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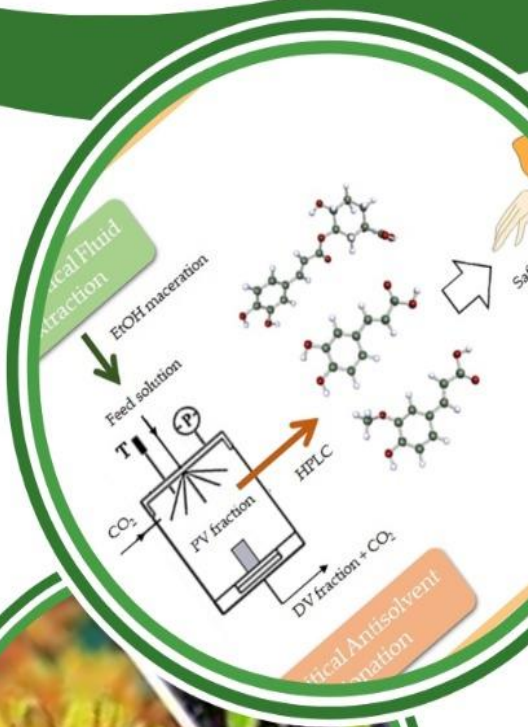
Extract: A Sustainable and Skin-Friendly Alternative to Synthetic Cleansers



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Development and Evaluation of Herbal Hand Wash Formulated with *Calendula officinalis* Extract: A Sustainable and Skin-Friendly Alternative to Synthetic Cleansers

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ABSTRACT

The main aim of this study is to formulate and evaluate a polyhedral hand wash incorporating aloe Vera and lemon juice. The objective of this study is to develop a hand wash product that provides effective cleansing while minimizing potential side effects. The formulation will focus on achieving a balance between thorough hygiene and gentle care for the skin, ensuring that it cleanses efficiently without causing irritation or dryness. This study explores the use of marigold extract to investigate the formulation and assess user preferences for a herbal hand wash. The research aims to evaluate how marigold's natural properties contribute to the hand wash's effectiveness and appeal among users. When formulating the hand wash, several factors are considered, including the base of the hand wash, oils, colour, fragrance agents, herbal extracts, and the optimization process to ensure the final product meets both functional and aesthetic standards. The primary focus is on maintaining hand hygiene by attempting to formulate a herbal hand wash using extracts from widely available plants, such as *Calendula officinalis*, as an alternative to synthetic formulations. The antibacterial activity of the prepared formulation was evaluated against pathogens such as *Escherichia coli* and *Staphylococcus aureus*.

Key words:

Herbal hand wash, Vitamin C, Oil, Citrus lemon, Marigold

1. Introduction

The World Health Organization (WHO) suggests washing your hands thoroughly for at least 20 seconds, especially before and after certain activities, to help prevent the spread of infections. Herbal medicine, also called botanical treatment or phytomedicine, uses parts of plants like seeds, roots, leaves, bark, flowers, or other parts to treat illnesses. It has been used for centuries to care for and manage many diseases [1]. Marigold (Tagetes Erecta L.), a member of the *Asteraceae* family, is gaining popularity as a commercial flower because it is easy to grow, adapts well to different conditions, and is in high demand, especially in India This vibrant plant is commonly grown in gardens during winter as an annual. Beyond its beauty, marigold is highly valued for its medicinal properties, and its pigments are widely used in food colouring products. In ancient India, people used natural ingredients like turmeric, tulsi (holy basil), neem (bark and leaves), lotus petals, and sandalwood paste as part of their hygiene routines. Today, herbal soaps, made from plant-based ingredients, carry on this tradition. These soaps often include vitamins, minerals, essential oils, and other natural components that nourish the skin. Their non-toxic and safe nature makes herbal soaps

