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Phytochemical Analysis, Antibacterial Activity and Formulation of Herbal Soap Using *Acalypha Indica* Leaf Extract

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***Abstract*: Herbal cosmetics have good effects and have no side effects, *Acalypha indica.* This plant has antibacterial properties and is useful in treating skin conditions brought on by bacteria such as pseudomonas species and staphylococcus aureus. Additionally address illnesses such as eczema and psoriasis. It aids with acne and pimple prevention, skin whitening, softening, and smoothing, and skin polishing, replenishing, and regeneration. Melt and pour is the procedure employed in the formulation of antibacterial herbal soap. The quality of the produced product was assessed using a variety of evaluation techniques. This study examines the effects of *Acalypha indica* leaf extracts on bacteria using the agar disc diffusion method. The antimicrobial activity of *Acalypha indica* was investigated against strains of bacteria, including *Staphylococcus sp, Pseudomonas sp, Micrococci sp* and *Klebsiella sp.* The extract of *Acalypha indica* demonstrated the lowest inhibition of *Staphylococcus sp* and *Klebsiella sp.* and the largest zone of inhibition against *Pseudomonas sp* and *Micrococci sp.* The presence of phytochemical substances such as alkaloids, tannins, saponins, steroids, and proteins was responsible for the *Acalypha indica* plant's antimicrobial effect.**

***Keywords*: *Acalypha indica,* antibacterial, herbal soap, phytochemical.**

1. Introduction

Kuppaimani, also known as *Acalypha indica,* is a weed that grows annually. It is a member of the Euphorbiaceae family. In many regions of Asia, it is a prevalent weed. It grows in gardens, wayside wastelands, and common farmlands. Leaf, root, stalk, and flower parts are used. The primary alkaloids found in phytochemicals are acalypus and aclyphine [1]. This plant is used to treat respiratory conditions like bronchitis, asthma, and pneumonia as well as a diuretic and antihelmintic.

Both conventional and contemporary medicines can be effectively derived from medicinal plants. Approximately 80% of people living in rural areas rely on herbal medicine for their primary medical needs. There are more than 20,000 species of therapeutic plants listed by the World Health Organization. Indian medicinal plants are utilized, together with their derivatives, to control the different illnesses, including ulcers, pneumonia, bronchitis, and diarrhea.

Thus, the current investigation focuses on determining *Acalypha indica's* antibacterial activity. The chosen microorganisms for the investigation were chosen based on their potential as pharmaceutical, clinical, and medicinal candidates.

2. Methodology

A. Plant materials

Acalypha indica grows in wastelands, gardens, roadsides, and common farmlands. The annual herbaceous weed, *Acalypha indica*. Reaching a height of 15 meters is possible for it. The stems are heavily hairy. Simple, spiral-arranged long petioles adorn the leaves [2]. The edges are serrate. They are thin and glabrous. Flowers are unisexual. The bracts cover the tiny fruit capsules. The seeds are smooth, round, and have a light brown in colour.

B. Collection and Extraction

The leaves of the kuppaimeni were freshly collected and washed properly and dried.

The Kuppaimeni leaf extraction in the mixture of its juice [3]. This Extraction gives a best result for the soap preparation.

C. Preparation of Extract

The leaves of the *Acalypha indica* plant were gathered from a village in the Coimbatore area. The collected leaves were cleaned with water to get rid of any dust particles. The collected leaves are shade-dried and crushed using a mortar pestle. This extraction was used for further process. After dissolving the extract in a solvent, its antibacterial activity was examined.

D. Chemicals Used

Glycerine soap base, Lavender essential oil, Rose water.

E. Melt and Pour Process

The easiest way of soap making is to start with melt and pour process. Using a purchased soap base, we can experiment with mixing, fragrance, colour and attractive soap moulds. It is suitable for other children and adults [4].

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3. Formulation of Herbal Soap

1. In the glass measuring cup, chop the 12g of soap base into chunks and heat it as per the directions on the package. Melt the soap base over a double boiler. To prevent overheating, keep a close eye on the soap.
2. After the soap has melted, add a few drops of colour and fragnance, then mix in a little amount of kuppaimeni extract (about 15g).
3. After filling the moulds with soap, set them on a level surface.
4. Let the soap cool fully, which should take an hour or more. Once the soap cools down, remove it from the moulds and it's ready to use.
5. Any bars that are not in use should be wrapped tightly in plastic wrap and stored in a cool, dry place immediately.

Kuppaimeni – Antifungal properties used to treat psoriasis.
Rose Water – Cooling agent.
Lavender Oil – Flavouring agent

A. Phytochemical Constituents

1) Test for Alkaloids (Meyer's Test)

The extract of *Acalypha indica* was evaporated to dryness and the residue was heated on a boiling water bath with 2% Hydrochloric acid. After cooling, the mixture was filtered and treated with a few drops of Meyer's reagent [5]. The samples were then observed for the presence of turbidity or yellow precipitation.

