https://doi.org/10.33472/AFJBS.6.6.2024.1334-1350

African Journal of Biological Sciences

Journal homepage: http://www.afjbs.com

Research Paper Open Access

Formulation and Evaluation of Skin Brightening Coffee soap with antioxidants and carcinopreventive effects

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Article History

Volume 6,Issue 6, 2024
Received:20 Feb 2024
Accepted : 28 Mar 2024
doi: 10.33472/AFJBS.6.6.2024.1334-1350

Abstract

The aim of this research work is to develop and evaluate natural coffee face soap using various bioactive herbal plants extract with different ethnic and dermatological importance in Ayurveda, namely Coffee and coconut oil. In human being the most common type of skin infection is bacterial infection which requires immediate treatment as well as continuous care to maintain the health of the skin. The aim of this study is to formulate a poly herbal soap with the extracts of Coffee powder and coconut oil. The studies indicated that coffee soap possesses so many advantages like it work as an anti-aging, anti-cancer, and anti-cellulite characteristics. Coconut oil, glycerine, steric acid, and sodium hydroxide are the substances used in the manufacturing and as a medications to treat various skin conditions. The developed formulation's physical properties are advantageous. As per evaluation parameters and other studies, it is evaluated that the products is of good quality, having sufficient foaming retention, and foam heights. The final product have excellent pH as per the need of skin. The melt-and-pour method can be used to prepare a good quality of coffee soap and the evaluation parameters confirms the amazing antioxidant and cellulite-reducing abilities.

Key words: Coffees soap, herbal, antioxidants, anti-inflammatory

INTRODUCTION

Varieties of antioxidants are present in coffee which helps to protect your skin from damage and ageing. The coffee plant can grow as a bush or tree up to ten metres (32-34 feet) in height, but it is usually cut to a smaller size [1]. Originally obtained from Ethiopia, apart from this coffee plants are currently grown in Southeast Asia, South America, and Central America. The Coffee plant is what gives coffee both its common and scientific names. Coffee plants are now grown in South-east Asia, South America, and Central Asia. They were originally native to Ethiopia and America. The two most often produced coffee bean kinds are C Arabica and C Robusta. Due to their multiple benefits they are not only thoroughly cleans your body without the use of any unidentified hazardous ingredients, but also enhances the need for numerous post-bath care products, such as anti-aging, and moisturising creams. Preparation of coffee-infused soaps are easy and convenient to reap their benefits, easy method to profit from them [2]. As per various literatures and studies, coffee oil can increase collagen and elastin, making the skin seem and feel tighter. The primary alkaloid present in coffee fruits is caffeine, which is responsible for the bitter flavour of coffee. Coffee's antioxidant qualities are associated with its chlorogenic, ferulic, caffeic, and n-coumaric acids. Melanoidins are powerful dark pigments that are created when coffee is roasted. Antioxidants Trigonelline and caffeine are categorised as antioxidants by certain sources as well [3]. Caffeine may have potential as an anticancer medication through a number of carcinogenic pathways in the body and brain. Caffeine is an active ingredient because it prevents excessive fat accumulation in cells, which has an aesthetic benefit [4].

Orally taken coffee can provide your body a varieties of antioxidants, while the majority of coffee's skin benefits are received topically, making coffee-infused soaps a quick and simple way to benefit from them. Using soaps made from natural ingredients, like coffee powder, not only cleans your body without any hidden dangerous ingredients but also satisfies your need for numerous post-bath care products, such as anti-aging, and moisturising creams, due to its extensive inherent benefits [5]

Benefits of coffee in soap are [6]

- Coffee not only help in maintaining skin hydration by lowering trans-epidermal water loss but also makes skin healthier.

- Coffee is responsible for the reduction of hyperpigmentation, which could be related to inflammation.
- It has also act as antibacterial and antifungal properties, and work as a potent anti-acne remedy.
- According to a recent study having coffee in diet regularly has been associated to a reduction in the effects of photo-aging,
- Coffee soap feels soothing post-sun care product application.
- It has the some anti-aging benefits.
- Two main compounds present in coffee i.e. chlorogenic and melanoidin are responsible for the anti-inflammatory effects of coffee.
- Niacin, is found in coffee often known as vitamin B3, is produced by the breakdown of a crucial substance called trigonelline
- It may prevent non-melanoma skin cancers and perhaps prevent other skin growths.
- Antioxidants present in coffee can help to shield your skin from ageing and damage from free radicals.
- Coffee oil can enhance production of collagen and elastin, making the skin clear and feel tighter, as per some research.
- The appearance of red spots, fine lines, and redness can be reduced by using coffee soap.
- It has a lot of antioxidants.
- It shields the skin from damaging UV radiation.
- It gives skin a smooth, healthy glow.
- It improves circulation.

