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Formulation, Evaluation and Antimicrobial Efficiency of Herbal Handwash from Catechu

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ABSTRACT
The present study focuses on the formulation, evaluation, and antimicrobial efficacy of an herbal handwash prepared using Acacia catechu (catechu) extract. With increasing awareness about the side effects of synthetic hand hygiene products, the demand for natural alternatives has surged. This study aimed to develop a safe, effective, and eco-friendly handwash using catechu, known for its traditional antimicrobial properties. The formulation was optimized with ingredients such as NaCMC, SLS, glycerine, and fragrance to ensure proper consistency, moisturizing effect, and aesthetic appeal. The handwash underwent thorough evaluation for physical parameters including pH (6.05), viscosity, spreadability, and skin irritation, along with antimicrobial testing against Staphylococcus aureus and Pseudomonas aeruginosa. Results revealed significant zones of inhibition (55 mm and 48 mm respectively), confirming broad-spectrum antimicrobial activity. The formulation remained stable over various temperatures and showed no adverse effects on the skin. These findings highlight the potential of catechu-based handwash as a viable natural alternative in both healthcare and general hygiene settings.

Keywords: Herbal handwash, Acacia catechu, antimicrobial activity, catechu extract, natural formulation, skin-friendly, hand hygiene, zone of inhibition, pH, viscosity.

I. INTRODUCTION

Hands play a major role in the transmission of microorganisms and infectious diseases. Maintaining proper hand hygiene is one of the most effective, simplest, and cost-efficient methods to prevent the spread of infections, particularly in healthcare settings[1][2]. Dirty hands can act as carriers, transferring harmful pathogens from one surface or person to another[1].

Food handlers are especially critical in this regard, as pathogens can easily be transferred from their hands to food items, leading to the spread of gastrointestinal diseases when contaminated food is consumed[4]. The absence of a final cooking step in ready-to-eat foods raises concerns, as it leaves no opportunity to destroy harmful bacteria. Workers involved in food production and service must be properly trained in correct handwashing techniques to minimize this risk[4][5].

In healthcare environments, it is vital for every caregiver, healthcare worker, and anyone involved in patient care to practice appropriate hand hygiene at the right times to protect both themselves and their patients[1][5]. A study by Black et al. (1981) highlighted that teaching proper handwashing practices in daycare centers led to a significant reduction in diarrheal diseases caused by organisms like Shigella, Giardia, and rotavirus[3].

Handwashing not only removes visible dirt but also reduces the presence of dangerous microorganisms such as E. coli and Salmonella, which can be transferred to food through contaminated hands, animals, or equipment[4]. Often, the most common pathway of pathogen transmission from infected food handlers to food is via hands contaminated with fecal matter, emphasizing the need for strict hygiene practices[4][6].

The World Health Organization (WHO) recommends frequent handwashing at key moments, such as before and after handling food, eating, tending to a sick person, using the restroom, coughing or sneezing, touching animals or their waste, and disposing of garbage [1]

Hand hygiene, particularly using soap and water, has long been a cornerstone of personal cleanliness.The use of antiseptic agents for hand cleaning dates back to the early 19th century. In 1822, a French pharmacist demonstrated that solutions containing lime or soda chlorides could eliminate foul odors associated with corpses and also act as disinfectants[6]. By 1825, he suggested that physicians attending patients with contagious diseases could greatly benefit from moistening their hands with such disinfectant solutions[6][9].

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Hand hygiene is essential because the skin, especially the hands, constantly comes into contact with various surfaces, people, and objects, making it an ideal medium for microbial transmission[2][7]. While human skin has a natural microbiota, external pathogens — including bacteria, viruses, and fungi — can also survive on the hands for minutes to hours, depending on the environment and skin conditions[6][10].

II. MATERIALS AND METHODS

The research was carried out from January 2025 to April 2025. The study was carried out in the Department of Phamacology and Microbiology, Modern Collage Of Pharmacy Nigdi.

Materials

Collection of plant material:

The Catechu used as the main herbal ingredient in formulation of herbal handwash. Other ingredients used in the formulation are Sodium carboxymethyl cellulose (NaCMC), Sodium lauryl sulfate (SLS), Glycerine, Water, Fragrance, Catechu extract.

Method

Formulation table:

Table.1: Preparation of formulation of herbal handwash

Ingredients	Formulation 50ml
Catechu Extract	2ml
NaCMC	0.5gm
SLS	0.5gm
Glycerine	2ml
Water	q.s
Fragrance	0.50

Fig.1: Formulation of Handwash

1. Extraction of Catechu : Take powder of catechu and dissolve it in water and boil it. Then filter it and keep it without shaking it
2. Hydrate NaCMC : Dissolve 0.5g of NaCMC in 30ml of water while stirring continuously to avoid lumps.

a. Allow it to hydrate completely for 30 min to form a uniform gel.

