

FORMULATION AND EVALUATION OF HERBAL SOAP***Shivi Bhasin, Arvind N. Shukla, Shristi Raj, Susmita Nath and Rushaan Abdulla**

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ABSTRACT

Skin is the prime source for the entry of any pathogen in the body, it is the most important protective layer of the body as it serves to protect the body from pathogenic attack. One, important way to limit the entry of pathogens in the body via skin, is by maintaining the hygienic state of the skin, this can be achieved by using soaps every day during bathing. The chemical based soaps contain harsh chemicals which can cause damage to the skin, so development of a herbal soap containing plant extracts is need of the hour. Some plants are known to have antimicrobial, anti-inflammatory, anti-scar, anti-spot, anti-acne and anti-wrinkle effect and these properties make them fit for use in any herbal soap. In the present study five different soap compositions were formulated according to different skin types, by using neem, tulsi, green moong dal, coffee, green tea, sugar, coca powder etc. as chief ingredients. The prepared soap formulations were tested for different evaluation parameters like color, odor, texture, pH, moisture content, foam forming and form retain capacity, antimicrobial activity, skin irritability etc. The obtained results were compared to the standard where the soap showed optimum results and was found to be fit for consumption.

KEYWORDS: Herbal soap, Antimicrobial, Anti-inflammatory, Formulation & skin types.**INTRODUCTION**

Skin is one of the most important organs of the body as it is the first line of defense and is also the first protective layer of the body. At, the same time it is also vulnerable to a wide range of problems, as it is the site of entry for many microorganisms. It is also the largest organ of the body which protects the body from entry of many harmful pathogens, it is so, required to keep the skin clean and free from any microbial attach this is mostly achieved by applying lotions, gels and soaps on the skin. However, a common problem related with the application of these products is that most of these products are synthetic and are loaded with chemicals, in order to overcome this problem extracts from plants are derived and are used for making herbal products which do not have any negative effects on skin. One such product which should be used daily to keep the skin and body free from any infection is herbal soap.

A soap is generally defined as a combination of salts of fatty acids used for cleaning body. Generally, when triglyceride fats hydrolyze into fatty acid, they react with alkali to form soap and the process is termed as saponification (Sucharita 2020). However, one problem is that these chemically synthesized soaps contain harmful substances like mercury, aluminum, phenol, plastic and other substances which are very harsh to skin and may also cause many problems as when applied to the skin (Talreja *et al.*, 2023). After, being absorbed by

skin these chemicals also reach other organs of the body and cause considerable amount of damage to them, which gives way for development of a herbal product having minimum side effects. Since, ancient time curing disease by using herbal medicine has been a common practice in India. Natural remedy systems of Indian origin like Ayurveda, Siddha and Unani have been used widely around the world to treat several deadly diseases as a result of which the demand for herbal soaps has increased considerably. Thus, development of a herbal soap containing plant extracts and other herbal ingredients in optimum proportion is need of the hour. A herbal soap is defined as an aggregation of plant extract, base soap and other necessary herbal compounds or oils which are able to nourish the skin without having any negative effect on it (Kumar Sudheer 2022). These soaps contain fair amount of anti-oxidants and have optimum antimicrobial and antiseptic action. They promote conditioning of skin, are soft to skin and have a pleasant aroma (Vigneswaran 2022 and Sudherani 2023). Thus, the current study was planned with the view of developing herbal soaps, synthesized by combining plant extracts, herbal oils and essential oils which can nourish the skin in best possible manner by causing minimum harm to the skin. The study also aims to develop different herbal soaps according to different types of skin so that they can give maximum benefit to the skin and can fulfill the requirement of an individual's skin specifically.

MATERIALS AND METHODS

For the preparation of herbal soap following steps are followed (Fig.1.).

(a) **Preparation of Soap Base:** For, preparation of Soap following steps are followed.

- (I) About 15 gm of Sodium Hydroxide (NaOH) was dissolved in 100 ml distilled water in a non-metallic pan.
- (II) The pan was heated at about 50⁰C until it becomes transparent, after which it was cooled.

(III) About 35 ml of each palm oil, coconut oil and castor oil were added to the above mixture.

(IV) Place the cover on slow cooker and put it on sim gas.

(V) After this alcohol and glycerin are poured in this mixture and the soap is allowed to simmer for about 30 minutes.