increasingly popular. With the added benefits of aromatherapy, they are an excellent choice for daily use [2]. For centuries, traditional healers have used plants to prevent and treat infectious diseases. Certain compounds found in plants, such as tannins, terpenoids, alkaloids, and flavonoids, have been shown to have antimicrobial properties in laboratory studies [3]. Cosmetics are products designed to be applied to the body—whether rubbed, poured, sprinkled, sprayed, or otherwise—to cleanse, enhance beauty, improve attractiveness, or change one's appearance. They also include any ingredients used to make these products [4]. Various chemical antiseptic are now widely available, including alcohol based sanitizers & chlorhexidine products. *Staphylococcus aureus, pseudomonas aerginosa, klebsiella pneumonia* and *proteus vulgaris* are some agents responsible for causing skin infections [5,7]. Hand hygiene is particularly crucial for those in the medical field and for individuals who prepare or serve food to the public [5,6]. Washing hands is one of the best effective ways to maintain personal hygiene and prevent diseases [6]. These hand wash help to control the transmission of contagious disease associated with healthcare more effectively, but they produce adverse effects with prolong use [7]. Calendula is also known as marigold. The calendar plant is native to northern Mediterranean regions. It is an annual bloom that reflects its nature, as it tends to flower in alignment with the calendar year. There are over 100 varieties of *Calendula* known to exist, and this herb is highly versatile, with numerous applications across various industries, including cosmetics. The Egyptians valued *Calendula* for its ability to enhance vitality, while in Hindu culture; it is considered sacred and used in temples to honor deities. Its vibrant colour and pleasant fragrance make it particularly special. Additionally, *Calendula* is believed to offer protective benefits to individuals [8]. Ayurveda is one of the world's oldest medical systems, originated in India over 3,000 years ago. This holistic approach emphasizes natural remedies and the balance between mind, body, and spirit. In line with Ayurvedic principles, Ayurvedic soaps are crafted using natural ingredients, primarily plant-based, and avoid synthetic additives or animal by-products. These soaps cleanse and rejuvenate the skin, with each specific ingredient offering unique benefits. For instance, herbs like *Ocimum tenuiflorum* (holy basil) and *Azadirachta indica* are commonly used in Ayurvedic soaps for their purifying and antibacterial properties. Aloe vera is a succulent plant characterized by thick, fleshy green leaves with serrated edges. Thriving in hot, arid climates, it has been utilized for centuries for its health, beauty, medicinal, and skincare properties. The gel within its leaves is rich in bioactive compounds, including vitamins, minerals, enzymes, sugars, lignin, saponins, anthraquinones, salicylic acid, and

amino acids. These constituents contribute to aloe vera's anti-inflammatory, antibacterial, antioxidant, immune-boosting, anticancer, antidiabetic, and anti-aging properties. Due to these beneficial properties, aloe vera gel is widely incorporated into various products, particularly in the cosmetic industry, to promote skin health and overall body. The essential oil derived from lemons is commonly used in pharmaceutical and cosmetic formulations for its flavour and aroma. Additionally, due to its confirmed antibacterial and fungistatic effects, it serves as a natural preservative in various products [9]. Different solvents with varying polarities have been utilized to extract phenolic and flavonoids compounds from *tagetes erecta*. Among them, ethanolic extracts demonstrated the highest antioxidant activity and the most effective radical scavenging properties [10]. Indian *tagetes erecta* flowers serve as a source of lutein, a natural antioxidant that can be incorporated into food supplements [11]. Plant-derived essential oils exhibit superior therapeutic effects compared to their isolated major components. The essential oil extracted from marigold has shown enhanced anticancer activity, particularly against NB4 and EACC cell lines [12]. In floriculture, both growth promoters and retardants are employed to regulate plant growth according to specific requirements [13]. Phytoremediation is a developing technology and understanding its underlying mechanisms is essential for its optimization [14]. In saline conditions, the uptake of Ca^{2+}, Mg^{2+}, K^{+}, and Na^{+} by marigold plants serves as a key indicator of stress effects [15].

