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FORMULATION AND EVALUATION OF TRIDAX PROCUMBENS POLY HERBAL SOAP

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ABSTRACT

This project centers on creating and analyzing a herbal soap made with *Tridax procumbens*, a plant recognized for its medicinal benefits such as antimicrobial, anti-inflammatory, wound-healing, and antioxidant effects. To boost the soap's skincare value, additional botanicals—*Ocimum sanctum* (Tulsi), Aloe vera, and *Curcuma longa* (Turmeric)—were incorporated. Using the melt-and-pour technique, a glycerin-based soap was produced in four variations (F1–F4), each with different extract concentrations. The soaps were assessed for physical attributes (appearance, scent, and transparency), pH, foaming ability and stability, moisture retention, and any adverse skin reactions. Phytochemical tests identified beneficial compounds including flavonoids, tannins, saponins, phenols, and alkaloids. Among the samples, formulation F4 exhibited the best foam stability and moisturizing effect without causing skin irritation. These results highlight the potential of this multi-herb soap as a natural, skin-safe alternative to conventional synthetic cleansers.

INTRODUCTION

This project aims to formulate and evaluate a polyherbal soap using Tridax procumbens, a medicinal plant with proven antimicrobial, wound healing, anti-inflammatory, and antioxidant properties. The formulation also includes Tulsi (Ocimum sanctum), Aloe vera, and Turmeric (Curcuma longa) to enhance skin benefits. Using the melt and pour method, four formulations (F1–F4) were created with varying plant extract concentrations.

The soaps were assessed for their physical properties (color, odor, clarity), pH, foam height and retention, moisture content, and skin irritation potential. Phytochemical screening

confirmed the presence of beneficial compounds like flavonoids, phenols, tannins, alkaloids, and saponins. Among them, F4 performed the best, showing high foam retention, good moisturizing properties, and no irritation.

The introduction highlights the importance of skin hygiene, the drawbacks of synthetic skincare products, and the increasing preference for natural herbal alternatives. Herbal soaps, made with plant-based ingredients, offer therapeutic and gentle cleansing benefits without harsh chemical side effects. Tridax procumbens is emphasized for its broad pharmacological activities, supported by both lab and animal studies.

Review of Literature

- **Neethu Asokan et al. (2024)**

Developed and evaluated **herbal topical treatments** for **bacterial mastitis**, focusing on natural plant-based alternatives for infection control and prevention.

- **Bansode Krushna Ashok & Wankhede Jayshri Sominath (2024)**

Created **transdermal patches** using **Tridax procumbens** aimed at delivering anti-inflammatory effects through skin absorption.

- **Krishna K.R et al. (2024)**

Formulated a **herbal soap with Ocimum tenuiflorum (Tulsi)** for improving **skin health**, showing benefits in cleansing and antimicrobial activity.

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Reiterated findings on Tulsi-based soap emphasizing **skin-soothing and protective**

Properties

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Designed a **herbal handwash** using simple natural ingredients, promoting cost-effective, skin-safe hygiene solutions.

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AIM

Formulation and evaluation of *Tridax Procumbens* polyherbal soaps.

OBJECTIVES

1. To reduce acne and skin irritation dry skin wrinkles, etc.
2. To enhance glow to the face
3. To promote healthy Skin.
4. To enhance the moisturizing properties of skill.
5. To ensure the soap is effective in cleansing and gentle on the skin.
6. To promote wound healing.

Need of Work

- Make natural soap accessible to everyone.
- Improve the quality and consistency of natural soaps.
- Educate consumers about the benefits of natural soap.
- Make natural soap production more sustainable.
- Develop new and innovative natural soap formulations.
- To ensure no or minimal side effects.
- Natural cosmetics are not that expensive. In fact, they are easily available at low cost.

Soap is typically made using a combination of **natural oils, alkalies, and functional additives**

- **Coconut Oil**: Provides excellent cleansing, hardness, and lather, thanks to its saturated fat and lauric acid content.
- **Glycerin**: Acts as a moisturizer and texture enhancer, preventing dryness and cracking while improving lather.
- **Alkali (NaOH/KOH):** Essential for saponification. Sodium hydroxide is used for hard bar soaps, while potassium hydroxide is used for liquid soaps.
- **Stearic Acid**: Adds hardness, stability, and improves moisturizing and lathering qualities.
- **Sodium Lauryl Sulfate (SLS):** A surfactant that improves dirt removal and foam formation, but may cause dryness in sensitive skin.
- **Ethano**l: Used as a solvent to evenly disperse ingredients like fragrances and colors

Plant Profile

1) *Tridax procumbens* (Coat Buttons)

A flowering plant from the Asteraceae family, commonly known as Ghamra in Hindi and Coat Buttons in English. Native to Tropical America, it is now naturalized across Africa, Asia, and Australia.