(VI) The prepared sugar solution is then dissolved in water and is added to the mixture.

(VII) Then soap mixture is added to mold and is allowed to solidify (Table 1)

Table 1: Composition of Base Soap.

Serial No.	Soap Base	
	Ingredients	Amount.
1.	Distilled Water	100 ml
2.	NaOH	15 gm
3.	Palm Oil	35 ml
4.	Coconut Oil	35 ml
5.	Castor Oil	35 ml
6.	Glycerin	20 ml
7.	Ethyl Alcohol	30 ml
8.	Sugar	20 gm

Neem Soap: The soap is prepared by following steps.

- (1) Take 100 gm of neem leaves, which are washed and grinded with the help of pistil motor.
- (2) Take 20 gm of soaked green moong dal and grind them fine.
- (3) Add powdered moong dal to the grinded mixture of neem.
- (4) Add 10 gm of fresh alovera extract or alovera gel to the above mixture.
- (5) After this add 10 ml coconut oil, drops of vitamin E oil, tea tree oil and mix them well.

(6) Add 50 ml of rose water to the above mixture and then, add 2 table spoon of glycerin to the prepared mixture.

(7) Take about 50 gm of soap base, put it in a beaker and place it on water bath at around 45⁰C.

(8) To, this preparation of melted soap add the above prepared herbal extract mixture and mix it well.

(9) Place it into soap molds, allow it to cool and place it in refrigerator for about 15 minutes (Table 2).

Table 2: Ingredients of Neem Soap.

Serial No.	Ingredients	Scientific Name	Component	Uses
1.	Neem	<i>Azadirachta indica</i>	Nimbin, Nimbanene, Nimbiol	Anti microbial, Anti acne, Anti inflammatory, Anti Oxidant
2.	Tulsi	<i>Ocimum tenuiflorum</i>	Oleanolic acid, Urosolic Acid, Eugenol	Anti microbial, Anti acne, Anti inflammatory, Anti Oxidant, Skin Brightening
3.	Alovera	<i>Aloe babadensis miller</i>	Amino acids, Vitamins, Lipids, tannins, enzymes, phenol, saponins	Reduces acne, rashes, tanning and sun burn, anti microbial and anti inflammatory
4.	Coconut Oil	<i>Cocos nucifera</i>	Fatty acid, Carprylic acid, lauric acid, oleic acid	Anti microbial, Anti inflammatory, reduces dark spots and facial redness
5.	Vitamin E Oil	Tocopherol	Alpha, Beta tocopherol	Reduces spots, fine lines, wrinkles
6.	Tea Tree Oil	<i>Melaleuca alternifolia</i>	Terpinem-4-ol, 1,8 ciniole, linalool	Anti inflammatory, Anti Acne and fit for itchy skin
7.	Green moong	<i>Vigna radiata</i>	Iron, Potassium, Copper, Magnesium, fiber	Skin Exfoliator, Tan remover and Anti Acne
8.	Rose Water	<i>Rosa damascena</i>	Phenylethanol, Linalool, Nerol	Anti ageing, Skin Smoothing, Reduces skin redness
9.	Glycerin	Glycerol, Propanetriol, Trihydric Alcohol	Alcohol	Moisturizing agent, Retains natural moisture of skin

Rose Soap: For, preparation of Rose soap following steps are followed.

- (1) Take about 200 gm of Rose petals, crush it properly.
- (2) Take 100 gm of Beet root and prepare its extract.
- (3) Take 25 gm of tulsi leaves and prepare its powder, add this tulsi mixture to the above prepared mixture of rose petals and beet root.
- (4) Add 10 ml of fresh alovera gel to the above mixture.
- (5) Add 20 ml of olive oil and 2-3 drops of rose essential oil to the above mixture.

- (6) Add 50 ml of rose water to the above mixture and 2 table spoon of glycerin to the prepared mixture.
- (7) Take about 50 gm of soap base, put it in a beaker and place it on water bath at around 45°C.
- (8) To, this preparation of melted soap add the above prepared herbal extract mixture and mix it well.
- (9) Place it into soap molds, allow it to cool and place it in refrigerator for about 15 minutes (Table 3).

Table 3: Ingredients of Rose Soap.

