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Formulation and evaluation of organic handwash prepared from herbal extracts

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Aloe vera, Antimicrobial activity, Herbal handwash, Hygiene, Organic handwash, Tulsi.

Abstract: The scientific study linked to the physical, chemical, biological, and structural characterization of drugs along with their history of cultivation, collection and preparation for marketing and preservation, is defined as pharmacognosy. The cardinal routes of the entry of various infections into our body are our hands. The infection caused thereby causes a spectrum of diseases, especially in children. To get rid of such infections, regular washing of hands after specific time intervals holds imperative cognizance of getting rid of such infectious diseases. The handwash available in the local markets is mainly composed of various chemical compounds which might pose several threats to our skin. In this notion, the search for alternate components for handwash preparation that are organic in nature and do not cause any damage to our skin has been in the research limelight for the past few years. Accordingly, in this research, an attempt has been made to prepare a skin-friendly handwash containing the essential extracts of various ingredients like *Aloe vera*, turmeric, honey, tulsi, lemon, etc., and thereby their antimicrobial and antiseptic efficacy were evaluated. The basis of the evaluation was set using multivariate criteria like odour, colour, viscosity, pH, foam height and retention, and grittiness. Finally, the skin irritation test was also carried out along with a few other parameters to draw conclusions regarding the suitability of the handwash for human usage. The obtained results were found within the desired ranges without the presence of any adverse side effects. Thus, the proposed scheme of this study may be regarded as an excellent approach to combat the harmful effects of commercial chemicals containing handwash and, thereby, will be beneficial to various stakeholders.

Introduction

Since ancient times, washing hands with soap and water has been considered a vital component of personal cleanliness and is frequently ingrained in religious and cultural practices (Ravi et al., 2005). Although the connection between washing hands and the transmission of the disease was established only two centuries ago, this can be viewed as remarkably early compared to the findings made by Pasteur and Lister, who passed away decades later. Since the skin is considered among the body's most exposed parts, the skin needs to be protected from a spectrum of microorganisms. Moreover, various mammals are also susceptible to such infections. Hand washing is unquestionably an essential safety measure to safeguard the skin from hazardous microorganisms and stop spreading numerous contagious diseases (Bjerke, 2004; Pahurkar et al., 2022). The main method of spreading diseases and germs is through the hands. Therefore, maintaining good hand hygiene is crucial to restrict the spread of dangerous bacteria and nosocomial illnesses. Numerous medicinal herbs are frequently used to treat skin conditions and also have antibacterial properties. However, due to the complexity of their chemical makeup, plants' medicinal properties depend on specific active chemical components (Tabassum and Hamdani, 2014; Bhadane et al., 2022). The term ‘herbal medicine’ describes the application of any plant's seeds, roots, leaves, bark, flowers, and aerial parts for

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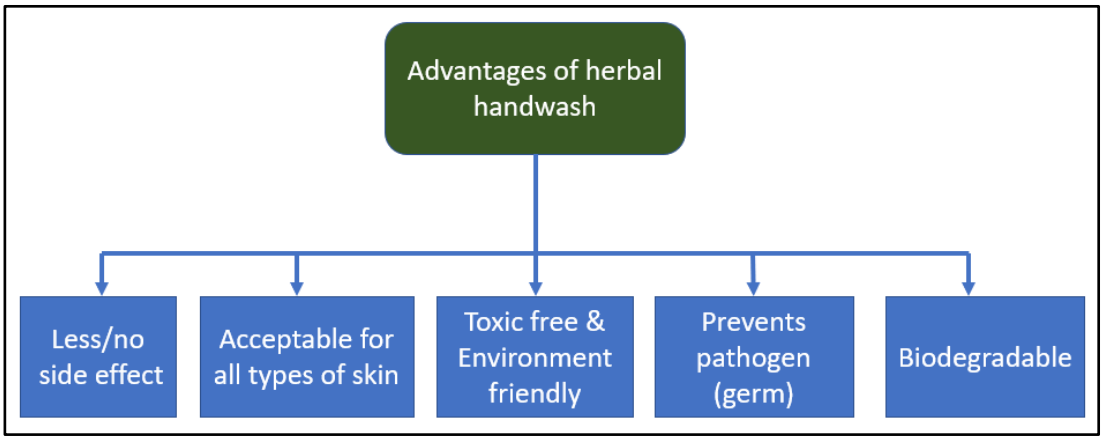

Figure 1. Advantages of herbal handwash.

