Research Article

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FORMULATION OF HERBAL SOAPS FROM *PHYLLANTHUS RETICULATUS* FRUITS AND *TECTONA GRANDIS* LEAVES AND EVALUATION OF ITS PHYSICOCHEMICAL PROPERTIES

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ABSTRACT

The present investigation aimed to develop and evaluate the herbal soap by aqueous extracts of *Tectona grandis* leaves and fruits of *Phyllanthus reticulatus*. The herbal formulation was then subjected to phytochemical screening and evaluated for colour, pH, odour, texture, foaming ability, moisture content and irritation test. The results demonstrated that the herbal soaps revealed the presence of alkaloids, tannins, flavonoids and anthocyanins. The physicochemical results were satisfactory for both the herbal soaps. No such studies related to the preparation of soaps using these extracts have been done so far. Hence, the present study was of great importance and could serve as an alternative to chemical soaps.

Keywords: Herbal soaps, *Tectona grandis*, *Phyllanthus reticulatus*, phytochemical screening, physicochemical evaluation.

INTRODUCTION

Plants have been used as traditional medicine since ancient times. The extract obtained from various parts of plants has been employed in curing various diseases and ailments. Even though many synthetic products are in demand over plant-based products, the safety of plant products has set standards. There is an increasing consumer demand for cosmetics comprising plant-based or natural ingredients[1].

Soap is defined as a mixture of chemical compounds formed due to the interaction of fatty acid with a metal radical. The metals commonly used in the preparation of soap are sodium and potassium. Herbal soap preparation is a medicine that does not contain any artificial colours, flavours, fluorides, etc., and mainly uses different parts of plants as a main ingredient to prepare soap. They are prepared by adding dried herbs and flowers and steam into a soap base. Herbal soaps have antibacterial, anti-ageing, antioxidant and anti-septic properties[3]. Besides these, herbal soaps have good cleansing power, moisturising effects, long-lasting fragrance, no irritation, rich lather and protection against various skin disorders such as (rashes and eczema) and infections such as (ringworm)[4].

The young leaves of *Tectona grandis* and fruits of *Phyllanthus reticulatus* are a source of natural dye because they contain anthocyanin pigment. Anthocyanins are pigments that impart blue, purple, violet, red or magenta in flowers, fruits, leaves, roots and tubers of plants. This pigment is not toxic and is safe to consume. In addition to food colouring, anthocyanins play a crucial role in biological systems, including cardioprotective capacity and the ability to inhibit the inhibition of chemical reactions that cause cancer[5,6].

The present work aims to formulate herbal soap containing the extracts of fruits of *Phyllanthus reticulatus* and leaves of *Tectona grandis* and analyse its phytochemical and physicochemical properties.

MATERIALS AND METHODS

Sample collection and extraction

Fresh leaves of *Tectona grandis* were collected and washed, and the extract was obtained using the water bath at 100 ^{0}C. The extract of *Phyllanthus reticulatus* fruits was obtained by crushing the fruits in distilled water.

Phytochemical screening analyses

Preliminary phytochemical screening was carried out for the aqueous extracts of *T. grandis* and *P. reticulatus* to determine the presence of various bioactive constituents like alkaloids, tannins, saponins, phenolics and flavonoids, anthraquinones, carbohydrates, coumarins, proteins, steroids and terpenoids by using standard methods[7].

Test for Alkaloids
Wagner's test: To a few mL of extract, a few drops of Wagner's reagent (solution of iodine in potassium iodide solution) were added. The formation of a reddish-brown precipitate indicates the presence of alkaloids.

Test for Tannins
Ferric chloride test: To 2 mL of filtrate, 2 mL of $FeCl_3$ (1% ferric chloride) was added. Occurrence of blue, black and green precipitate indicates tannins.

Test for Saponins
Foam test: 5 mL of extract was shaken vigorously with 5 mL of distilled water in a test tube. The formation of stable foam indicates the presence of saponins.