Serial No.	Ingredients	Scientific Name	Component	Uses
1.	Rose Petals	<i>Rosa rubiginosa</i>	Flavonoids, Terpenes, Tannins, Phenolic Acid	Skin Lightening, Skin moisturizer, Anti Acne and Anti ageing
2.	Alovera	<i>Aloe babadensis miller</i>	Amino acids, Vitamins, Lipids, tannins, enzymes, phenol, saponins	Reduces acne, rashes, tanning and sun burn, anti microbial and anti inflammatory
3.	Olive Oil	<i>Tree Olea europaea</i>	Triacylglycerol, Fatty Acids, Glycerol	Anti Oxidants, Anti inflammatory and moisturizes skin
4.	Vitamin E Oil	Tocopherol	Alpha, Beta tocopherol	Reduces spots, fine lines, wrinkles
5.	Rose Essential Oil	<i>Rosa rubiginosa</i>	Flavonoids, Terpenes, Tannins, Phenolic Acid	Skin Lightening, Skin moisturizer, Anti Acne and Anti ageing
6.	Rose Water	<i>Rosa damascena</i>	Phenylethanol, Linalool, Nerol	Anti ageing, Skin Smoothing, Reduces skin redness
7.	Glycerin	Glycerol, Propanetriol, Trihydric Alcohol	Alcohol	Moisturizing agent, Retains natural moisture of skin

Orange Soap: For, preparation of Orange Soap following steps are followed.

- (1) Take about 200 gm of orange, grind its peel part properly.
- (2) Add 10 ml of fresh alovera gel to the above mixture.
- (3) Add 20 ml of olive oil, 2-3 drops of Orange essential oil and 2-3 drops of Vitamin E oil to the above mixture.

- (4) Add 50 ml of rose water to the above mixture and 2 table spoon of glycerin to the prepared mixture.
- (5) Take about 50 gm of soap base, put it in a beaker and place it on water bath at around 45°C.
- (6) To, this preparation of melted soap add the above prepared herbal extract mixture and mix it well.
- (7) Place it into soap molds, allow it to cool and place it in refrigerator for about 15 minutes (Table 4).

Table 4: Ingredients of Orange Soap.

Serial No.	Ingredients	Scientific Name	Component	Uses
1.	Orange Peel	<i>Citrus senensis</i>	Vitamin C, Folate, Cellulose, Pectin, Hemicellulose	Skin Lightening, Skin moisturizer, Anti Acne and Anti ageing
2.	Alovera	<i>Aloe babadensis miller</i>	Amino acids, Vitamins, Lipids, tannins, enzymes, phenol, saponins	Reduces acne, rashes, tanning and sun burn, anti microbial and anti inflammatory
3.	Olive Oil	<i>Tree Olea europaea</i>	Triacylglycerol, Fatty Acids, Glycerol	Anti Oxidants, Anti inflammatory and moisturizes skin
4.	Vitamin C Oil	Ascorbic Acid	Alpha, Beta tocopherol	Reduces spots, fine lines, wrinkles
5.	Orange Essential Oil	<i>Citrus senensis</i>	Vitamin C, Folate, Cellulose, Pectin, Hemicellulose	Skin Lightening, Skin moisturizer, Anti Acne and Anti ageing
6.	Rose Water	<i>Rosa damascena</i>	Phenylethanol, Linalool, Nerol	Anti ageing, Skin Smoothing, Reduces skin redness
7.	Glycerin	Glycerol, Propanetriol, Trihydric Alcohol	Alcohol	Moisturizing agent, Retains natural moisture of skin

Anti Ageing/ Skin Whitening Soap: For, preparation of Anti ageing/Skin whitening soap following steps are followed.

- (1) Take about 250 gm of potato, grind it properly to make extract.
- (2) Take 100 gm of haldi and grind it to prepare its extract.
- (3) Take 25 gm of sandalwood and prepare its powder, add this tulsi mixture to the above prepared mixture.
- (4) Add 10 ml of fresh alovera gel to the above mixture.

- (5) Add 20 ml of coconut oil and 2-3 drops of sandalwood essential oil to the above mixture.
- (6) Add 50 ml of rose water to the above mixture and 2 table spoon of glycerin and 2 table spoon of honey to the prepared mixture.
- (7) Take about 50 gm of soap base, put it in a beaker and place it on water bath at around 45⁰C.
- (8) To, this preparation of melted soap add the above prepared herbal extract mixture and mix it well.
- (9) Place it into soap molds, allow it to cool and place it in refrigerator for about 15 minutes (Table 5).