2. Methods

Plant materials for the study were gathered from the college garden, and pathogens were isolated from the hands of healthcare workers (HCWs). Among the isolated pathogens, *Staphylococcus aureus and Pseudomonas aeruginosa* were selected for analysis.

2.1 Preparation of Methanol Extract

To prepare the methanol extract, 10 g of each plant material was added to 100 ml of methanol. The mixture was heated in a water bath at 60°C for one hour. After heating, the solution was filtered, and the filtrate was used as the methanol extract.

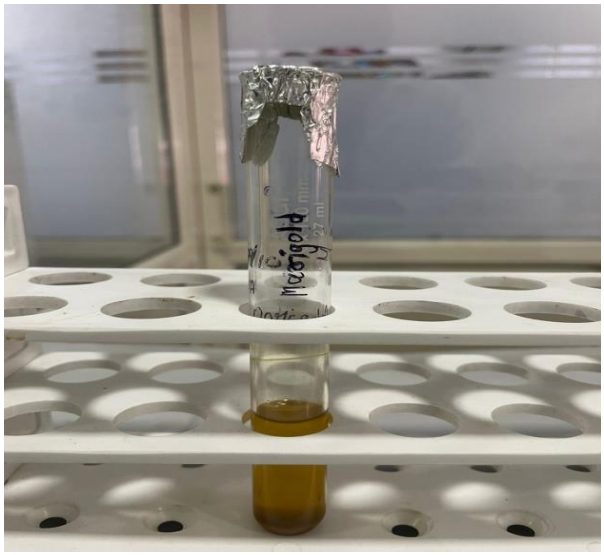

Fig 1: Methanolic extract of Marigold

2.2 Herbal Hand wash Preparation

The herbal hand wash was created by combining 4 ml of the methanol extract from the plant materials with 6 ml of distilled water, making a total volume of 10 ml. To this, 3 g of sodium lauryl sulphate (SLS) was added, following standard procedures for hand wash formulation. The solution was mixed thoroughly at room temperature to ensure homogeneity.

2.3 Antibacterial Screening

The antibacterial activity of the herbal hand wash was evaluated using the disc diffusion method. Test cultures of *S. aureus and P. aeruginosa* were used. Sterile filter paper discs (6 mm) were loaded with 10 µl of the herbal hand wash. Discs containing commercial antiseptic soap and SLS were prepared similarly for comparison. Once dried, the discs were placed on Mueller-Hinton agar plates inoculated with the test cultures. The plates were then incubated, and the zones of inhibition around the discs were measured to determine the antibacterial activity.

2.4 Efficacy Testing

Glove Juice Method

The efficacy of the herbal hand wash in reducing bacterial contamination was tested using the glove juice method. In this procedure, the hand wash was applied to gloves, which were then worn. Sampling solutions were introduced inside the gloves, and bacterial levels were measured by extracting samples at regular intervals. The effectiveness of the product was assessed based on the log reduction of bacteria, with higher reductions indicating greater efficacy.

Both *S. aureus* and *P. aeruginosa* served as test cultures for this evaluation [5].

	Quantity	**Action**
Marigold ext.	0.8 ml	Antimicrobial
Aloe vera gel	0.6 ml	Healing agent
SDS	0.7 ml	Foaming agent
Eucalyptus oil	0.05 ml	Cooling agent
Glycerine	1.2 ml	Moisturizing agent

3. Results

- Colour light brown
- Odour: characteristics
- PH: The pH of the herbal hand sanitizer was found to be 6.8 which is good for skin pH.
- Irritants test: During irritancy tests, the formulation showed no signs of redness, swelling, inflammation, or irritation. This indicates that the products are safe for use on the skin.

The organoleptic evaluation of the herbal hand wash highlighted its unique features. It displayed a deep brown-yellow colour, reflecting its natural composition. The texture was notably smooth, offering a comfortable and enjoyable feel during use. Additionally, hinting at the inclusion of botanical extracts. These sensory qualities combine to create a delightful and appealing hand washing experience, perfectly complementing the herbal nature of the formulation.