Out of the 90% of women who have cellulite, the majority have substantial cosmetic concerns. Caffeine is an active ingredient in many anti-cellulite lotions that have been created to minimise the appearance of cellulite, some study suggests that caffeine, which is present in coffee, enhances blood vessels under the skin and increases general blood flow, which helps to reduce cellulite [7]. To provide your skin a smooth and even appearance, coffee soap exfoliates the skin while also assisting in the appearance of cellulite reduction. Coffee soap was created using coffee powder and a clear soap base, and it was then assessed using a variety of criteria, including organoleptic Features, pH, foam height retention, and skin Irritation and resistance to hot temperatures [8]. We Enumerated type of soap, various soap

making techniques Coffee soap production and advantages. Since ancient times, people have used soap, and it is still commonly used today as a cleaning agent, a mild antiseptic, and sometimes even an ingestible antidote. Poisonous methods. A soap maker can create soap. A quick procedure called saponification that requires Occurs when an alcohol interacts with a fatty acid Alkali. When fatty acids-containing fats or oils are mixed with a powerful alkali, the alkali coming first divides the fatty acids and glycerine from the fats or oils. Then, the potassium or sodium component of the Alkali combines with the fatty acid component of fats or oils. The potassium or soap is the name given to this mixture. The fatty acid's sodium salt. Thus, soap is a cleaning agent. Agent produced by the blending of fats [9]

Properties of Caffeine

1. Antioxidant properties

It is well known that UV rays speed up photo aging of the skin, decrease the production of precollege, affect collagen fibre, decrease skin elasticity, cause blood vessels in the skin to expand and crack, promote the formation of wrinkles, spots, and discoloration, and in severe cases, can cause skin cancer, such as melanoma. The generation of free radicals is also increased by UV light, which damages cells as a result. Incorporating caffeine into sunscreen products improves their ability to block UV rays, lowers the production of free radicals in skin cells, and may even help prevent skin cancer from UV exposure. Caffeine is an effective scavenger of hydroxyl radicals (OH) and alkoxyl radicals (OCH 3), a poor scavenger of free radicals [10]

2. Anti-carcinogenic properties

An increasing body of research suggests that coffee may guard against both melanoma and non-melanoma skin cancers.14-26 despite the fact that there if there are additional substances that could fight cancer Caffeine is one of the most widely studied substances. Had substances in the chemo preventive capacity of COF Fee. Due to its anti-proliferative and a reduction in the risk of cancer through controlling cell proliferation, Growth and apoptosis. Caffeine lowers sunburn lesions in the epidermis, blocks UV rays, and has sunscreen effects, according to research by inhibiting for- (UV)-induced carcinogenesis the synthesis of thymine dimers. Caffeine boosts Eli-precancerous cells that have been damaged and tumour apoptosis. Through p53-dependent and p53-independent biological pathways, caffeine alters the cell cycle and promotes UV-induced apoptosis Ways. Recent research' data have showed

a Caffeine's ability to prevent the spread of Cell lines from melanoma and nonmelanoma tumours [11]

Caffeine's effect on carcinogenesis has been extensively researched and was first tested in rats. When taken orally, caffeine reduced the risk of UVB-induced cancer. Mice, and when the caffeine was removed, these effects disappeared. Tea, either green or black. Caffeine inhibited two important carcinogenic pathways and caused apoptosis in UVB-damaged keratinocytes when administered to human cells. In the development of skin tumours following UVB exposure [12]. These early encouraging results prompted not only extensive research to assess potential links between caffeine consumption and the risk of developing melanoma and nonmelanoma skin cancers. Investigations to pinpoint the genetic causes of cancer as well as parameters affecting the interaction between caffeine and UV-induced Carcinogenesis. NEIL3, a particular DNA repair gene A was discovered in the DNA repair pathway for base excision a significant factor in caffeine-mediated skin tumour inhibition, furthermore elucidating caffeine's function in preventing skin cancer [13].