Table 5: Ingredients of Anti ageing/ Skin whitening Soap.

Serial No.	Ingredients	Scientific Name	Component	Uses
1.	Potato	<i>Solanum tuberosum</i>	Carotenoid, Anthocyanin, Phenolic Acid and Minerals	Anti microbial, Anti acne, Anti inflammatory, Anti Oxidant, Anti ageing
2.	Tulsi	<i>Ocimum tenuiflorum</i>	Oleanolic acid, Urosolic Acid, Eugenol	Anti microbial, Anti acne, Anti inflammatory, Anti Oxidant, Skin Brightening
3.	Alovera	<i>Aloe babadensis miller</i>	Amino acids, Vitamins, Lipids, tannins, enzymes, phenol, saponins	Reduces acne, rashes, tanning and sun burn, anti microbial and anti inflammatory
4.	Coconut Oil	<i>Cocos nucifera</i>	Fatty acid, Carprylic acid, lauric acid, oleic acid	Anti microbial, Anti inflammatory, reduces dark spots and facial redness
5.	Vitamin E Oil	Tocopherol	Alpha, Beta tocopherol	Reduces spots, fine lines, wrinkles
7.	Sandalwood	<i>Santalum album</i>	Sesquiterpenic alcohol, alpha santalol	Anti microbial, Anti inflammatory, reduces dark spots, facial redness and Anti Acne
8.	Rose Water	<i>Rosa damascena</i>	Phenylethanol, Linalool, Nerol	Anti ageing, skin Smoothing, Reduces skin redness
9.	Glycerin	Glycerol, Propanetriol, Trihydric Alcohol	Alcohol	Moisturizing agent, Retains natural moisture of skin
10.	Honey	Chemical formula is C ₆ H ₁₂ O ₆	Hexose, sugar, fructose, glucose, antioxidant, flavonoid, pinocembrin & selenium	Exfoliator, Anti acne, Reduces Spots, sunburn and tan.

Scrub Soap: For, preparation of scrub soap following steps are followed-

- (1) Take about 25 gm of walnut, grind it properly to make extract.
- (2) Take 20 gm of sugar and grind it properly.
- (3) Take 20 gm of green tea, 10 gm of coca and 20 gm of coffee grind it well, and add this mixture to the above prepared mixture.
- (4) Add 10 ml of fresh alovera gel to the above mixture.
- (5) Add 20 ml of coconut oil and 2-3 drops of sandalwood essential oil to the above mixture.
- (6) Add 50 ml of rose water to the above mixture and 2 table spoon of glycerin to the prepared mixture.
- (7) Take about 50 gm of soap base, put it in a beaker and place it on water bath at around 45⁰C.
- (8) To, this preparation of melted soap add about prepared herbal extract and mix it well, mix it well.
- (9) Place it into soap molds, allow it to cool and place it in refrigerator for about 15 minutes (Table 6).

Table 6: Ingredients of Scrub Soap.