Table 1. Taxonomical Classification of materials used for herbal hand wash.

Raw Material	Kingdom	Division	Family	Order	Genus	Species
Tulsi	Plantae	Magnoliophyta	Lamiaceae	Lameness	Osmium	*Ocimum tenuiflorum*
Lemon	Plantae	Magnoliophyta	Rutaceae	Sapindales	Citrus	*Citrus limon*
Aloe vera	Plantae	Magnoliophyta	Xanthorrhoeaceae	Asparagales	Aloe	*Aloe vera*
Turmeric	Plantae	Tracheophyta	Zingiberac-eae	Zingiberal-es	Curcuma	*Curcuma longa*

therapeutic purposes. In this perspective, various biomasses have proven substantial cognizance towards alleviating such issues. Moreover, after the extraction of the herbal extracts, the remaining portions can be harnessed for energy procreation which may be used for various in-house applications. However, such applications require mandatory pre-treatments and depend upon various process input parameters. Numerous diseases have been treated and managed with herbal therapy. To prevent or treat infectious diseases, traditional healers have long employed plants.

A wide range of secondary metabolites present in plants, including tannins, terpenoids, alkaloids, and flavonoids, have been reported to exhibit in-vitro antibacterial activities. In order to create a herbal hand sanitizer that contains alcoholic extracts of these amazing herbs combined with other relevant excipients and can be used as a ready-to-use herbal hand wash, we set out to formulate and analyze the product (Garner and Faviro, 1986). Synthetic soap-containing products, which are now widely accessible on the market, perform a better job of reducing the spread of infectious diseases and pathogens in the healthcare setting, but they are not without drawbacks or drawbacks. They can make infections more resistant and cause skin irritation when used frequently (Chirani et al., 2021). Moreover, the addition of enzymes can also make the process faster and safer. Additionally, the businesses that produce these synthetic formulations discharge these dangerous chemicals into the environment, which could affect various ecosystems. Several advantages of using hand washing are shown in Figure 1.

Materials and Methodology

Collection of plant material

Tulsi leaves (*Ocimum tenuiflorum*), Lemon (*Citrus limon*), Aloe vera (*Aloe vera)*, Turmeric (*Curcuma)*, and Honey (*Apis mellifera*) were obtained in fresh form from the local markets. The taxonomical classification of the raw materials used in this study is mentioned in *Table 1*.

Extraction of plant material

Tulsi leaf samples were cut apart, cleaned with water, and carefully dried. Therefore, the dried leaves were sorted. The tulsi powder was used to produce an ethanolic extract. For 5 days, 75 ml of methanol was used to dilute a total of 25 gm of finely ground tulsi powder to get a clean filtrate. The alcoholic Decoction underwent filtration (Patankar and Chandak, 2018).

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Table 2. Formulation table of herbal hand wash.