3. Anti-cellulites

Cellulite is a common issue for women. It is also known as gynoid lip dystrophy or the orange peel effect (because the dimpling on an orange looks similar to the dimpling on the skin). The thighs and buttocks are where it mostly shows up [14].The presence of extra subcutaneous fat that pushes into the dermis causes cellulite, a complex condition involving the lymphatic and microcirculatory systems that results in the dimpling appearance. This fat is broken down through a process called lipolysis, which is complicated and controlled by a number of hormones and neurotransmitters. By accelerating lipolysis and preventing the build-up of extra fat, caffeine has an impact on this intracellular pathway. The removal of stored fat, toxins, and superfluous materials produced by the lipolysis process, which collectively may impair the microcirculation in blood vessels and promote the development of cellulite, occurs through the stimulation of the draining lymph systems in fatty tissue by caffeine [15].

Materials and methods [16, 17, 18]

Table: 1 Materials used in soap preparation

Ingredients used in the formulation of Coffee Soap

Coffee Powder	
Synonyms	Arabica coffee, Arabian coffee, Brazilian coffee and Ethiopian coffee
Biological Source	Dried ripe seeds of Coffee Arabica
Family	Rubiaceae
Geographical Source	It is indigenous to Brazil, Ethiopia, India, Vietnam, Mexico, Guatemala, Indonesia and Sri Lanka
Chemical Constituents	Caffeine -2-3% caffeine Protein and tannin 13% Sugar 3-5% Fixed oil 10-15% Wax also found in small amount. Caffeine is found in the seeds as a salt of Acid chlorogenic
Use	Remove dead skin cells by rubbing the coffee grounds Revealing softer, smoother skin. It can be used to obtain a glowing and a beautiful complexion.
Sodium hydroxide	

The IUPAC name: Sodium oxadinoid	
Other names	Caustic soda, lye and sodium hydroxide
Chemical formula	NaOH
Appearance	White crystal
Odour	Odourless
Melting point	318°C
Solubility	Water, Ethanol, Methanol
Uses	This is responsible for saponification process.
Coconut oil	
Active ingredients	Rich in antioxidant, Saturated fats, and vitamins like vitamin E, amino acids, lauric acid, and caprylic acid.
Uses	Antibacterial, antifungal, antiviral.
Mechanism of action	Coconut oil forms a moisturising barrier over the skin that works as a protective. To create a wholesome lather.

Benefits of Coconut Oil in Soap	Moisturizing Rich lather Reduce eczema and Acne Reducing Inflammation Skin Healing
Stearic acid	
Appearance	White solid
Odour	Pungent, oily
Density	0.9408 g/cm3 (20 °C), 0.847 g/cm3
Melting point	69.3 °C
Boiling point	361 °C
Solubility	**:**Soluble in alkyl acetates,
Uses	Used to thicken lotion. Hardening agent in soap.
Ethanol	Solvent
Aloe Vera	
Uses	Moisturising gent

Distilled water	Used as a solvent.

Table: 2 Materials and quantities

Ingredients	Quantity	Uses
Coconut oil	10 gm	Natural fat
Sodium hydroxide	7 gm	For saponification process
Steric acid	1 gm	Hardener
Coffee Powder	2 gm	For glowing and a beautiful complexion.
Ethanol	30 ml	solvent
Aloe Vera juice	2 ml	Moisturizer, antiseptic
Soft paraffin	0.70 gm	Soothing agent
Distilled water	q.s.	Vehicle

Preparation of Soap:

Formulation of soap contains active coffee was carried out using hot saponification method. The mixture of naturally occurring fatty acid salts in the form of sodium or potassium is known as soap [19]. In this method, coconut oil and alkali as lye has been used here for saponification reaction as follows: 10.0 gm of coconut oil was taken in the beaker. In separate beaker 7 gm of alkali (NaOH) was dissolved with 25 ml of ethanol and distilled water with continuous stirring. The oil-filled beaker is then filled with the lye solution. The resultant mixture was kept at hot plate at low heat with continuous stirring until the smell of oil/fat disappears and lead to formation of homogeneous solution. Solution obtained was then added with 2 gm of *coffee powder* along with 1 gm steric acid, 0.70 gm soft paraffin and 5 ml ethanol with continuous stirring in water bath until the extract gets dissolved and become homogeneous [20]. To it addition of few drops of *Citrus lemon* peel oil was added and mixed properly. The homogeneous semisolid mixture formed was poured into a mould and allow to solidify at room temperature and physical observation was done for any characteristic changes [21].