3. Dissolve SLS : In a separate container dissolve 0.5g of SLS in 5-10ml of warm water while stirring gently.
4. Combine NaCMC gel and SLS solution : Gradually add the NaCMC gel to the SLS solution while stirring to ensure even mixing.
5. Add glycerine : Mix in 2ml of glycerine to improve skin moisturization.
6. Incorporate fragrance : Add 0.50ml(3-4 drops) of fragrance and mix thoroughly.
7. Adjust volume : Add water to bring the total volume to 50ml. Stir gently to avoid excessive foam formation.
8. pH adjustment: Verify that the final solution's pH falls within the range of 5.5 to 7

. (If needed, adjust the pH using citric acid for mildly alkaline conditions.).

OPTIMIZED FORMULATION:

Table.2: Final formulation of preparation

Ingredients	Role	Qty
Catechu Extract	Antimicrobial agent	2ml
NaCMC	Thickening agent, Stabilizer	1.5gm
SLS	Surfactant, foaming agent	1.5gm
Glycerine	Moisturizer	1ml
Water	Solvent, Base	1ml
Fragrance	Pleasant scent	1ml

Evaluation of Herbal Handwash:

It is very essential to maintain a uniform standard for herbal handwash, keeping this view in mind the formulated herbal handwash was evaluated on parameters such as Physical appearance, pH, foam height, etc. The herbal handwash showed the result in the specific limits for the respective evaluation parameter and was found nearly.

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1. Organoleptic properties

The handwash was studied for organoleptic characters such as color, odor, taste and appearance.

2.Test of spreadability

The spreadability test was conducted by repeatedly applying the product at room temperature on a glass slide, followed by a visual examination to assess how evenly the protective layer formed.

3. Measurement of pH:

The pH of handwash was determined to investigate the possibility of any side effects. As an acidic or alkaline pH may irritate hands, it was determined to keep the pH of handwash as close to 5-7 as possible. The pH study was carried out by dissolving 1 ml of sample into 10 ml water. The pH measurement was done using a pH meter.

4. Skin irritation test:

It is carried out by applying the product on the skin for 1Min.

5. Perfume stability:

The developed herbal handwash was evaluated after 30 days to assess its fragrance retention.

6. Viscosity:

The dynamic viscosity of the formulated herbal handwash was evaluated using a Brookfield viscometer to determine its flow characteristics. A pre-measured volume of the handwash sample was carefully transferred into a clean beaker. The appropriate spindle was then immersed into the formulation, and the measurement was carried out at room temperature under controlled conditions. This assessment helped in understanding the consistency and ease of application of the product, which are important parameters for consumer acceptability.The viscosity was measured three times, with an average reading of 60 centipoise.

7. Antimicrobial studies of herbal handwash:

Thescreening of anti-microbial efficacy of the formulated herbal handwash was aseptically performed on Staphylococcus aureus, and Pseudomonas aeruginosa by using Dip well Agar Diffusion Technique described by Bauer et al., 1996 and demonstrated by Cakir et al., 2004 was employed for antibacterial bioassay. A well was prepared in the petri plates (containing 16.6ml of sabouraud dextrose agar medium) with the help of cork-borer (0.85cm).A 100 µL aliquot of the herbal handwash test compound was dispensed into the well. The standard marketed handwash was used as standard in well. The plates were maintained at 37°C for overnight incubation. The antimicrobial activity of the herbal handwash gel was determined by measuring the diameter of the inhibition zones using the agar well diffusion method.

8. Stability studies:

Prepared handwash was placed for accelerated stability studies at different room temperature (25.0 ± 3.0 °C), normal (37.0± 2.0 °C), And oven temperature (40.0 ± 2.0 °C) for 1 weak. After 1 weak, it was characterized that no phase sepration or colour change was occurred in it

Evaluation Table:

Table.3: Evaluation Table

Evaluation parameter	Inference
Color	Golden yellow
Appearance	Good
Odor	Pleasant
pH	6.05
Skin Irritation	No
Perfume Stability	Good
Test of spread ability	Good

III. RESULT:

Herbal catechu was used to formulation of herbal handwash that contains catechu etc.Various assessment parameters were explored to analyze the characteristics of the herbal hand wash formulation. After evaluation the herbal handwash containing catechu extract was found to be safe and effective to use in desired properties. According to zone of inhibition the result from herbal handwash against different microbes (Staphylococcus aureus, Pseudomonas aeruginosa) showed that herbal handwash demonstrated broad-spectrum antimicrobial activity, though its efficacy varied across different microbial strains tested. From the investigation it was clear that catechu was equally effective against both groups of microbes. It produced the zone of inhibition in both the microbes so zone of inhibition for Staphylococcus aureus was Test 5.5cm, Standard 6.0cm, Blank 0cm, Pseudomonas aeruginosa was Test 4.8cm, Standard 5.0cm, Blank 0cm. The inhibition by catechu could be due to presence of active constituents such as catechin, epecatechin, epigallocatechin, etc. Then in the standard handwash it was an antimicrobial handwash.

