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RESEARCH ARTICLE

Embedding *Luffa acutangula* in the Biotic Cleanser

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ABSTRACT

Cleansers are essential toiletries that ensure healthy hygiene. The microbeads are used for exfoliation processes in the cosmetology and are small in size like 0.5mm, which leads to marine contamination. *Luffa acutangula* L., as an alternate source for the microbeads. The present investigation is to prepare the scrub by embedding the *L. acutangula*, with *Aloe vera* and Fuller's Earth and to determine the pH, moisture content, total fat molecules, alkali content, foam formation. The pH of the sample scrub that has been prepared is about 9 and percentage of TFM near grade 2. The foaming potential was valued to be more or less equal to other scrubs as per BIS. The results compared with the data from the BIS and it can be concluded that the values determined are within the limits set by BIS so, it could be used as an alternative for the products that contain microbeads.

Keywords: Cleanser, Exfoliation, BIS

INTRODUCTION

Cleansers are boiled version of sodium salts of fatty acids is certainly one of the most essential toiletries that ensure healthy hygiene. Not only does it remove dirt from the grimy body, and claims to keep bacteria at bay, its fragrant properties helps one feel fresher, cleaner and better. Although the first recorded evidence of the manufacturing of soap-like materials dates back to around 2800 BC in ancient Babylon, commercial soap production began in England around the end of the 12th century. There, because of the heavy taxes, soap remained an expensive item until 1853, when the tax was repealed. In the 19th century, soap gained popularity throughout Europe and across British-occupied regions.Today, India, more than 700 registered companies manufacture bar/cake and liquid soaps of various kinds with combined annual revenue of over Rs 1,700 corers. These soaps were embedded with plastic micro beads to enhance its potential of cleansing activity (Anonymous, 2016).

Plastics have a high rate of benefits and efficiency across the people living in the society. As a result of this the use of plastics has increased around 20 times compared in past 50 years. Some plastic micro beads are manufactured in purpose for or in the use of cosmetics. Micro beads reach and persist in the environment in large numbers because they are in products which are designed to be 'rinsed-off' and flushed down the drain. They are not captured by most wastewater treatment systems. In 2015 United Kingdom (Napper *et al*., 2015) estimated that between 4594 and 94,500 microbeads can reach the environment per use of just one facial scrub containing microbeads. In 2013 a study sampled for microbeads in the Laurentian Great Lakes, USA found that microbeads were present very high in number. It was estimated approximately 43,000 microbeads particles/ km^2, with one sampling location downstream from a major city containing 466,000 particles/km^2. In 2015, United Kingdom scientific study of facial scrubs found that the tested products could contain between 137,000 to 2,800,000 microbeads per bottle (Eriksen *et al.,* 2013).

Every year many whales are found dead in these oceanic areas because of the consumption of these microbeads and then these get cloated in their digestive systems. In 2013, a grey whale was found dead and examined due to which that it had consumed about 34 pounds of plastic in its stomach. These products consist of polyethylene, polypropylene, polysterene petrochemical products, polyethylene terephthalate, polymethlyl methacrylate (Fendell *et al*., 2009). They are found in products like Bioré, Deep Clean, Colgate max clean, Clearasil, Clean and clear etc., These microbeads are used for exfoliation processes in the cosmetology. Exfoliation is nothing but the removal dead skin from the skin's outermost surface. Plastic microbeads are very small in size like 0.5mm. Waste water treatment plants are designed to filter only human waste but they could not filter these plastic microbeads as because of their size (James *et al*., 2017). The marine species are not able to distinguish between their usual food and these microbeads. Marine species have been shown to uptake these particles, potentially introducing toxins to the base of the food chain. Microbeads have the potential to transfer up the food chain, which may lead to consumption by humans at the end. Humans may consume these microbeads either by consumption of fishes or by uptake of commercial salts (Ali karami *et al*., 2017). Micro plastics were taken up via the gills, and ingested into the stomach (Cole *et al.,* 2011). From there, they were taken up into cells, and translocated into the circulatory system. The impact of micro plastics on the marine environment has received significant attention from regulators in various parts of the world.

