Marigold in Herbal Handwash Formulations: A Comprehensive Review

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Abstract: The study aimed to create a herbal handwash using extracts from plants like Marigold, Neem, and Tulsi, which have antimicrobial properties. Traditional healers have used plants to treat or prevent infectious diseases, and secondary metabolites found in plants have been shown to possess antibacterial qualities. The polyherbal hand wash was found to be light green in color, non-greasy, smooth in texture, and easily washable with a good pH close to normal skin PH range. During the first few days of use, no skin discomfort was seen, indicating that the polyherbal hand wash has demonstrated cleaning properties without causing skin irritation and is simple to use, reducing the possibility of adverse effects.

The study also investigated the skin-nourishing and antibacterial properties of Marigold, Neem, and Tulsi in a herbal hand wash formulation. The combination of Marigold, neem, and Tulsi extracts showed strong antibacterial activity against various diseases, making it a useful tool for hand hygiene. By adding these organic components, the skin was nourished and hydrated, providing advantages beyond mere washing.

The study underlined the importance of herbal hand washes for promoting hand cleanliness while lowering the risk of synthetic chemicals included in traditional solutions. Overall, the outcome showed the importance of including Marigold, Neem, and Tulsi in hand wash formulas to offer a healthy, safe, and efficient alternative for preserving personal hygiene.

Keywords – Marigold, Tulsi, Neem, Antimicrobial Properties, Polyherbal Handwash

INTRODUCTION

The human body has received drugs in recent decades by a number of routes, including as oral, sublingual, rectal, topical, parental, and inhalation. Applying a drug-containing formulation to the skin to treat cutaneous conditions like acne or the cutaneous signs of a general disease like psoriasis directly with the goal of limiting the drug's pharmacological or other effects to the skin's surface or inside the skin is known as topical delivery. Medicated powders, solutions, foams, sprays, and even medicated adhesive systems are used, although semi-solid formulations in all of their forms are the most common topical administration techniques. [1]

Hand washing is undoubtedly a crucial safety measure. The current project's goal is to make and test a herbal handwash using an extract from widely accessible plants. In addition to hand washing with soap and water, hand sanitizer acts as an antimicrobial. Handwash comes in a variety of forms, including gel, foam, liquid solution, and more. Customers would always choose ready-made herbal handwash formulations over hand washing in the contemporary automated lifestyle environment. Traditional healers have traditionally utilized plants to treat or prevent infectious illnesses. In vitro, secondary metabolites found in plants, such as flavonoids, alkaloids, terpenoids, and tannins, have been shown to possess antibacterial qualities. [2]

The primary source of multidrug-resistant germs and illness transmission to patients is hands. Consequently, it raises the problem of cleaning hands hygienically. Nowadays, a variety of antimicrobial substances are available on the market as detergent, hand wash, and other products with an alcohol base. Although they have specific drawbacks or negative effects, these soaps or solutions help avoid microbial contamination linked to healthcare. Regular use of these may increase resistance to infection and skin discomfort. [3]

HERBAL DEFINE

The use of medicinal plants to prevent and treat illnesses is known as herbal medicine. It includes everything from the use of tritated and standardized plant extracts to the conventional and widely used treatments found in every country. Cultural rootedness and widespread use in a traditional medical system may generally indicate safety but not efficacy of treatments, especially in herbal medicine, where tradition is almost entirely based on remedies

comprising active principles at very low and ultra low concentrations or relying on magical-energetic principles.

Evaluating the "transferability" of therapies across cultural boundaries is not a relevant objective for clinical research in the era of globalization and the so-called "plate world," but rather the evaluation of effectiveness and safety that must be based on recognized clinical medical practices.

What is also unclear about herbal-based treatments is the lack of precise and thorough information on the composition of extracts. The pharmacological properties and safety of herbal treatments require a thorough and robust evaluation, which is really possible with the use of emerging biological technologies such as pharmacogenomic, metabolomic, and microarray methology.