Scientific Classification

- **Kingdom**: Plantae
- **Family**: Asteraceae
- **Genus**: Tridax
- **Species**: *procumbens* L.

Chemical Constituents

Rich in sodium, potassium, calcium, and bioactive compounds like alkaloids, saponins, flavonoids, and tannins. Contains unique compounds such as procumbenetin, puerarin, and oleanolic acid.

Uses

- Treats wounds and infections
- Promotes hair growth
- Supports liver function and immunity

2) *Ocimum sanctum* (Tulsi / Holy Basil)

A perennial aromatic herb from the Lamiaceae family, Tulsi is well-known for its detoxifying, purifying, and antimicrobial properties. It is used widely in traditional medicine and skincare.

Scientific Classification

- **Kingdom**: Plantae
- **Family**: Lamiaceae
- **Genus**: *Ocimum*
- **Species**: *Ocimum tenuiflorum / sanctum*

Chemical Constituents

Rich in eugenol (70%), carvacrol, methyl eugenol, caryophyllin, fixed oils, alkaloids, glycosides, tannins, vitamin C, and organic acids like maleic and tartaric acids.

Uses

- Aids in respiratory relief and oral health
- Enhances immunity and helps manage blood sugar
- Provides anti-inflammatory and antioxidant skin benefits

Aloe vera

Derived from a tropical cactus of the Aloe genus, Aloe vera is known for its healing and soothing properties. The name comes from Arabic "Alloeh" (shining bitter substance) and Latin "vera" (true). It belongs to the Asphodelaceae family.

Scientific Classification

- **Kingdom**: Plantae
- **Order**: Asparagales
- **Family**: Asphodelaceae
- **Genus**: *Aloe*
- **Species**: *vera*

Chemical Constituents

Contains lignans, phytosterols, polyphenols, acetylated mannans, anthraquinones (like emodin), and lectins, known for their biological activities.

Uses

- Moisturizes, soothes, and heals the skin

- Provides sunburn relief, anti-aging benefits, acne treatment, and reduces redness

***Curcuma longa* (Turmeric / Haldi)**

A perennial herb from the Zingiberaceae family, Turmeric is widely cultivated in tropical and subtropical regions, especially in India and China. It is known for its yellow rhizomes and powerful medicinal properties.

Scientific Classification

- **Kingdom**: Plantae
- **Family**: Zingiberaceae
- **Genus**: *Curcuma*
- **Species**: *longa*

Chemical Constituents

Rich in curcuminoids (curcumin, demethoxycurcumin, bisdemethoxycurcumin) and essential oils like turmerone, atlantone, and zingiberene.

Uses

- Promotes anti-aging, moisturizing, scar reduction, and skin brightening
- Supports acne treatment and wound healing

METHODOLOGY

Extraction

Tridax procumbens

Dried and powdered leaves (40g) were subjected to Soxhlet extraction using 400 ml of 95% ethanol at 50°C for 72 hours. This method ensures maximum extraction of bioactive compounds like alkaloids, flavonoids, and terpenoids.

Turmeric *(Curcuma longa)*

The roots were powdered and air-dried. 10g of powder was macerated in 100 ml of acetone for 4 days. The extract was then filtered and collected for formulation.

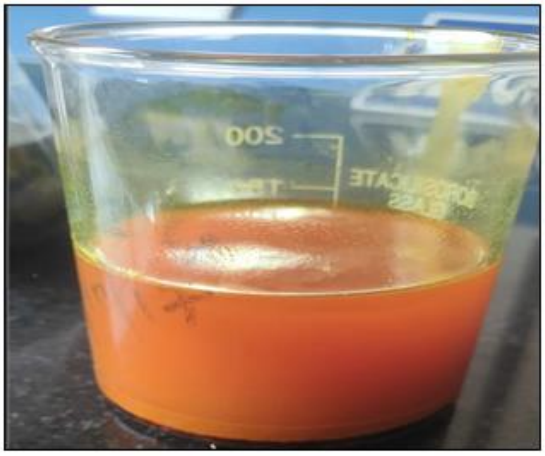

Fig: Extract of *Tridax procumbens*.

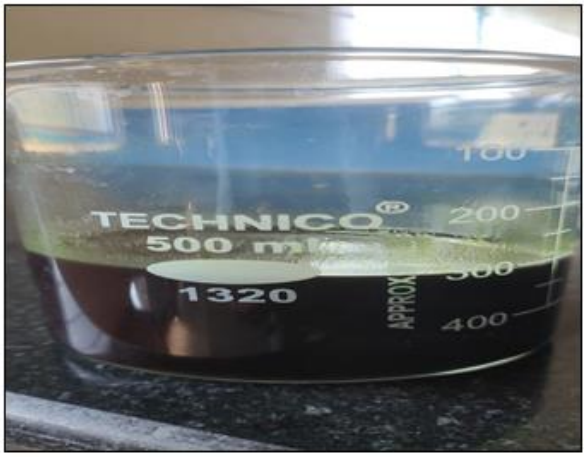

Fig: Extract of Turmeric.