Ingredient	Quantity (%)	Action	Uses and Probable Mode of Action
Lemon	4	Antiseptic	The antioxidant properties of citrus flavonoids Lemon-hesperidin are beyond their capacity to scavenge free radicals, including their role in cellular defense against antioxidants. The gram-positive bacteria enterococcus faecalis and bacillus substitute as well as the gram-negative *Shigella sonnei* have both been demonstrated to be inhibited by lemon fruit. Due to its proven antibacterial and fungistatic properties, this oil is employed as a flavour or scent as well as a natural preservative in pharmaceutical and cosmetic formulations (Klimek-Szczykutowicz et al., 2020).
Tulsi	8	Antimicrobial agent	The Tulsi leaves have stimulating, aromatic, spasmolytic, and diaphoretic-like properties. The juice is employed as an antiperiodic, a component of numerous skin disease treatments, and a remedy for earaches. Tulsi also functions as a natural immune booster and antiviral, antifungal, and antifungal agent (Cohen, 2014).
Honey	6	Antibacterial as well as antiseptic	Moisturises the skin along with cleansing (Patil et al., 2017).
Turmeric	3	Antioxidants & anti-inflammatory	In addition to being used for detoxification, turmeric is renowned for its antibacterial and germ-killing properties. Due to the yellowish colour of turmeric, it can also be used as a colouring agent (Hanai et al., 2009).
Aloe Vera	7	Healing agent	Several *Aloe vera*-based cosmetics products in the market make a claim to provide natural skin care based on the healing and soothing properties of aloe vera. These products also treat eczema, psoriasis, dermal imperfections, acne, and pigmentation. *Aloe vera* is a fantastic source of vitamins and antioxidants that promote skin nourishment and protection (Surjushe et al., 2008).
Sodium Lauryl Sulphate	6	Foaming Agent	Sodium lauryl sulfate is an anionic surfactant frequently used in household cleaning products as an emulsifying cleaning agent (Bondi et al., 2015).
Methyl Paraben	0.3	Preservative	Methylparaben is used as a food preservative as well as an anti-fungal agent.
Glycerine	15	Moisturizing agent	Glycerine functions as a humectant, allowing the skin to retain moisture, boost hydration, reduce dryness, and regenerate the skin's surface from the inside out. Additionally, glycerine is also an emollient that helps soften skin and is beneficial for treating rough or dry patches brought on by psoriasis or eczema. In addition, glycerine's strong antibacterial properties protect the skin from dangerous infections. Glycerine can also rejuvenate, repair, and hasten the healing of wounds.
Rose oil	q.s.	Fragrance	It enhances complexion brightness and skin tone. Additionally, it lessens dark spots, acne scars, and blemishes. Antibacterial and antifungal effects are linked to rose oil (Mohebitabar et al., 2017).
Distilled Water	50	Base material	Distilled water is used as a base material where all the other materials are dissolved to prepare a handwash.

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Chemicals

Sodium Lauryl Sulphate, Methyl Paraben, Glycerine, and Rose oil were used in this study. All the chemicals were obtained from Nice® Chemicals (Kerala India).

Preparations of Herbal Hand wash

20ml of water is combined with 4ml of citrus Limon juice and tulsi leaf methylolic extract. To create foaming capability, *Aloe vera* is mixed twice. Then, while working moderately, add the necessary amount of glycerine and eucalyptus oil. Preservatives were added in an adequate amount at the end. The solution is blended, made uniform, and kept at room temperature before being used to screen the activity. The formulation table for herbal hand wash is mentioned in Table 2, along with the uses and mode of action (Powar et al., 2015; Shaloo et al., 2017).

Evaluation Parameters of Herbal hand wash

The following assessment criteria were applied to the prepared formulation of herbal hand wash.

Organoleptic Assessment

This involved measuring the aspects like texture, colour, and odour. First, visual and tactile perception was used to evaluate colour and texture. Next, the formulation was sensed in order to examine the odour.

Appearance, Homogeneity and grittiness

Visual inspection was used to assess homogeneity and appearance. The formulation was assessed after 1ml of handwash was taken on the fingertips and rubbed between two fingertips to check grittiness (Joshi et a., 2008).

pH and Viscosity

Using 100ml of distilled water, 1ml of herbal hand wash sample was dissolved. Using a standardized digital pH meter, the pH of the obtained solution was assessed. Viscosity was obtained by using an Ostwald viscometer (Powar et al., 2015).

Foam Retention

A 100 ml measuring cylinder was filled with 25 ml of herbal hand wash and it was shaken ten times. The foam volume was measured at 1-minute intervals for 10 mins (Bahuguna and Kashyap, 2016).