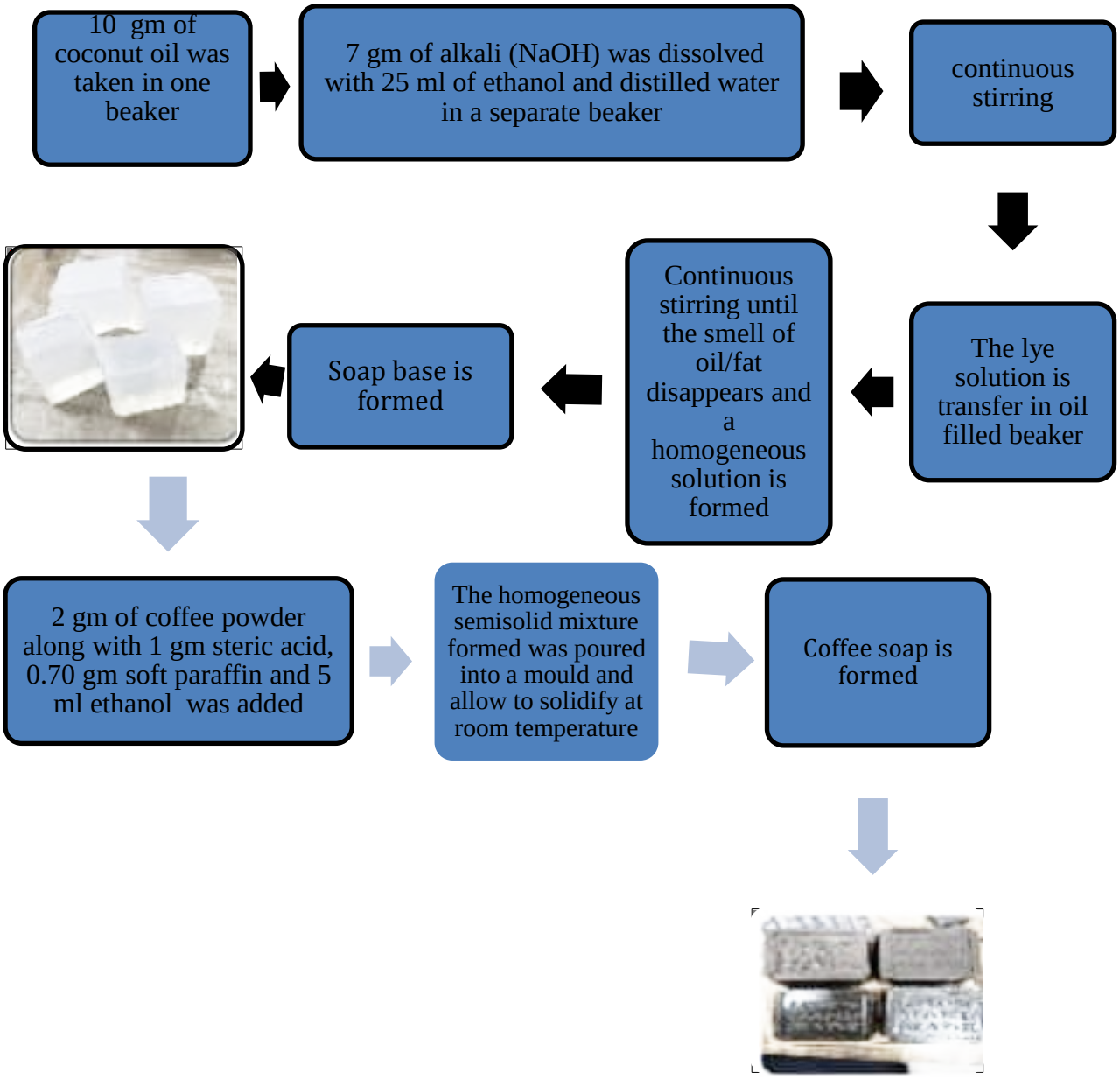

Figure 1: Formation of soap base and coffee soap

Evaluation parameters of coffee Soap

The following Physico-chemical parameters were evaluated for determining the quality of prepared soap.

Physical parameters

The colour and clarity of the prepared soap were observed with naked eye keeping it on white background. The order of the soap was smelled [22].

pH

The prepared formulation was dissolved in 100 ml distilled water and kept for 2 h. pH measurement of the solution was done using a previously calibrated pH meter [23].