Formulation of *Tridax procumbens* herbal soap

A) Preparation of glycerin Soap base

The glycerine soap base was prepared using a modified method based on traditional soap-making techniques. Initially, 100 ml of coconut oil was heated in a water bath for 5 minutes. Following this, a sodium hydroxide solution (20 g NaOH dissolved in 100 ml of water) was added to the oil with continuous stirring for 8-10 minutes. Sodium lauryl sulfate (10 ml) was subsequently incorporated into the mixture and stirred for an additional 2 minutes. Glycerine (10 ml) was then added, and the mixture was stirred for 2-3 minutes to ensure proper blending. To improve the soap's properties, 1 g of stearic acid was included as a hardening agent, along with 5 ml of ethanol as a solvent. Soft paraffin (0.7 g) was added next and stirred for 5-8 minutes. Finally, 10 ml of triethanolamine was introduced and mixed thoroughly to form a thick paste. The resulting mixture was poured into molds and left to solidify at room temperature.

Table 1: Preparation of glycerin Soap base.

Sl.no	. Ingredients	Quantity	Category

1	Coconut oil	100 ml	Lather, Moisturizing
2	NaOH solution	20 g	Detergent
3	Sodium lauryl sulphate	10 ml	Foaming agent
4	Glycerin	10 ml	Humectant
5	Ethanol	5 ml	Solvent
6	Stearic acid	1 g	Hardening agent
7	Soft Paraffin	0.7 g	Hardening agent[8]

B) Formulation of Herbal Soap

1. **Sterilization**: Glassware is sterilized using dry heat (160–180°C for 1–2 hours) to eliminate microbial contaminants.
2. **Soap Base Preparation**: 100 grams of glycerin soap base, made from coconut oil and sodium hydroxide, is weighed and melted gently, likely in a double boiler or on a hot plate, until it becomes a homogeneous liquid.
3. **Herbal Blend Preparation**: In a separate sterile beaker, a mixture of Tridax extract, vitamin E oil, aloe vera gel, coconut oil, and turmeric is prepared. These ingredients are blended until completely dissolved to create a uniform solution. Each ingredient serves a specific purpose, such as moisturizing, soothing, antioxidant benefits, and skin repair.
4. **Mixing and Molding**: The melted soap base is mixed with the herbal solution. This mixture is then poured into molds and left to harden at room temperature for several hours.
5. **Variations**: Four different versions of the soap are made by adjusting the amounts or types of ingredients.

Table 2: Formulation of Herbal Soap.

S.No	Ingredients	F1	F2	F3	F4
1	Plant Extract	0.4g	0.8g	1.2g	1.5g
2	Soap base	100g	100g	100g	100g
3	Vitamin E	400mg	400mg	400mg	400mg
4	Tulasi oil	0.1ml	0.1ml	0.1ml	0.1ml
5	Aloe vera gel	-	-	5g	-
6	Turmeric	0.5ml	1ml	-	-
7	Coconut oil	-	-	10ml	-
8	Total weight	100.4	101.2	106.6	101.9

Fig: Herbal Soap.

Fig: Glycerin Soap base.

Phytochemical analysis of plant extract

The phytochemical analysis of the plant extract includes several tests to detect various compounds:

1. **Flavonoids**: A few drops of 10% NaOH solution are added to the extract. A yellow coloration that fades upon adding dilute HCl indicates the presence of flavonoids.
2. **Phenols**: 0.5 mL of alcoholic ferric chloride ($FeCl_3$) solution is added to the extract. A bluish-black coloration confirms the presence of phenols.
3. **Saponins**: The extract is diluted with distilled water and shaken. The formation of stable foam after 15 minutes indicates the presence of saponins.
4. **Tannins**: A gelatin solution is mixed with the extract. The formation of a white precipitate indicates the presence of tannins.
5. **Alkaloids**: A few drops of dilute iodine solution are added to the extract. A blue coloration that disappears upon boiling and reappears when cooled indicates the presence of alkaloids.
6. **Steroids**: 2 mL of acetic anhydride is added to the methanol extract, followed by 2 mL of H_2SO_4. A color change from violet to blue confirms the presence of steroids.