Foam Height

50 ml of distilled water was used to dissolve in one gram of the Hand Wash sample. Water was used to make a volume of 100 ml. This solution is divided into ten test tubes into portions of 1, 2, 3, and 10 ml each, with the remaining volume being filled with water to a final volume of 10 ml. The test tubes were then shaken for 15 seconds. The test tube is then left to stand for five minutes. Thereafter, the height of the foam was measured (Afsar and Khannam, 2016).

Cleaning Action

A beaker containing 200 ml of water and 1g of Hand Wash sample was filled with 5g of wool, which was then placed in grease and agitated for 4 minutes. The sample was taken out of the solution, dried, and weighed. The formula was used to determine how much grease was taken out.

Percentage of Detergency power = 100 * (1 - Wool Weight of formulated product / Wool Weight of marketed product) (Terker et al., 2016).

Dirt dispersion test:

10 ml of distilled water was added into a test tube before 1 ml of Hand Wash was added. After adding a drop of Indian ink, the test tube was stopped and then shaken. Estimation of the ink content of the foam was done (Patil et al., 2017).

Skin Irritation Test

In order to check the skin's irritability, the herbal handwash was applied over the skin and was allowed to remain for 30 minutes. After the 30 minutes had passed, the skin was checked for itching, rashes, or redness using both sensory and visual methods.

Antimicrobial study:

According to the standard literature-reported protocol, soil microbes were used to test the anti-microbial activity of hand wash using the agar plate method. For the purpose of evaluating the antibacterial activity against soil microbes, two sterile Petri plates were used. Agar solution containing nutrients was placed on the plates, and solidification was permitted. The soil isolate from the subculture was solidified, then introduced into the nutrient agar using the Pour Plate Method and inoculated for 24 hours. Two cavities were created in it using the Cup Plate Method after it had been injected for 24 hours. Marketed herbal hand wash is placed in the first cavity, and formulated hand wash is placed in the second. It was ensured that the sample was positioned at the cavity level. To assess the activity, the plates were put in an incubator at 37°C. After an incubation period of 48 hours, the plates were checked to see if the Zone of Inhibition had formed. The antibacterial activity of the formulation is evaluated from the Zone of Inhibition. The diameter of the zone of inhibition was measured to assess the effectiveness of formulated Hand Wash (Bayot and Bragg, 2021; Wolfe and Lantagne, 2017).

Result and Discussion

The anti-microbial efficacy of the herbal hand wash formulation was evaluated, and the results revealed that it

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had significantly more anti-microbial activity than commercially available hand soap. Bacterial growth in culture plates was significantly inhibited by the herbal hand wash formulation's efficacy. Results obtained from the mentioned experiments have been summarized in *Table 3*.

The formulation that was produced was tested against soil culture to determine the zone of inhibition. The findings demonstrated that the formulation contains a wide range of antibacterial agents. Investigation results demonstrated that the formulation formed an inhibitory zone against soil culture. After incubation, the diameter

Table 3. Various evaluation parameters of the performed experiment.

Evaluation parameters	Observations
Colour	Yellow
Texture	Smooth
Odour	Sweet, Rosy fragrance
Homogeneity and Appearance	Luminous or Translucent
Grittiness	Stable
pH	7.78
Viscosity	47-112 m Pascals
Foam retention	14 ml
Foam height	3.2 cm
Dirt dispersion	Light
Cleaning Action	Wool Weight of formulated product = 11.50 g Wool Weight of the marketed product = 15.75 g Detergency power = 100 * (1 – 11.50 / 15.75) = 100 (1 - 0.73) = 100 × 0.27 Detergency power = 27 %

Table 4. Comparison of Zone of inhibition in formulated and marketed hand wash after and before incubation.

