



THE ART OF SAPONIFICATION & EMULSIFYING IT BY ECO-FRIENDLY DIY METHOD

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Abstract

A soap molecule consists of two dissimilar ends, one is a hydrophilic end (polar head) which binds with water and another is hydrophobic end (non-polar hydrocarbon tail) that binds with oil. The soap is prepared by the saponification process, in which the oil reacts with triglycerides and lye (NaOH). Oils with different properties make them unique from each other as the composition of fatty acids is incompatible. In the present study, an attempt is made to review the manufacturing process of soaps, with different types of oils i.e., coconut oil, palm oil, castor oil, olive oil and ghee oil and with different processes involved. By the knowledge gained through the literature survey, soap was synthesized at home. Soap samples were home prepared by mixing caustic soda, distilled water, cold pressed coconut oil. To enhance the quality parameters controlled quantity of fragrances and colours were added to the samples.

Keywords: soap, saponification, oil, cold processed method

I. Introduction

In Man's day to day activities luxurious baths & laundry soaps play an integral part. Although the preparation of soap is same, it is produced in different varieties for various purposes in different methods. Potassium alkali is used to make liquid soaps rather than sodium alkali as soaps produced by sodium alkali are hard compared to potassium alkali. When the fatty acids react with the alkali metal salts called soaps are formed. More than 100 variants of oil can be used for the production of soap [1]. But unfortunately, most of the soaps produced are non-saponifiable fatty acids. Sadly, for yielding profit, many of the soap producers compromise with quality and retain unreacted soap alkali [2]. To retain the bleaching property of the soap, the alkali is left in it. Soap is a compound of salt which can be called as a, fatty acid. It is a mixture of Na^+ or K^+ ions with fatty acids. Fatty acids can be classified into saturated and unsaturated fatty acids.

Palmitic and stearic acids, are the most abundant saturated fatty acids, whereas oleic and linoleic acids are the unsaturated fatty acids. Production of quality soap consists largely of choosing the right proportions of the right oils with their different fatty acids. Different parameters affect the process of soap making, and the quality of the produced soap depends upon the quality of materials used for the production of soap. The characteristics of the soap depend on the quality of oil, the amounts of the caustic soda and water used to prepare it. The speed of the reaction between the oil and the caustic soda is influenced by the presence of free fatty acid content of the oil, and the heat of the components before mixing, and how vigorously the mixing is done. Free fatty acid contents, vigorous mixing, heat, act as a catalyst for the soap-making process.

The cleaning action of soaps is due to their ability to emulsify or disperse water-insoluble materials and hold them in the suspension of water. This ability is derived from the molecular structure of soaps. There are many methods adopted to prepare soap.

1. Semi boiling

The soft and hard oils or their blends are suitable for the semi boiling process in which the fat is melted, followed by treating with a weak 9-10% caustic soda solution, and then by boiling the mixture. 14 to 15% of caustic soda is required for saponification of the weight of the oil. When Caustic soda is dissolved in oil saponification starts. Moderate heat is maintained during the boiling process. If soap shows any signs of graining or separation further water has to be added. Once the boiling process is done, the fire is taken off and soap is allowed to cool. At this point, perfume and colour can be added. This process is ideal for laundry soaps & liquid soaps.

2. Hot or Full boiling

This method of saponification is mainly used for production of hard sodium soaps. This is similar to the semi boiling process. The remaining alkaline solution is added by portions by stirring during heating. After adding the calculated alkaline, heat the mass for a few hours. At the end of this the graining out by adding salted water or humid salt, must be carried out. The

initial mass divides into 2 phases: an inferior stage composed of salted water, glycerol and soluble impurities present in the mixture and a superior stage composed of the soap (insoluble in salted water). The resulted soap undergoes special operations like cocking in a strong bleach, liquidation etc., before being poured in moulds for hardening. When this process is correctly executed we can produce a soap of semi industrial quality. This process can be adapted for the production of laundry and simple toilet soaps.