So, for this reason we could opt for the traditional methodology of using the *Luffa acutangula* Linn., commonly known as ridge gourd as an alternate for the microbeads. It belongs to the family Curcubitaceae (Brindha *et al*., 2016). The entire plant of *Luffaacutangula* is medicinally important and is used extensively in Indian traditional system of medicines. From Ayurvedic point of view, ridge gourd increases vata (the impulse principle necessary to mobilize the function of the nervous system) and kapha (the body fluid principle which relates to mucous, lubrication and the carrier of nutrients into the arterial system) and also it cools down and pacifies the dosha pitta (the energy principle which uses bile to direct digestion and hence metabolism into the venous system) in the body (Manikandaselvi *et al.,* 2016). Thoroughly ripened *L.acutangula* when its skin is removed, and divested of the seeds, is left with the skeleton of xylem fibers. It is this loofah with its network of fibers that becomes spongy when soaked in water. The loofah, in its spongy form, has been used for scrubbing and/or cleansing the skin during bathing or showering, making it an excellent natural exfoliating agent. Ridge gourd is allowed to dry and mature on the vine and it can be harvested as a sponge. This sponge has been used traditionally from ancestral period. They are considered to be useful in removing dead cells from the skin thus making the skin smooth and conditioned. The blood purifying properties of ridge gourd are helpful against pimples and acne problems. Loofah sponge is also effective in fighting off foot and body odour. Juice of ridge gourd mixed with other healthy vegetables taken daily helps in strengthening the immune system and helps the body in fighting against infections effectively. Ridge gourd loofah is a very good alternative that could be used as a replacement for the microplastics (Ananthan *et al.,* 2012).These ridge gourd loofah are grinded and then made to a corous powder which are used as an alternate for the microbeads that are present in the cosmetics and cleansers.

MATERIALS AND METHODS

Preparation of the Soap (Phansteil, 1998)

Here we use two types of oils and a base solution for the preparation of the soap. Taken 150 ml of olive oil and 150 ml of coconut oil and then measured 72 ml of NaOH solution and kept aside. This oils and the base solution are slowly heated to 32^{o}C and then both the oils and the NaOH solution were slowly mixed. The base solution is poured along the sides of the beaker to avoid bubble formation. The solutions were mixed using a blender. A thick aqueous solution is formed. At this stage the finely grinded *Luffa acutangula* fibers has been embedded and essential flavours like honey or cardoman flovours were added to it. Along with these Bentonite Clay (Multanimitti), *Aloe vera* gel was also added. This mixture was poured onto moulds and left for 24 hours for hardening purpose.

Analysis of pH (Viorica, 2012)

5 grams of soap sample has been taken and then completely dissolved in 100 ml of distilled water. This solution was tested with pH paper as well as pH meter. The colour change was observed in the pH paper. The reading was noted that was shown in pH meter.

Test for Moisture Content: (Viorica, 2012)

Firstly the china dish were washed and then dried in hot air oven and then cooled. Then 5 grams of test soap was taken and then placed in the dish and then weighed. Initial weight was noted. Then it has been dried for half an hour in hot air oven and then the weight was measured. The loss in weight and percentage of moisture was calculated by:
% moisture = mass of water ÷ dry mass of sample ×100

Determination of Total Fatty Molecules in soaps (Betsy, 2013)

5grams of soap sample was dissolved in 100ml hot water. About 40ml of 0.5N HNO_3 was added to make it acidic. The mixture is heated until fatty acids are floating as a layer above the solution. It was then cooled in ice water for the solidification of the fatty acids. The fatty acids were separated and the aqueous solution was treated with 50ml chloroform to remove the remaining fatty acids. The separated fatty matter was mixed together, solvent was evaporated. The total fatty matter present was calculated by the formula below:
Percentage of fatty matter = (y – x) × 100 ÷ weight of sample

Determination of Total Alkali Content (Betsy 2013)

5gm of soap sample was dissolved in 100ml hot distilled water. About 40ml of 0.5N HNO_3 is added to make the solution acidic. The mixture was heated until fatty acids found floating as a layer above the solution. It is cooled in ice water for the solidification of fatty acids. The fatty acids were separated and the aqueous solution was treated with 50ml chloroform to remove the remaining fatty acids. The aqueous solution was measured and 10ml of it was titrated against 0.5N NaOH using methyl orange as an indicator. The colour change from yellow to pink colour indicates the end point. The titration value was noted and then with that the alkali content present was calculated by the formula:
Total volume of the aqueous solution = V ml
10 ml of aqueous solution required t ml of NaOH
V ml of aqueous solution requires = V*t /10 = A ml.
Amount of NaOH required by acid in aqueous solution =A ml
Volume of HNO_3 required, B ml =A x Normality of NaOH / Normality of HNO_3
Volume of HNO_3 required for neutralizing NaOH = C=40 – B
Amount of NaOH in 1000 cc of soap solution (E) = (C x 40 x Normality of HNO_3 g) /1000
250 cc of soap solution contains (F) = (E x 250) / 1000 g
2 NaOH→ Na_2O + H_2O
80 gram of NaOH gives 62 g of Na_2O

F g of NaOH requires (Y) = (62 x F) / (80) g of Na_2O
Weight of soap taken = 5 g
% of alkalinity = (Y x 100) / w

Test for foam formation (Viorica, 2012)

The sample soap was taken and then washed in running water to check the formation of lather. This was done to verify the amount of time take by the soap for the formation of foam. These methodologies that were assayed for the prepared soap was given by the Bureau of Indian Standardsunder chemical section.The prepared sample soap was tested to satisfy the standards as prescribed by the BIS.