Serial No.	Ingredients	Scientific Name	Component	Uses
1.	Walnut	<i>Juglans regia</i>	Vitamin B ₆ , E, Folate	Anti microbial, Anti acne, Hydrates skin, Anti Oxidant, Anti ageing
2.	Green tea	<i>Camellia sinensis</i>	Tryptophan, Ethyl glutamine, tryptophan, Aspartic Acid, Tyrosine, Leucine	Anti microbial, Anti acne, removes scar & spots, Anti oxidant, Anti ageing
3.	Coffee	<i>Coffea arabica</i>	4 chromogenic acid, caffeine, antioxidant	Anti microbial, Anti inflammatory, reduces acne
4.	Sugar	<i>Sucrose</i>	Glycolic acid, alpha hydroxyl acid	Exfoliator, treats damaged area of skin, stimulates cell regeneration.
5.	Coca Powder	<i>Erythroxylum coca</i>	Pyrazine, thiazides, pyrones, fiber, vitamin E	Detoxifies skin, exfoliator, tan remover, anti acne, anti scar
6.	Alovera	<i>Aloe babadensis miller</i>	Amino acids, Vitamins, Lipids, tannins, enzymes, phenol, saponins	Reduces acne, rashes, tanning and sun burn, anti microbial and anti inflammatory
7.	Coconut Oil	<i>Cocos nucifera</i>	Fatty acid, Carprylic acid, lauric acid, oleic acid	Anti microbial, Anti inflammatory, reduces dark spots and facial redness
8.	Vitamin E Oil	Tocopherol	Alpha, Beta tocopherol	Reduces spots, fine lines, wrinkles
9.	Sandalwood Oil	<i>Santalum album</i>	Sesquiterpenic alcohol, alpha santalol	Anti microbial, Anti inflammatory, reduces dark spots, facial redness and Anti Acne
10.	Rose Water	<i>Rosa damascena</i>	Phenylethanol, Linalool, Nerol	Anti ageing, skin Smoothing, Reduces skin redness
11.	Glycerin	Glycerol, Propanetriol, Trihydric Alcohol	Alcohol	Moisturizing agent, Retains natural moisture of skin
12.	Honey	Chemical formula is C ₆ H ₁₂ O ₆	Hexose, sugar, fructose, glucose, antioxidant, flavonoid, pinocembrin & selenium	Exfoliator, Anti acne, Reduces Spots, sunburn and tan.





Fig 1: Preparation of herbal extract for herbal soa.

Evaluation of the Herbal Soap: To verify the efficacy and quality of herbal soap, following physicochemical characteristics were tested viz. color, aroma, pH, clarity, dirt, dispersion, foam height, form retention, skin irritation, saponification value etc. The formulations were tested by using following standard methods.

- (1) **Color:** A white background was used to determine the color and visualize the clarity of soap.
- (2) **Odor/ Aroma:** Odor or aroma of sample were analyzed by heating the soap sample on a hot plate.
- (3) **Shape:** Sensory and Visual evaluation of organoleptic properties like shape and clarity was done to obtain correct results.
- (4) **pH:** The pH or hydrogen ion concentration of the sample was determined by preparing 1% of sample, using buffer solution and using pH meter to take the final pH.
- (5) **Dirt Dispersion:** 1% of sample solution was prepared and 2 drops of ink are added to the sample which is taken in a straight glass jar. The jar was then shaken and ink was allowed to settle down and foam was noticed.
- (6) **Wetting Time:** A piece of cotton fabric was taken, was cut into disc shape of 1 inch, then sample weight was determined as how long it took to get wet. In the next step sample is taken and is kept on top of the sample. The disc made of fabric was allowed to float freely on sample and the amount of time the disc took for fabric disc to go sinking from floating is carefully recorded which is referred as wetting time.
- (7) **Foam Forming Ability:** 1 % soap sample solution was prepared and was added to 50 ml water, this was then put in a 10 ml measuring cylinder and the cylinder was then vigorously shaken for more than 10 times. After, shaking for 1 minutes height of the foam was measured and total volume of foam was recorded.
- (8) **Foam Stability:** 1 % soap sample solution was prepared and was added to 50 ml water, this was then put in a 10 ml measuring cylinder and the cylinder was then vigorously shaken for more than

10 times and after 10 minutes volume of foam was calculated.

- (9) **Moisture Content:** For, the estimation of moisture content 10 gm of material was heated in hot air oven at 100°C for an hour. After, this the initial weight of sample was deducted from the final weight of the sample. The moisture content was calculated by using following formula.

Moisture Content= (Difference in Weight/Initial Weight)X 100

- (10) **Skin Irritation Test:** Sample was applied on clean skin to observe any signs of irritability.

- (11) **Determination of Saponification Value:** Saponification Value is defined as mean of molecular weight of fatty acid present in fat or oil. For, calculating its value, 2 gm of soap sample is taken in a conical flask, to this 0.5 M KOH is added. The mixture is subjected to heat of around 55°C along with continuous stirring on a hot water bath. Then, the temperature was increased to 100°C, boiling was continued for 1 hour and titration was performed against 0.5 M HCL by using phenolphthalein as indicator, the disappearance of pink color was the end-point. The value is calculated as-

Saponification Value= Volume of KOHX 28.056/ Weight of Oil (gm)