Explanatory and practical studies are helpful and should be viewed as complementary in the acquisition of trustworthy data for patients and healthcare providers alike, as the widespread and expanding use of natural derived substances worldwide makes it foolish to rely solely on tradition or purported millenarian beliefs. [4]

INTRODUCTION OF MARIGOLD

Unsafe medications, persistent illnesses, resistant infections, autoimmune diseases, and degenerative ageing disorders are some of the problems facing modern conventional healthcare. Herbal medicine is gaining popularity because of its natural nature and fewer side effects, although over 70% of India's 1.1 billion people still utilize non-allopathic medical systems. [5] Nearly 8% of the world's biodiversity is found in India, and 80% of people worldwide primarily use traditional medicines, primarily plant-based medications. [6] Modern medicine and Ayurveda coexist, with 30% of current treatments coming from natural sources. [7] Clinical microbiologists are interested in screening medicinal plants for antimicrobial activity and phytochemicals as possible new treatments since they are abundant sources of antimicrobial agents. Due to its nematocidal, cosmetic, and therapeutic qualities, marigold is utilized as both an ornamental and medicinal plant. [8] Beneficial fungus and bacteria found in biofertilizers enhance phosphate solutions, agricultural output, and the chemical and biological properties of soil. [9]

Fig.1. Marigold

2.1 Botanical Study

Kingdom : Plantae

Order : Asterales

Family : Asteraceae

Genus : Tagetes

Species : erecta

2.2 Some of major Marigold varieties

1. African or American Marigolds

These marigolds are tall, upright plants that can reach a height of three feet. They are big, globe-shaped blooms. The diameter of flowers can reach up to 5 inches. African marigolds make wonderful bedding plants.These flowers range in hue from yellow to orange, and red marigolds are not among them. Compared to French types, Africans take longer to reach the blossoming stage.

2. French Marigolds

The height range of these marigold varieties is 5 to 18 inches. The hues of flowers include yellow, orange, and red. There are also bicolor patterns in red and orange. The flowers are smaller (2 inches in diameter). French marigolds are perfect for large plantings and flowerbed edging. They thrive in window boxes and pots as well.

3. Signet Marigolds

Compact plants with finely split lacy leaves and clusters of tiny, solitary blooms are produced by signet marigolds. Their edible blossoms range in hue from yellow to orange. Signet marigold blossoms

taste like peppery tarragon. The leaves have a nice scent of lemon. Signet marigolds make excellent bed borders and window box plants.

4. Mule Marigolds

The term "mule marigolds" refers to these sterile hybrids of tall African and dwarf French marigolds. The majority of triploid cultivars reach heights of 12 to 18 inches. Despite having all of their parents' traits, they don't germinate very often.

2.3 Chemical Constituents

In the past, Marigold was widely used in olden days as medicinal herb used to cure wounds. It is sometimes referred to as a fragrant annual plant. It reaches a height of 0.4–1 m. It produces Marigold oil, a highly fragrant essential oil that is mostly utilized in the creation of premium fragrances, and is a very popular garden plant. Folk medicine uses several elements of this plant, especially the bloom, to treat a variety of illnesses. [10] The leaves are said to be beneficial for wounds, ulcers, muscle soreness, renal issues, and piles. The crushed leaves are used externally on carbuncles and boils. According to reports, it has analgesic, anti-mycotic, and antioxidant properties. GC-MS has identified 18 active chemicals, several of which are terpenoids. [11]

The flower is used to treat eye disorders as well as fevers, epileptic fits (Ayurveda), stomachic, astringent, carminative, scabies, and liver issues. Flower juice is used to treat bleeding piles, rheumatism, colds, and bronchitis, and they are believed to cleanse blood. Numerous chemical compounds, including thiophenes, flavonoids, carotenoids, and triterpeniods, have been isolated as a consequence of phytochemical analyses of its various portions. It has been demonstrated that the plant Marigold contains methyl-3, 5-dihydroxy-4-methoxybenzoate, quercetagetin, a glucoside of quercetagetin, phenolics, syringic acid, quercetin, thienyl, and ethyl gallate. [12]