Efficacy	Formulated hand wash	Marketed hand wash
	Diameter (cm)	Diameter (cm)
Before incubation	1.7	1.7
After incubation	3.5	3.9

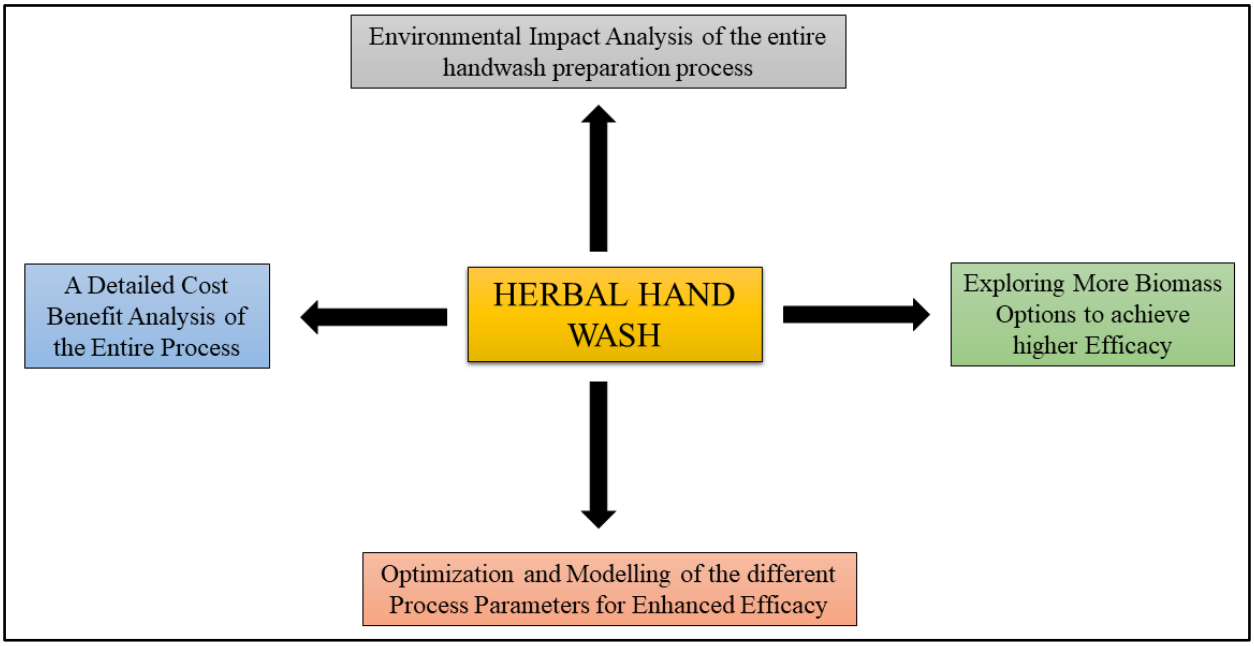

Figure 2. Future Scopes of this study.

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of the zone of inhibition of formulated hand washes increases to 3.5 cm from the initial measurement of 1.7 cm, whereas the zone of inhibition in the case of marketed hand wash reached 3.9 cm from 1.7 cm after the incubation period. Accordingly, the obtained results indicated that the formulation has effective antibacterial properties. A comparison between formulated and marketed hand wash mentioning their efficacy, is summarized in *Table 4*.

Conclusion

Skin, respiratory, gastrointestinal, and other diseases are primarily spread through the hands. Due to numerous illnesses and bacteria, the bar soap becomes contaminated, which could cause germs to spread. Soaps are typically used to clean and remove dirt and microorganisms from the skin's surface. Each person has a different preference for soap, but the soap must not irritate skin that is already sensitive and must be effective in removing skin-infecting germs. Compared to available commercially manufactured hand washes, this formulated hand wash is more efficient. As a result, these substances can be isolated and added to bases to create superb antibacterial hand soap with little to no negative effects. Thus, a novel approach for overcoming antibiotic resistance in pathogenic organisms can be developed, allowing for the provision of safe and healthy living through germ-free hand techniques. The future scopes of this study have been presented in *Figure 2*.

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Author's contribution statement

All the authors have contributed equally to the conducted research.

Conflict of interest

No potential conflict of interest among the authors was reported in this conducted study.

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