RESULTS

The usage of *Luffa acutangula* in the cleanser that has been prepared in the laboratory has satisfied the regulations of the Bureau of Indian Standards.The results were compared with those of other soaps that have been in markets at present.

There are different grades and percentage that the Bureau of Indian Standardscomprises. All these percentages have to be satisfied by the product that has been prepared.

Prepared Soap

Figure 1 shows **t**he soap has been prepared in the laboratory under sterile condition by using olive oil, coconut oil, *Aloe vera* gel, Mulltanimitti and embedding *Luffa acutangula*

pH Analysis

The pH of the sample soap that has been prepared is about 9. This pH of 9 indicates that the soap is basic in nature. According to the standards of BIS pH 8 to pH 10 of soaps are acceptable.

The table 5.1 shows the comparitive results between the commercial soaps and the sample soaps. The pH of the test soap has been around the grade 2 soaps, according to the BIS.

Moisture Content

The moisture content of the soap was estimated.

Initial weight of sample is 5 grams. Final weight of sample is 4.43 grams. The loss in mass of the 0.57 grams. By the formula,

% moisture = mass of water ÷ dry mass of sample × 100
% moisture = 0.57 ÷ 4.43 × 100 = 12.86 %

There is no specific requirement of moisture content as per the national standard. It should not be too high or too low. Here when compared to the Dove and Nivea product, the moisture content is higher, but when analyzed with Jhonson, Dermafex products the moisture content is low.

Determination of TFM

The most important factor to be considered in soap quality is its total fatty matter (TFM). Higher the TFM quantity in the soap, better is its quality. As per BIS, Grade 1 soaps should have 76% minimum TFM, while Grade 2 and Grade 3 must have 70% and 60% minimum TFM, respectively. The TFM level of the sample soap was analyzed:

% of TFM = (y – x) ×100 ÷ weight of sample
% of TFM = 31.67- 27.67 × 100 ÷ 5
% of TFM = 69.6

The sample soap that has been prepared shows a percentage of TFM near grade 2 soaps as per the norms of the BIS as prescribed. The TFM percentage is lower when compared to that of Dove, Pears and Jhonson's baby soap. The percentage of TFM recorded is slightly higher than that of Lux soap product.

Determination of Total Alkali content

Standard requirement of alkali content as prescribed is 3 per cent maximum. The free alkali in soap is usually made of hydroxide of sodium or potassium. Alkalinity may also be due to the presence of sodium silicate or other alkaline compounds that are sometimes added in the soap.

Total volume of the aqueous solution = V = 100 ml

10 ml of aqueous solution required 0.5 ml of NaOH

100 ml of aqueous solution requires = 100×0.5 /10 = 5 ml.

Amount of NaOH required by acid in aqueous solution =A= 5 ml

Volume of HNO_3 required, B ml =5 ×0.1 /0.5 = 1 ml

Volume of HNO_3 required for neutralizing NaOH = C=40 – 1= 39ml

Amount of NaOH in 1000 cc of soap solution (E) = (39 x 40 x 0.5 g) /1000= 0.78g

250 cc of soap solution contains (F) = (0.78 x 250) / 1000 g = 0.19 g

$2\ NaOH \rightarrow Na_2O + H_2O$

80 grams of NaOH gives 62 g of Na_2O

0.19 g of NaOH requires (Y) = (62 x 0.19) / (80) g of Na_2O = 0.14 g

Weight of soap taken = 5 g

% of alkalinity = (0.14 x 100) / 5= 2.8 %

The percentage of alkalinity when compared to other soaps the test sample percentage of alkalinity is higher (Table: 5.4). But this percentage is below the limits as prescribed by the BIS.

Foaming Potential

Lather is the foam or the froth created by soap when stirred in water or while bathing or washing hands. It is an important parameter for acceptability of soaps. To test the soap's ability to create lather, the soap is taken and washed in running water and the form is measured in measuring Jar. It took 7 seconds for the sample soap to make upto 103ml of foam in measuring jar. The foaming potential of the test soap was analyzed. This values were more or less equal to other soaps when compared (Table: 5.5). This was not too high or low when placed with comparison with other branded soaps. Hence, the test sample soap showed the results that has been satisfying to all the regulations that has been placed by the Bureau of Indian Standards,and it does not show any type of errors because of embedding the *Luffa acutangula*. By the preparation and usage of this soap which consist of *L. acutangula* instead of microbeads that has been present in other products, we could surely get rid of this microplastic pollution that has been found vastly in all parts of the nation. India is the country which still doesn't got affected by this microplastic pollution, but if we continue to adopt for the western culture, soon we would also get affected by this and all the aquatic regions surrounding the country will be affected. Ongoing by the words of the ancestors as prevention is better than cure, we should stop using the foreign products and has to go for Indian as well as natural products.