- (12) **Determination of TFM (total fatty matter):** The total fatty matter of a soap is tested by making the soap react with acid in association with hot water. 10 gm of soap is dissolved in 150 ml of distilled water by heating. The soap solution was treated with 20 % of sulphuric acid and was heated till the solution cleared. The fatty acids were then observed at surface of film which was solidified by addition of 7 gm of bees wax and was again subjected to heat. The formation of cake was removed and TFM was calculates as following-

% Total Fatty Matter= (A-X)/WX100

Where, X=weight of wax

A= Weight of wax+ Oil

W=Weight of Soap

(13) **Antimicrobial Test:** The soap sample was tested for antimicrobial activity by using dilution technique. In this 1 gm of soap was dissolved in 100 ml distilled water, various concentration of sample viz. 5, 10, 20 and 50 mg/ml, after which the antibiotic Ciprofloxacin 5ug was used. The plates were then incubated for 24 hours at 37°C and the zone of inhibition was calculated.

RESULT AND DISCUSSION

The result of various parameters tested for evaluation of poly herbal soap are listed in table 7. Different soaps exhibit different colors according to the ingredients added in them. The neem soap is green in color, the rose soap is dark red in color, orange soap is orange in color, potato soap is white in color and de-tan soap is brownish in color. All the soaps show a characteristic odor which is related to the chief ingredients present in them. All soaps are rectangular in shape and their pH value ranges between 6.5-7.0, the pH values of all soaps are found to lie within optimum range as lower or higher pH value of soap may harm the skin. All the soaps are known to

show good dirt dispersion quality and are reported to show wetting time ranged between 15-25 seconds, the foam forming ability of soap was reported between 15.2-16.5 ml and the foam retention time was reported between 10-15 minutes. This indicates that the leather producing ability of the soap was stable and satisfactory. At the same time the moisture content of the soap lied between 10-13% which is in accordance with the ideal moisture content of the soap ranging between 10-14%. The total fatty matter of the soap ranged between 70-75 % as low percentage of fatty matter in soap may harm the skin whereas, higher fatty matter in soap suggests that the soap has good moisturizing effects on skin. Similarly, the saponification number of the soap lied between 163 gm/liter-165 gm/liter which indicates that the soap is fit for consumption. Similarly, all the soaps are reported to show anti-microbial activity as no microbial colonies are reported in areas where soap solution has diffused, this shows that soaps have anti-microbial properties which inhibit the growth of microbe in areas where soap was used.

Table 7: Evaluation of Poly Herbal Soap.

S. No.	Characters	Neem Soap	Rose Soap	Orange Soap	Potato Soap	De-tan Soap
1.	Color	Green	Dark Red	Orange	White	Brown
2.	Odor	Characteristic	Characteristic	Characteristic	Characteristic	Characteristic
3.	Shape	Rectangular	Rectangular	Rectangular	Rectangular	Rectangular
4.	Ph	7.2	7.0	6.5	7.1	6.8
5.	Dirt Dispersion	Good	Good	Good	Good	Good
6.	Wetting Time	20	18	23	22	16
7.	Foam Formation	15.2	16.1	16.5	15.8	15.3
8.	Form Stability	10	12	12	14	15
9.	Moisture (%)	10	12	13	10	11
10.	Skin Irritability	No	No	No	No	No
11.	Fatty Matter (%)	75	70	71	72	72
12.	Saponification Value	160	162	161	160	163
13.	Anti Microbial Activity	Present	Present	Present	Present	Present

Evaluation and formation of herbal soaps has gained popularity in India and across the globe in recent times as several workers have worked on the formulation and evaluation poly-herbal soap. Different scientist and researchers have used various herbs and plant extracts for preparation of herbal soaps. Nisha & Deepak Kumar (2021) worked on the formulation, development and characterization of herbal soap using *Borassus flabellifer* and *Curcuma zedoaria*. Bothe *et al.*, (2022) reviewed different formulations and compositions used for

preparation of herbal soaps. Patil *et al.*, (2022) worked on the preparation of herbal, anti-aging soap by using aloe-vera. Selvamani *et al.*, (2022) worked on preparation of herbal soap by using plant extracts, whereas, Sanobai *et al.*, (2022) also worked on the formulation of antibacterial poly herbal soaps. Anu *et al.*, (2022), Bhujbal *et al.*, 2023 and Singh *et al.*, (2023) worked on the formulation and evaluation of herbal soap. Talreja *et al.*, (2023) used *Moringa olifera* as the chief ingredient for the preparation of herbal soaps (Fig. 2).