Test for Phenolics and Flavonoids
Ferric chloride test: To 2 mL of extract, a few drops of 10% ferric chloride solution was added. The formation of blue or violet colouration indicates flavonoids.

Test for Steroids
Salkowski test: 2 mL of extract, 2 mL of chloroform, and 2 mL of concentrated H_2SO_4 were added along the sides of the test tube and shaken well. The chloroform layer appeared red, and the acid layer showed greenish-yellow fluorescence, indicating the presence of steroids.

Test for Terpenoids
5 g of powdered dyes were dissolved in ethanol; 1 mL of acetic acid was added, followed by concentrated H_2SO_4. The change in colour from pink to violet indicates terpenoids.

Test for Anthraquinones
2 mL of filtrate, 2 mL benzene and 1 mL ammonia solution were added and shaken well. The formation of pink/red/ violet colour indicates anthraquinones.

Test for Carbohydrates
Molisch test: To 1 mL filtrate, a few drops of Molisch's reagent were added, followed by 1 mL of concentrated H_2SO_4, along the side of the test tube. The mixture was allowed to stand for two minutes and then diluted with 5 mL of distilled water. The formation of red or dull violet at the interface of the two layers was a positive test.

Barfoed test: 1 mL of Barfoed's reagent was added to the filtrate and then heated in the water bath for 2 minutes. The reddish precipitate of cuprous oxide was considered a positive test.

Benedict test: To 2 mL of filtrate, a few drops of Benedict's reagent were added. The solution is then heated in a boiling water bath for 3 minutes. The formation of a reddish precipitate indicates the presence of carbohydrates.

Fehling test: 1 mL filtrate was heated with 5 mL equal volumes of Fehling's solution A and B. The red precipitate of cuprous oxide indicated a positive test.

Test for Proteins
Biuret test: To 3 mL of extract, 1 mL of 4% sodium hydroxide and 1 mL of 1% copper sulphate was added. The change of the solution to violet or pink indicates the presence of proteins.

Xanthoprotein test: To 3 mL of extract 1 mL concentrated H_2SO_4, was added. The appearance of a white precipitate, which turns yellow upon boiling and orange upon adding ammonium hydroxide (1 mL), indicates the presence of proteins.

Ninhydrin test: To 3 mL of extract, 3 drops of 5% lead acetate solution were added and boiled in the water bath for 10 minutes. The change in colour of the solution to purple or blue indicates the presence of amino acids.

Test for Coumarins
NaOH test: To 1 mL of filtrate, 10% NaOH and chloroform were added. The yellow formation shows the presence of coumarins.

Test for Anthocyanins
To 2 mL of extract, 2 mL of 2N HCl was added. The appearance of a pink-red colour that turns purplish blue after the addition of ammonia indicates the presence of anthocyanins.

Formulation of herbal soap

Soap base was purchased from a local market in Margao, Goa. About 100 gm of soap base was cut into pieces and melted into a liquid base using the double boiling method. 10 mL of aqueous fruit extract of *Phyllanthus reticulatus* and 10 mL of aqueous leaf extract of *Tectona grandis* were added. A few drops of coconut oil were also added. The mixture was poured into a mould and allowed to dry.

Market soap
Market soap was purchased from the shop to compare the physicochemical properties of market soap to that of herbal soap.

Physicochemical evaluation of herbal soap
Organoleptic parameters like colour, odour and texture were evaluated for herbal and market soaps either manually or physically[8].

Determination of pH
2 gm of each herbal and market soap was dissolved in 10 mL of distilled water and stirred until the sample dissolved. The pH was determined using a pH meter.

Determination of foaming ability
2 gm of herbal and market soap was dissolved in 50 mL water in a 100 mL measuring cylinder and shaken vigorously for 2 minutes. It was allowed to stand for 10 minutes, and the foam height was measured. The experiment was repeated thrice, and the mean was computed.