DISCUSSION

The pH of the Hotel soaps were higher than that of any compared soaps like, Palmolive, bubble magic, and the test sample soap. The pH of the hotel sample soaps were 10.3, whereas the pH of the prepared soap is 9, which is acceptable by the BIS.The high pH content indicated high percentage amount of unspecified and unsaponificable matter due to incomplete alkaline hydrolysis.Moisture content of the soap prepared was similar to the Dove, Nivea, Jhonson's baby soaps. There is no specific requirement of moisture content as per the national standard. It should not be too high or too low. The study indented to determine the total alkali content and total fatty matter of soaps, revealed that, the soaps which have high total fatty matter and low alkali content are having good quality. The low total fatty matter is associated with hardness and lower quality of soap and it is the most important characteristics describing the quality of soap. As per BIS, Grade 1 soaps should have 76% minimum TFM, while Grade 2 and Grade 3 must have 70% and 60% minimum (Betsy 2013). The TFM of the test cleanser is equal to the soaps of grade 2. The

higher TFM was found in Jhonson's baby soap. Among the bathing soaps that has been analyzed, it is observed that, all the soaps having alkali content in the range of 2-3% and the fatty matter content between 60-80%, shows an indication of good quality. Soap samples that have lower alkali content and higher TFM value, makes them good for health and environment. Lather is the foam or the froth created by soap when while bathing or washing hands. It is an important parameter for acceptability of soaps. All the brands had undergone the lather test. Higher scores of lather shows the good quality of the cleanser (Viorica, 2102). The sample cleanser that has been prepared has various positivity. It is suitable for all people as the pH is basic. The pH is low when compared to other hotel soaps. The moisturizing activity is also moderate, and the TFM is also in sufficient percentage that it could be also used for people who possess dry skin. The *L. acutangula* that has been embedded shows no toxicity (Anitha, 2014) neither to the people nor to the aquatic living beings. Altogether, soap prepared using *L. acutangula* hold numerous medicinal (Jyothi, 2010) value and hence it is safe for the use of public.

SUMMARY AND CONCLUSION

Microbeads are the plastic pollution found worldwide. It affects the marine ecosystem by causing hazards for the aquatic fishes living in the ecosystem. The fries and fishes couldn't identify their own food with these microplastics, and due to the consumption, it results in their fatal death. In order to replace these microbeads in the current study, *Luffa acutangula* has been used as an exfoliate in the cleanser that has been prepared. The soap prepared had undergone the tests as mentioned in the Bureau of Indian Standards, and it also elate the margins that has been prescribed in BIS. The work was carried for commercial soaps (Dove, Palmolive, lux, Fiama di wills, Nivea, Jhonson's baby soap) with the test sample soap that has been prepared. It was analzed for pH, TFM, Alkali content, Moisture content, and foaming property. A cursory look at the obtained results revealed similarities between the commercial soaps and the test cleanser. The results were compared with the data from the BIS and it can be concluded that the values determined are within the limits set by National Standards. As the test cleanser gratify the BIS, it could be used as an alternative for the products that contain microbeads.

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Table 1.Indicates the pH of test soap

Soaps	pH	BIS
Test Soap	9	The pH standard as per the Bureau of Indian Standards is from 8 to 10.
Palmolive aroma crme	9.5	
AMBR (Hotel brand)	10.3	
Clean and clear	8.2	
Bubble magic	7.2	

Table: 2. Moisture content present in the test samples

Product	Moisture %	BIS
Test soap	12.8	There is no certain percentage published by Bureau of Indian Standards for the moisture content of the soaps.
Dove	10	
Nivea	10.3	
Jhonson	16.2	
Dermafex	14	

Table: 3. Shows percentage of TFM present in samples

Soap	% of TFM	BIS
Test sample	69.6	The TFM level for grade 1 soaps are 76% to 80% as per the norms of Bureau of Indian Standards
LUX	68.2	
Jhonson's baby soap	77.6	
Pears	71.6	
Dove	73	

Table: 4. Shows percentage of alkalinity in samples

Soap	% of Alkalinity	BIS
Test sample	2.8	The percentage of alkalinity could be upto 3% as by the Bureau of Indian Standards
Lux	2.3	
Jhonson's baby soap	2.08	
Pears	1.61	
Fiama di wills	2.31	

Table: 5. Foaming potential of the soap

Soap	Foam height	BIS
Test sample	103	As per the regulations of Bureau of Indian Standards, the foaming level should not be too high or low
Dove	115	
Jhonson's baby soap	105	
Nivea men	107	
Park avenue	113	

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