3. Cold processed

This process involves the treatment of fat or oil with alkali. Oils & fats should be free from excess acidity (because caustic soda neutralises free fatty acids forming granules of soap which grains out caustic solution & hence the soap becomes thick and gritty). Caustic soda used must be pure, water must be soft and all other materials must be free from particles of dirt. Pushing of caustic soda solution must be done slowly. When the solution is run in to the oil, it must be stirred in one direction. When all caustic soda is run into the oil mixture it is stirred for 30 to 45 minutes. During this stage, chemical reaction takes place which results in the saponification of oil. When the edge of the soap becomes more transparent, it is ready. At this stage perfumes can be added and it can be poured in to moulds for hardening. Literature survey analysis of the oils and the process adapted for making the soaps are illustrated in Table 1.

Table 1: Literature survey analysis of oils and the process adapted for the preparation of soap

S. No	Oil used	Process adapted	Reference
1	Neem oil	Toilet soap prepared using neem oil using saponification	E. E. Mak-Mensah et.al(1)
2	Apricot kernel oil and palm stearin	Toilet soap prepared by saponification	Adel Y. Girgis et.al (2)
3	Palm oil and castor oil	Soap prepared using different blends by saponification	Shoge Mansurat Oluwatoyin (3)
4	Sheabutter oil and palm kernel oil	Soap prepared using different blends by saponification	Eke U. B. Dosumu et.al (4)
5	Sheanut oil and groundnut oil	Soaps prepared using cold process synthesis	A.A. Warra et.al (5)
6	coconut oil, olive oil, castor oil, gee oil and palm oil with composition of NaOH, H ₂ O, oil (1:3:7) respectively.	cold process synthesis	Arasaretnam S and Venujah K(6)
7	Palm oil	Traditional method	Atiku, F. A(7)
8	Jatropha oil, Castor oil and Mahua oils	Heating & using Buchner funnel	Geetha Sarasan and Juzer Ali Rangwala(8)

9	Coconut oil (30%), palm oil (20%), soybean oil (20%), olive oil (20%), castor oil (5%), and shea butter (5%)	Cold saponification	Prieto Vidal N et.al(9)
10	J. curcas seed oil	Cold saponification	Jumat Salimon et.al(10)
11	Daniellia oliveri, Elaeis guineensis and Vitellaria paradoxa (Shea butter)	Saponification	OlubunmiAtolani et.al(11)
12	Avocado oil	Saponification	Susan Sutheimer et.al(12)
13	Jatropha oil	Traditional method	Rangwala Juzer Ali and Sarasan Geetha(13)
14	shea butter, palm kernel and plantain peels	semi boiling method	S. A. Zauro et.al(14)
15	Palm oil, olive oil, sunflower oil	Saponification	Maria Ulfa and Denis Eka Cahyan(15)
16	Neem oil	Saponification	E. E. Mak-Mensah and C. K. Firempong(16)
17	coconut oil,olive oil, peanut oil	cold saponification	Mohammed Haneefa K.P et.al (17)
18	beef tallow and waste cooking vegetable oils	cold process	Tlanelo Maotsela et al(18)

4. Advantages of different oils used

The olive oil soap is having good alkaline content, TFM value and pH value. The ghee oil is a saturated fat and it is animal fat it gives hardness to soap quickly than other oils. The coconut oil is cheapest oil and it is available in plenty (6). The olive oil, sunflower oil is very expensive and they are not common oil hence they are not very much suitable to prepare soap commercially (15). For the commercial production of soap, the palm oil, coconut oil is beneficial but they are not good for skin health.

Mahua oil in soap paces up the process of saponification. It has antimicrobial activity, which will enhance the medicinal importance of these soaps (6). Jatropha, Castor and Mahua oil are comparatively cheap, and have high medicinal value. So it can develop great importance in cosmetic as well as pharmaceutical sector (6). Soaps from non-edible oil has more potential of inhibiting bacterial growth as compared to commercial antiseptic soap, which shows that production of soap from non-edible oil could be of great importance in agriculture as well as pharmaceutical sector. Rice bran oil reduces the content of unsaponified mono-unsaturated fatty acids in natural herbal soaps, when incorporated in the formulation at the expense of olive oil (7). Shea butter soap has the highest activity against *Klebsiella granulomatis*, while soaps made from blend of palm kernel oil and Shea butter had highest activity against *Aspergillus niger* (2, 5). The production of soaps using this shea butter, palm kernel oil is highly cost effective (4, 9). Soaps prepared from Jatropha Oil contain ingredients which have antifungal and bactericidal effect and it also prevents skin rashes (11-13). The qualities of soaps produced by the shea butter, palm kernel and plantain peels finds application in

exploiting vegetable matter to generate alkali for soap production(2,14). It helps to keep our environment free from the agricultural wastes that makes it untidy. Moreover, it is eco-friendly and it makes use of the locally available raw material (15).