Evaluation of Herbal Soap

The evaluation of the herbal soap involves several key tests to assess its properties and quality:

1. **Examination of Physical Properties**: The color, clarity, and odor of the soap were visually assessed across all four formulations.
2. **Determination of pH**: Five grams of soap were dissolved in 100 mL of water, and the pH of the solution was measured using a digital pH meter for each formulation.
3. **Foam Height**: A 0.5-gram sample of soap was dispersed in 25 mL of distilled water and subjected to 25 strokes in a measuring cylinder. The foam height above the aqueous volume was then measured.
4. **Foam Retention Test**: A 1% soap solution was shaken in a graduated cylinder, and the time taken for the foam to dissipate was recorded.
5. **Skin Irritation Test**: The soap was applied to the skin for 10 minutes, with no irritation observed, classifying it as non-irritating.
6. **Moisture Content**: A 5-gram soap sample was weighed (wet weight), dried in an oven at 100-115°C for one hour, and reweighed (dry weight). The moisture content was calculated based on the difference in weight.

RESULTS

The formulated soaps were thoroughly evaluated for both physical and chemical properties. The aesthetic qualities, such as color, clarity, and odor, were checked to ensure consistency. Various quality parameters, including pH, free alkali content, foam height, and foam retention, were tested to assess effectiveness. The pH was measured for skin compatibility, while free alkali content was analyzed for cleansing efficiency. Foam height and retention were evaluated to determine lathering ability and user satisfaction. Alcohol-insoluble matter and moisture content were also analyzed to assess composition stability and longevity. The results of phytochemical analysis and the evaluation of the four soap formulations (F1, F2, F3, and F4) are provided in Tables 3 and 4, respectively.

Table 3: Phytochemical analysis of plant extract.

Phytochemical analysis	Observation	Results
Test for Flavonoids (Alkaline reagent test)	Dark yellow colour was formed	+
Test for Phenol	Bluish black colour was observed	+
Test for Tannins (Gelatin Test)	White precipitate was formed	+
Test for Alkaloids (Iodine test)	Blue colour is observed and disappeared on heating	+
Test for Saponins (Foam test)	Foam was generated on shaking	+

Table 4: Evaluation of Herbal Soap.

Evaluation parametes	F1	F2	F3	F4

Colour	Dark green	Dark green	Dark green	Dark green
Clarity	Good	Partly good	Good	Good
Odour	Tulasi odour	Tulasi odour	Tulasi odour	Tulasi odour
pH	9.4	8	8.1	8.7
Foam height	42ml	36ml	49ml	52ml
Foam retention time	4min	7min	6min	9min
Moisture content	23%	18%	17.4%	28.8%

DISCUSSION

The results of the present study demonstrate that the formulated Tridax procumbens polyherbal soaps possess desirable physical and therapeutic properties. The combination of medicinal herbs enhanced the soap's efficacy in cleansing, moisturizing, and providing skin protection. The presence of phytochemicals like flavonoids, saponins, and tannins contributed to the soap's antimicrobial and antioxidant properties. Among the formulations, F4 showed superior performance in foam retention, moisture content, and pH balance, indicating its potential for daily skincare use without causing irritation. These findings support the use of natural ingredients in cosmetic formulations as a safe and effective alternative to synthetic products

SUMMARY

The formulation and evaluation of a polyherbal soap incorporating Tridax procumbens, along with Tulsi (Ocimum sanctum), Aloe vera, and Turmeric (Curcuma longa), to harness their combined therapeutic properties. These herbs are known for their antimicrobial, wound healing, anti-inflammatory, antioxidant, and moisturizing benefits. The soap was prepared using a glycerin base through the melt and pour method, and four formulations (F1–F4) were created by varying the concentrations of plant extracts.

A series of tests were conducted to evaluate the physical characteristics (color, clarity, odor), pH, foam height and retention, moisture content, and skin irritation potential of each formulation. Phytochemical analysis confirmed the presence of key bioactive compounds such as flavonoids, phenols, tannins, alkaloids, and saponins in the extracts. Among the four, Formulation F4 exhibited superior foam retention, better moisturizing properties, and no skin irritation, making it the most effective and user-friendly variant.

This work highlights the potential of Tridax procumbens polyherbal soap as a safe, natural, and affordable skincare solution, especially for individuals seeking alternatives to chemical-based soaps. The project also emphasizes the broader relevance of herbal cosmetics in

promoting skin health, reducing environmental impact, and supporting sustainable personal care practices

CONCLUSION

The formulated *Tridax procumbens* polyherbal soaps offer a promising natural alternative to synthetic soaps, combining the benefits of multiple medicinal plants. They are effective in cleansing, moisturizing, and promoting skin health, with minimal to no side effects, making them suitable for regular use and potentially beneficial for individuals with sensitive or acne-prone skin.

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