T, Lia Laila. Physical Evaluation of Anti-aging and Anti- acne Andaliman (Zanthoxylum acanthopodium DC.) Ethanolic Extract Peel Off Gel Mask. Der Pharma Chemica. 2016;8(23):6-10.

Source of Support: The author(s) received no financial support for the research, authorship, and/or publication of this article.

Conflict of Interest: The author(s) declared no potential conflicts of interest with respect to the research, authorship, and/or publication of this article.

For any question relates to this article, please reach us at: globalresearchonline@rediffmail.com
New manuscripts for publication can be submitted at: submit@globalresearchonline.net and submit_ijpsrr@rediffmail.com