% free Alkali content

The beaker containing 10g of dried soap was filled with 150 ml of distilled water. To dissolve the soap, it was heated for 30 to 40 min on a water bath. This solution was cooled, transferred to the 250 ml conical flask, and the further it was filled with distilled water. Two drops of the phenolphthalein indicator were added to 10 ml of the soap solution in the titration flask. The solution was then titrated against 0.1M HCl until it turned colourless [24].

Lather formation

2 gm of prepared soap was dissolved in 50 ml of distilled water completely by shaking or stirring. Solution was then transferred into a 250 ml measuring cylinder along with washings. The volume was made up to 200 ml by adding more distilled water. 25 uniform strokes were given to the mixture and kept stand still for some time until the water volume comes to 200 ml. The foam height was measured from above the water volume [25].

Foam stability

Same quantity of soap sample and quantity of distilled water along with process was carried out as that of foam-ability and the mixture was kept stand still for 30 min. After 30 min measurement of foam height was done from above the water volume [26].

Moisture content

10 gm of soap were taken and marked as "wet weight of the sample." Using the appropriate drying equipment, this wet sample was dried to a constant weight at a temperature not to exceed 115 °C. After cooling, the sample was weighed once more to determine its "dry weight." The following equation was used to calculate the sample's moisture content [27].

$$\%\, Weight = \frac{A - B}{B} X100 \ldots$$

Where; %Weight = % of moisture in sample, A = weight of wet sample (gm), B = weight of dry sample (gm).

Alcohol insoluble matter

25 ml of ethanol was introduced to a conical flask containing a 2.5 gm sample of soap in order to dissolve it. Using tarred filter paper, the liquid was filtered and then dried at 50 ^{0}C for an hour. The weighted filter paper had dried out [28].

RESULTS

Figure 2: Coffee soap with 5% of coffee powder of total weight of soap

The results obtained for Physicochemical and biological properties are summarized below in tables.

Table: 3 physicochemical parameters of herbal soap

Parameters	**Results**
Physical parameters	
Colour	Dark brown
Odour	Pleasant, almond nutty
Appearance	Good
pH	6.5
Free alkali content (%)	0.20
Lather formation	16 cm
Foam stability	15 cm
Moisture content	3,0
Alcohol insoluble matter	18.20
Irritation on skin	No

CONCLUSION

Along with water and tea, coffee is one of the three most consumed beverages worldwide and one of the most lucrative international commodities. Coffee is a natural excipients, beverage made from the roasted and ground seeds of African-derived tropical evergreen coffee bushes. Coffee soap beneficial for skin because coffee soap is loaded with antioxidants, it stimulates blood flow to the skin's surface and aids in the reduction of body fat. Even the appearance of cellulite might be helped. The skin can be cleared of dry, dead skin cells and given a more radiant and smooth appearance by adding finely ground coffee beans to a soap bar or body scrub. Coffee increases circulation, which enhances the look of the skin by promoting blood flow.

Caffeine is the main alkaloid component in coffee fruits and the source for bitter taste of coffee. The chlorogenic, ferulic, caffeic, and n-coumaric acids found in coffee are linked to its antioxidant properties Melanoidins, which are produced when coffee is roasted and are

brown pigments, are potent antioxidants Some sources also classify caffeine and trigonelline as antioxidants. Due to its capacity to inhibit cell proliferation and trigger apoptosis in numerous organs, including the oesophagus, breast, liver, and brain, via a number of carcinogenic routes, caffeine may have potential as an anticancer drug. Caffeine has a cosmetic role by preventing excessive fat build-up in cells, which is why it is an active ingredient in anti-cellulite products. By inhibiting the activity of phosphodiesterase, this alkaloid promotes the breakdown of fats during lipolysis. According to the research and study mentioned above, coffee soap has anti-aging, anti-carcinogenic, and anti-cellulite characteristics varied skin appearances to cure several components used in pharmaceuticals, including glycerine, coconut oil, clear soap base, steric acid, and sodium hydroxide. The developed formulation exhibits favourable physical properties. The formulation offers outstanding pH, foaming retention, foam heights, and high temperature quality based on evaluation experiments based on the study's findings, it can be said that coffee soap can be successfully created using the melt-and-pour method, which has outstanding anti-oxidant and Anticelluites qualities.

Acknowledgement

The authors express their sincere appreciation to Prof. Hina Chadha ma'am, Principal, at Vishveshwarya group of institutions, Department of pharmacy, GB Nagar Dadri, for her continuous support and encouragement. Additionally, we would like to thank the management, COO, Advisor and Director additional for their continuous help and support to provide opportunity to complete the research work at their premises.

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