Fig. 2: Prepared herbal soaps.

The current study works on preparation of certain herbal soap containing plant extract as their chief ingredient. The formulations are prepared with different components and as they suit different skin types. For oily skin, neem soap was prepared which contains powdered neem leaves (*Azadirachata indica*) as the neem plant contains mimbidin, nimbotide and azadirachtin along with antioxidant & anti-microbial properties; it also contains the ability to lighten, scar, spots, pigmentation and acne (Visnugopalan, 2013). Along with neem, the soap also contains green moong (*Vigna radiate*) which is rich in iron, potassium, copper, magnesium, fiber, vitamin B₆ and folate and is an excellent exfoliator; it is known to hydrate skin, reduce sun-tan, prevent acne and pimples (Hou *et al.*, 2019). Along with neem and green moong, tulsi (*Ocimum tenuiflorum*) powder is also added to the herbal extract preparation of the soap as tulsi contains oleanolic acid, urosolic acid, rosmarinic acid, carvacrol, linalool and beta caryophyllene etc. which provide antioxidants, anti-aging and antifungal properties to the soap; tulsi is also an excellent cleanser, contains anti-scar and anti-spots properties which further adds skin benefits to the soap (Chen *et al.*, 2014). Soap also contains aloe vera gel (*Aloe baibadensis miller*) which is also an excellent moisturizer, reduces itchy rashes, acne, tanning and sunburn. As aloe vera contains tannins, enzymes, phenol and saponins, it also provides anti-inflammatory and antimicrobial properties to the soap which makes it perfect for being applied on oily skin (Sanchez *et al.*, 2020). Further, coconut oil (*Cocos nucifera*), vitamin E (Tocopherol) oil, tea tree (*Malaleuca alternifolia*) and glycerin are added for moisturizing and soothing the skin (Chavan *et al.*, 2021, Ken *et al.*, 2016, Carson *et al.*, 2006). At the same time, rose water (*Rosa damasena*) is added to the soap mixture which can reduce skin redness and can impart anti-ageing properties to skin (Rana *et al.*, 2023). Thus, the neem soap is formulated with a composition which will suit people with oily skin and will reduce the problem of acne, spots and pigmentation in skin.

Another preparation was of rose soap which was prepared by using rose petals (*Rosa rubiginosa*) as the main ingredient, to which beetroot extract, tulsi powder, aloe vera gel, rose essential oil, olive oil and glycerin were added (Safia *et al.*, 2019). Rose petals contain flavonoids, triterpenes, tannins, phenolic acid and polysaccharides whereas beetroot (*Beta vulgaris*) contains magnesium, potassium, sodium, iron, zinc,

copper, boron, Sulphur, folate, lycopene (Chan *et al.*, 2021). Both rose petals and beetroot have anti-inflammatory, anti-spots and skin brightening properties which make the soap fit for all skin types and will be especially beneficial for those who want skin brightening effects. To this soap, further, tulsi, aloe vera gel and glycerin are added to provide hydration, reduce sun tanning, spots, wrinkles, acne and are responsible for soothing the skin. The soap contains drops of rose essential oil which impart anti-inflammatory and anti-spot property to the soap; it also provides fragrance to the soap, this makes the soap fit for producing skin lightening and brightening effects and the soap can be used by a person of any skin type.

Similarly, orange soap was prepared by using orange peel (*Citrus sinensis*) and orange essential oil. Both these contain cellulose, pectin, hemicellulose, sugar, protein, phenolic compounds, neonesperidin, hesperidine, nobilentin, naritinimididymine and sinensetin (Oyebola *et al.*, 2017). The component of orange aids in skin brightening, provides shine to the skin, contains anti-inflammatory properties, reduces dark spots and evens the skin. Olive oil is derived from *Olea europaea* tree, it contains triglycerol, fatty acids, glycerol, flavors, oleic acid, linoleic acid and palmitic acid; hence, it provides moisturizing, anti-bacterial and anti-wrinkle effects to the soap (Waterman *et al.*, 2008). Vitamin C is also added to the soap which stimulates the formation of collagen fiber, provides anti-inflammatory effect, cleansing effect, anti-wrinkle effect and moisturizes the skin (Chambial *et al.*, 2013). The combination of these ingredients makes the soap suitable for all skin types and particularly for brightening of skin and for reducing wrinkles on skin.