2) Test for Tannins

To 0.5 ml of extract solution, 1 ml of water and 1-2 drops of ferric chloride solution was added. Blue colour was observed for gallic tannins and green black for catecholic tannins.

3) Test for Terpenoid and Steroid

4 mg of extract was treated with 0.5 ml of acetic anhydride and 0.5 ml of chloroform. Then concentrated solution of sulphuric acid was added slowly and red violet colour was observed for terpenoid and green bluish colour for steroids

4) Test for Reducing sugars

To 0.5 ml of extract solution, 1 ml of water and 5-8 drops of Fehling's solution was added at hot and observed for brick red precipitate.

5) Test for Glycoside

To the solution of the extract in Glacial acetic acid, few drops of Ferric chloride and Concentrated sulphuric acid are added, and observed for reddish brown colouration at the junction of two layers and the bluish green colour in the upper layer.

6) Test for saponins

The extract (50mg) was diluted with 20 ml of distilled water and it was agitated in a graduated cylinder for 15 minutes. The formation of 1 cm layer of foam showed the presence of saponins.

7) Test for Flavonoids

To 1 ml of the extract, a few drops of dilute sodium hydroxide was added. An intense yellow colour was produced in the plant extract, which become colourless on addition of a few drops of dilute acid indicates the presence of flavonoids [6].

8) Test for Phenolic compounds

The extract is dissolved in distilled water and to these few drops of 1% lead acetate were added a bulky white precipitate was formed, which indicates the presence of phenolic compounds.

Table 1
Phytochemical composition of *acalypha indica*

Phytochemicals	Ethanol extract of *acalypha indica*
Alkaloids	+
Tannins	+
Terpenoids	-
Steroids	+
Reducing sugar	-
Amino acids	-
Saponins	+
Flavanoids	+
Glycosides	+
Phenolic compounds	+

(+) = indicates presence; (-) = indicates absence

B. Antibacterial Activity

The present study aimed at testing the antibacterial activity of *Acalypha indica* against *Pseudomonas aeruginosa sp, Klebsiella sp, staphylococcus sp, micrococci sp*. Antimicrobial activity of *Acalypha indica* was extracted against bacterial strains like *Pseudomonas aeruginosa sp, Klebsiella sp, staphylococcous sp, micrococci sp* [7]. The extract of *Acalypha indica* showed the maximum zone of inhibition against *Pseudomonas aeruginosa sp* and *micrococci sp* minimum inhibition of *Klebsiella sp,* and *staphylococcous sp.*

Antibacterial activity was performed by the Agar disc diffusion method. The 20µl of *Pseudomonas aeruginosa sp, Klebsiella sp, staphylococcous sp, micrococci sp* broth culture was prepared and swabbed on MHA plates with sterile cotton swabs and allowed on the plates for 2-3 minutes. The plain sterile disc was immersed on the plant extracts and the plant extract disc was placed in centre of MHA agar plate for the *Pseudomonas aeruginosa sp, Klebsiella sp, staphylococous sp, micrococci sp* organisms [8]. The plates was incubated at 37℃ for 24 hours. After incubation, the diameter of the zone of inhibition (mm) was measured and recorded.

The zone of inhibition was for formed for *Pseudomonas aeruginosa sp* was noted as 14 mm on MHA agar plates. The zone of inhibition was for formed for *staphylococci sp* was noted as 09mm on MHA agar plates. The zone of inhibition was for formed for *micrococci sp* was noted as 12mm on MHA agar plates. The zone of inhibition was for formed for *Klebsiella sp* was noted as 08mm on MHA agar plates.

Table 2
Antibacterial activity of *Acalypha indica*

Organism	Zone of Inhibition (mm)
Pseudomonas aeruginosa sp,	14mm
staphylococous sp	09mm
micrococci sp	12mm
Klebsiella sp	08mm

4. Conclusion

The investigation into the antibacterial activity of Acalypha indica herbal plant extract revealed that the acetone extract

exhibited antibacterial effects against Staphylococcus aureus and Bacillus species, while showing minimal inhibition against Escherichia coli and Klebsiella species. Conversely, the aqueous extract of Acalypha indica demonstrated maximum inhibition against Escherichia coli, Bacillus, and Staphylococcus aureus, but Klebsiella species were resistant to the aqueous extract. Phytochemical analysis attributed the antibacterial properties of Acalypha indica to the presence of compounds such as alkaloids, saponins, steroids, and proteins. The findings suggest that scientific validation of traditional medicinal claims can lead to significant results, indicating that these plants could be valuable sources for developing new antimicrobial agents.

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