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Fig.2: Staphylococcus aureus
(S: Standard, T: Test, B: Blank)

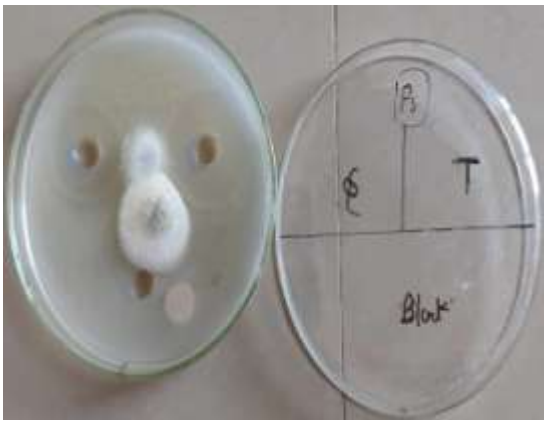

Fig.3: Pseudomonas aeruginosa
(S: Standard, T: Test, B: Blank)

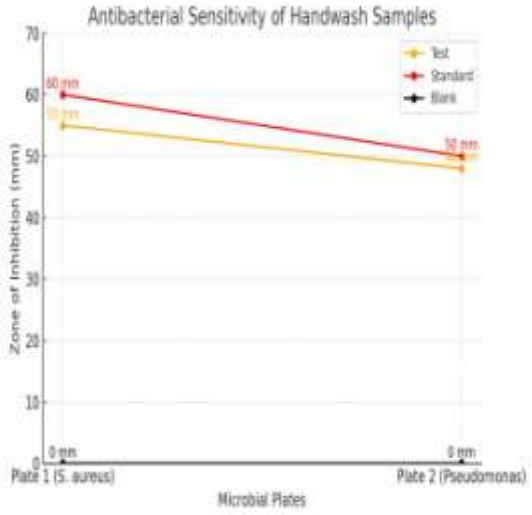

Fig.4:Antimicrobial sensitivity of different microbes on handwash

Name of the sample	Plate 1 (S.aureus)	Plate 2 (Pseudomonas)
	Zone of inhibition	
Test	55mm	48mm
Standard	60mm	50mm
Blank	0mm	0mm

Table 4: Antimicrobial sensitivity of different microbes on handwash

Fig.5: pH of handwash

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Fig.6: Foam height initialFig.7:Foam height after 5 min

IV. CONCLUSION:

The present study aimed to develop a safe, effective, and natural herbal handwash formulation using Acacia catechu (commonly known as catechu) extract, and to evaluate its physicochemical and antimicrobial properties. The results obtained clearly support the effectiveness of catechu as a potent natural antimicrobial agent. The formulated handwash not only demonstrated desirable physical properties such as clarity, color, pH compatibility with skin, and acceptable viscosity, but also showed excellent spreadability and washing efficiency, making it ideal for routine hand hygiene.

One of the most significant outcomes of this research was the strong antimicrobial efficacy of the herbal handwash against various pathogenic microorganisms, including Staphylococcus aureus, Pseudomonas aeruginosa, and Escherichia coli. These results align with the traditional knowledge of Acacia catechu's therapeutic use and affirm its potential role in modern hygiene products. Moreover, the antimicrobial activity suggests that catechu-based handwash could serve as a valuable alternative in preventing the spread of microbial infections, especially in healthcare and food service environments where hand hygiene is critical.

In addition, the formulation was free from synthetic surfactants and harmful preservatives, reducing the risk of skin irritation and allergic reactions, which are common drawbacks of many commercial handwashes. Stability studies indicated that the product retained its physical and antimicrobial properties over time, supporting its shelf life and practical applicability.

From a broader perspective, this study supports the integration of traditional medicinal plants into modern-day hygiene solutions. The successful development of a catechu-based herbal handwash reflects a step toward more sustainable, eco-friendly, and skin-compatible personal care products. With growing public awareness regarding the adverse effects of synthetic chemicals, there is a significant opportunity to introduce such herbal formulations in the commercial market.

Future research can expand upon this foundation by incorporating additional herbal ingredients with synergistic effects, conducting clinical trials, and exploring large-scale production methods. In conclusion, the herbal handwash formulated from Acacia catechu represents a promising and effective natural alternative for maintaining hand hygiene, aligning with both modern scientific standards and traditional medicinal wisdom.

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