The hand wash emitted a delightful fragrance, significantly enhancing the user experience. Stability tests confirmed that the formulation remained consistent and durable under various storage conditions, ensuring its extended usability. Regarding foaming properties, the hand wash produced a foam height of 3.5 cm, demonstrating adequate foaming capability for

efficient cleaning. Its viscosity was measured at 63 Centipoises (cp), reflecting a moderate thickness that allows for effortless application and rinsing. Additionally, the liquid consistency of the hand wash ensured smooth dispensing and even coverage during use. These evaluation metrics collectively highlight the quality and effectiveness of the herbal hand wash, offering a refreshing and reliable cleansing experience.

4. Phytochemical test

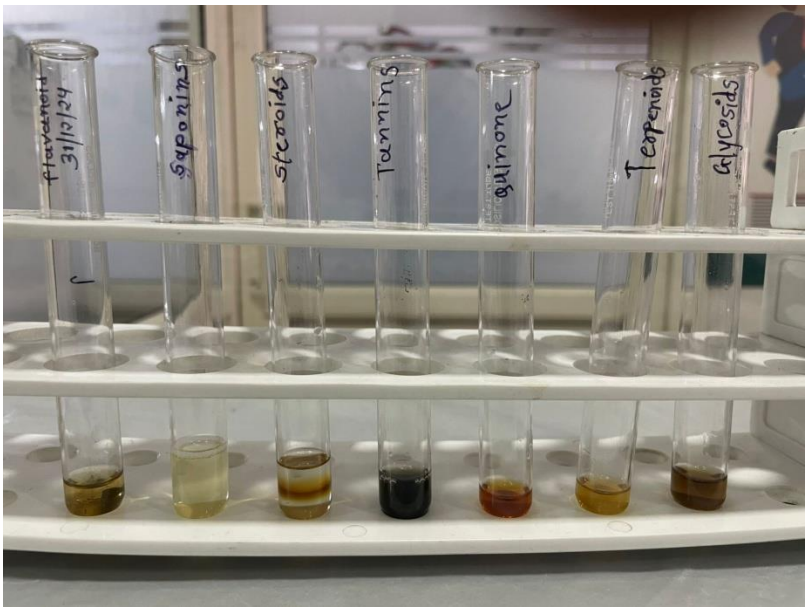

Fig 2: Result of secondary metabolite test of marigold

4.1 Marigold *(calandula)*

Secondary Metabolites	Methanolic
Flavonoids	+ve
Saponins	+ve
Steroids	+ve
Tannins	+ve
Quinone	+ve
Terpenoids	+ve
Glycosides	+ve

Figure 3: Herbal Handwash

5. Conclusion

Hands are a key medium for transmitting diseases related to the skin, respiratory system, and digestive tract. Traditional bar soap, while widely used, poses a risk as it can become contaminated with harmful germs over time, increasing the potential for infection spread. On the other hand, liquid hand washes have gained popularity in recent years due to their convenience and enhanced hygienic benefits. These liquid soaps are considered safer as the product remains untouched, reducing contamination risks. With each use, a fresh pump dispenses the soap, ensuring it stays uncontaminated and more hygienic. Natural remedies are often preferred because they are considered safer and have fewer side effects compared to synthetic alternatives. Herbal hand sanitizers, in particular, have gained popularity worldwide due to their effectiveness and gentler impact on the skin. Studies show that herbal formulations can be excellent alternatives for hand hygiene, offering long-lasting protection with minimal side effects. In fact, some herbal sanitizers have demonstrated better performance than conventional alcohol-based ones. Indian herbs like *Azadirachta indica*, *Ocimum tenuiflorum*, and aloe vera have proven to be effective against harmful bacteria such as *Staphylococcus aureus*, E. *coli*, *and Pseudomonas aeruginosa* without causing harm to human skin. This makes them an appealing choice for safer and natural sanitation solutions.

6. Acknowledgement

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