Neem oil is rich in essential fatty acids (EFAs), triglycerides, vitamin E and calcium. Because of the presence of EFAs, vitamin E, neem oil penetrates deep in to the skin to heal the minute cracks occurring due to severe dryness(1). Neem stimulates collagen production, which is good to prevent aging of skin. Vitamin E acts as a free radical scavenger, by hindering the oxidizing processes in the skin. It promotes soft and supple skin, and helps to reduce old scars and promotes healing (17). The soaps prepared from coconut oil, olive oil, peanut oil can be used as a biopharmaceutical product for the treatment for bacterial skin infections, and hence it can be used as normal herbal bath soap (18).

Beef tallow, coconut oil and waste vegetable cooking oil waste can be used after purification and bleaching together to produce toilet (bath) soaps (19). It provides skin hygiene. It provides good lather stability and firmness to soap.

II. Materials used

A. Caustic soda

Caustic soda or Sodium hydroxide is essential in soap making. When sodium hydroxide is added to water it forms lye solution. When this lye solution is mixed with oil or fats, it leads to the chemical reaction called saponification and subsequently soap is formed.

B. Cold Pressed Coconut oil

Cold pressed coconut oil is have not been exposed to high heat before or after pressed. It is extremely nourishing, nutrient rich and offers proper moisture to the skin. Coconut oil hydrates when it is applied directly to skin. It is an excellent moisturizer. When it combines with sodium hydroxide it enhances the cleansing property of the skin. It helps to remove dead skin and dirt from the body. It helps to firm skin and prevents antiaging as the soap is rich in antioxidants.

C. Water

Water is a universal solvent. It is a crucial component in soap making process. It is used to dissolve sodium hydroxide lye. When sodium hydroxide, oil and water interact saponification process gets started.

D. Multani mitti

Multani mitti is a quintessential home ready for revitalising and rejuvenating skin. It is potent healing clay which absorbs the impurities like accumulated sebum, sweat oil and dirt from the clogged pores. It has bleaching property to reduce blemish and dark spots.

E. Javadhu

Javadhu –“The perfume from paradise”, an ancient fragrance used for 1000’s of years in South India, which was formulated by Sagas lived in Tamilnadu. It gives a soothing and divine fragrance, which refreshes the world around us, vitalises the mood and charisma in every moment of life.

III. Results & Discussion

For the preparation of soap, we have to melt the fat first (Fig1) Soap preparation Lye (NaOH) was dissolved in distilled water then cooled to room temperature. It was mixed with coconut oil and heated to room temperature again (Fig 2). It has to be mixed thoroughly. Desired materials to enhance the properties of soap like multani mitti and javvadh are added in this stage (Fig 3). Then it was carefully poured into lye water and blended until to “trace” form (Fig 4). After that it was allowed to pour in to the moulds and kept in the shady place for 40 days to solidify and harden as masses of soap (Fig 5 and Fig 6).

In this research paper, authors made a sincere effort to study the materials, methods adopted for the manufacturing of toilet soaps. From the gained experience we tried to formulate toilet soap and it was successful. Synthesizing of the soap came out well according to our expectation. The texture of the soap was hard. It showed good foaming stability and produced more lather. It regained its fragrance too. Various stages in our preparation of soap as shown below



Fig 1: Melting of fats/oils



Fig 2: Mixing of lye mixture and fats



Fig 3: Desired materials to enhance the properties of soaps are also blended in the mixture



Fig 4: Blended mixture is poured in to lye water to form the “trace”



Fig 5: The finished product after pouring into moulds



Fig 6: The finished product in oval shape

Conclusion

Soap production technology is an area in which it can contribute much to the development of national economy. It can provide wide employment opportunities for the youth and the ladies. The prepared soap has shown good physical properties which can be due to quality of the materials and additives used. We used natural and high quality ingredients in our soap making. The usage of our soap is an organic way to stay skin nourished and hydrated. Carefully hand-picked oils and butters are added during the cold press process of organic soaps. Herbs like multani mitti were added for further benefit of the skin and create the best effects.

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