Another soap prepared was anti-ageing or skin whitening potato soap which used potato (*Solanum tuberosum*) as the chief ingredient. To this, potato extract, tulsi powder, haldi powder (*Curcuma longa*), and sandalwood (*Santalum album*) powder were added. The mixture was mixed for some time and to this mixture, aloe vera gel, coconut oil, glycerin and vitamin E oil were added. Potato contains bioactive carbohydrate, proteins, carotenoids, anthocyanin, conjugated phenolic acids and minerals; it also contains natural bleach which lightens dark spots and smoothens skin. Potato is also a rich source of anti-oxidants which impart anti-ageing properties to the soap (Zarzecka *et al.*, 2015). On the other hand, sandalwood contains sesquiterpenic alcohol

alpha and beta santalol which have anti-microbial and skin nourishing property thus, making the soap effective against rashes and ulcer. Sandalwood also provides anti-spot, anti-tan, anti-ageing and anti-septic properties to the soap (Newton *et al.*, 2021). Then, alovera gel, vitamin E oil and coconut oil are added to the soap which help in hydrating and moisturizing the skin (Klen *et al.*, 2016). The soap can be used by any skin type but is best suited for generating skin lightening and anti-ageing effect.

Scrub Soap: For, preparation of scrub soap firstly, walnut is crushed to which powdered green tea, coffee and cocca powder are added the mixture is then mixed properly. After this alovera gel, coconut oil, vitamin E oil, sandalwood oil, glycerin and honey are added to the mixture. Walnut contains vitamin B₆, folate, phosphorus and antioxidants which help to provide anti-aging properties to the soap. Walnut helps to protect from sun-tan, dirt and effect of pollutants on skin (Sharma *et al.*, 2022), it also helps to boost collagen production in skin, keeps skin moist and exfoliates the skin. Coco powder (Katz *et al.*, 2011), coffee and green tea are good exfoliator and exhibit anti-spot, anti-tan, anti-pimple effect. Like walnut they also increase collagen content of body which helps to improve elasticity of skin thus reducing the amount of wrinkles in the skin (Hassan *et al.*, 2019).

Green tea (*Camellia sinensis*) contains enzymes, amino-acids, threonine, glutamic acid, ethyl glutamate, glutamic acid, valine and leucine. It contains polyphenols and pharmacological agents which help to prevent skin disorders and micro relief which acts as a good moisturizer. It also contains catechism viz. epigallocatechin, epicatechin, gallate, epigallocatechin and free radicals which impart anti-ageing properties to the soap (Sotto *et al.*, 2022). Similarly, coffee contains cellulite, antioxidants and trigonoline which smoothen skin and decrease skin scars and sun spots, coffee also contains chlorogenic acid which reduces hyperpigmentation and imparts anti-bacterial and anti-inflammatory properties to the soap (Duangjai *et al.*, 2020). Sugar (Sucrose) is added to the mixture which contains glycolic acid, alpha-hydroxy acid which stimulates the formation of new cells and helps to treat damaged cell portions, sugar is also known to exfoliate skin and maintain skin equilibrium (Danby *et al.*, 2010). Then, alovera gel, Vitamin E oil, honey and coconut oil are added to the soap which help in hydrating and moisturizing the skin, honey in particular is also helpful to reduce the scars and spots on skin. The soap can be used by any skin type but is best suited for generating skin lightening and anti-ageing effect. In all the soaps herbal extracts are mixed with the base soap and the addition of these herbal ingredients to the base soap neutralize and reduce the effect of chemical ingredients in the base soap.

CONCLUSION

Our team has eventually, produced results and formulations for the creation of herbal soaps which contains less chemicals and harmful substances. Five different formulations of herbal soaps exhibiting favorable physical properties were formulated for different skin types. These formulation were tested for different evaluation criteria viz. color, odor, texture, forming time, foaming stability, moisture content etc. The soap was critically tested for antimicrobial activity and skin irritability. The results were compared to standard and it was found that the soap was fit for consumption.

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