Determination of moisture content
10 gm of herbal and market soap was weighed and transferred to a tarred China dish of known weight. It was kept in the oven at 100 ^{0}C for an hour. Then, the sample was weighed along with the China dish to detect the actual weight of the tarred China dish. Moisture content was determined using the following formula.

Moisture content = Difference in weight/ Initial weight X 100

Irritation test
It is done by applying herbal and market soap for 10 minutes on the skin directly.

Table 1: Phytochemical analysis of *Phyllanthus reticulatus* (fruits) and *Tectona grandis* (leaves) extracts

Phytochemicals	*Phyllanthus reticulatus*	*Tectona grandis*
Test for Alkaloids	+	+
Test for Tannins	+	+
Test for Saponins	-	+
Test for Phenolics and flavonoids	+	+
Test for Steroids	-	-
Test for Terpenoids	-	-
Test for Anthraquinones	+	-
Test for Carbohydrates	-	-
Test for Proteins	-	-
Test for Coumarins	-	+
Test for Anthocyanins	+	+

(+) indicates present (-) indicates absent

Table 2: Physicochemical evaluation of herbal and market soap

Parameters	*Phyllanthus reticulatus*	*Tectona grandis*	Market soap (control)
Colour	brown	red	white
Odour	pleasant	pleasant	pleasant
Texture	smooth	smooth	smooth
pH	9.6	9.5	9.8
Foaming ability	7 mL	8 mL	14 mL
Moisture content	0.36	1.47	1.55
Irritation test	No irritation	No irritation	No irritation

Figure 1 A: *Phyllanthus reticulatus* soap

Figure 1 B: *Tectona grandis* soap

Figure 1C: Market soap (control)

RESULTS AND DISCUSSION

Phytochemical analysis

The *Phyllanthus reticulatus* fruit extract revealed the presence of phytochemicals such as alkaloids, tannins, flavonoids, anthocyanins and anthraquinones. Whereas the extract of *Tectona grandis* leaf contains alkaloids, tannins, saponins, flavonoids, anthocyanins and coumarins (Table 1). Alkaloids have analgesic, antispasmodic and antibacterial properties. Whereas the tannins include anti-inflammatory, regeneration and antimicrobial properties. It also has a soothing effect. Saponins have expectorant, antimicrobial and cough-suppressant properties.

Physicochemical evaluation

The formulation of *Phyllanthus reticulatus* and *Tectona grandis* soap was good in appearance with pleasant odour and colour (Figure 1). The pH of *Phyllanthus reticulatus* was 9.6, and *Tectona grandis* was 9.5, which were found to be in a specified range, i.e. 7-10. The pH of the market soap was 9.8. The pH above 11 is considered harsh on the skin, as reported by NAFDAC-National Agency for Food and Drug Administration and Control[1].

The foaming index of herbal soap *Phyllanthus reticulatus* was 7 mL, and *Tectona grandis* was 8 mL. Market soap has a foaming index of 14 mL. The foam generation has little to do with cleansing ability and hence can be considered as a parameter in evaluating soaps.

Moisture content is a parameter that measures the shelf life of a product. High moisture content in soap could lead to a reaction of excess water with un-saponified fat to give free fatty acid and glycerol in a process called hydrolysis of soap on storage. The moisture content of *Phyllanthus reticulatus* was 0.36, *Tectona grandis* was 1.47, and market soap was 1.55 (Table 2).

The herbal soaps prepared contain alkaloids, tannins, phenolics and anthocyanins. These phytochemicals are reported to have anti-inflammatory, antiviral, antitumor, and wound-healing properties. Also, the pH of both the soaps was within the normal range. Thus, the soaps prepared were skin-friendly and can be used as a promising alternative to commercial chemical-containing soaps.

CONCLUSION

The aqueous extracts of the plant materials show the potential in soap formulation. The physicochemical properties of the formulated soap were excellent and comparable to the control. Thus, the soaps formulated could serve as an alternative to chemical soaps.

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