Lutein is an oxycarotenoid, also known as xanthophyll, that has the fundamental C-40 isoprenoid structure shared by all carotenoids and two cyclic end groups, one beta and one alpha-ionone ring. It is the primary pigment and one of Marigold key components. [13]

2.4 Pharmacological Actions

1. Anti-bacterial Activity

The antibacterial properties of several Marigold flower solvents against Proteus vulgaris, Pseudomonas aeruginosa, Campylobacter coli, Escherchia coli, Alcaligens faecalis, Streptococcus mutans, Streptococcus pyogenes, and Klebsiella pneumoniae. The flavonoid has antibacterial action against every strain that has been tested, and it exhibits the highest zone of inhibition for Klebsiella pneumoniae (29.50 mm). Its antibacterial action may be attributed to the flavonoid patulitrin. [14]

2. Antimicrobial Activity

Plants used in Colombian traditional medicine to treat cutaneous diseases were tested for antimicrobial activity using the disc susceptibility assay against Neisseria gonorrhoeae (NG). Overall, 71% of the crude extracts shown antibacterial action against the NG strain that was sensitive to antibiotics, whereas 10% of the extracts inhibited the NG strain GC1–182, which produces penicillinase. Maximum inhibitory activity against the NG strain was demonstrated by the sections of the marigold flower. [15]

3. Wound healing Activity

The ability of carbopol gels made from hydroalcoholic extracts of Gymnema sylvestere (GE) and Marigold (TE) to cure wounds in albino mice with burn and excision wound models. Excision and burn wound models demonstrated a significant reduction in the duration of epithelization and wound contraction in animals treated with GE and TE. Additionally, the combined gel demonstrated rapid wound healing activity, which may be due to synergism. The phytoconstituents (flavonoids) in hydroalcoholic extracts, which either alone or in combination accelerate the wound healing process, and their ability to scavenge free radicals may be the cause of their increased wound healing activity. [16]

4. Anti-oxidant Activity

Three distinct assays, including DPPH, reducing power, and superoxide radical scavenging activity at varying doses, were employed in the antioxidant investigations on the ethanolic extract of Marigold flowers. Marigod outperformed the standard (ascorbic acid) in all three assays in terms of reducing power, however DPPH antioxidant activity and super oxide anion scavenging activity were lower than expected. However, in every in vitro model, the

ethanolic extract of Marigold showed antioxidant properties. [17]

5. Hepatoprotective Activity

The hepatoprotective effect of carbon tetra chloride-induced hepatopathy in Marigold flowers. Serum ALT, AST, ALP, and bilirubin levels increased in response to the ethanolic extract. When given orally at a dosage of 400 mg/kg, the ethyl acetate fraction of Marigold (EATE) dramatically reduced the increased blood marker enzymes and bilirubin level, bringing it nearly to normal in comparison to the group that was drunk with CCl4. Rats given 400 mg/kg of EATE extract and CCl4 demonstrated a considerable recovery in their liver histological abnormalities, with the exception of moderate inflammation, lobular inflammation foci, and cytoplasmic vascular degenerations around portal tracts. The reported hepatoprotective action is caused by phytoconstituents such steroids, terpenoids, and flavonoids. [18]

6. Insecticidal Activity

Tribolium castaneum (Herbst), a stored product insect pest, is inhibited by Marigold flowers. The petroleum ether fraction and ethanol extract were the next most harmful substances to Tribolium castaneum larvae and adults, after the chloroform fraction. The chloroform fraction's LC values were 11.64, 14.23, 19.26, 29.02, 36.66, and 59.51 µg/cm2 (72 hours) for larvae in their first, second, third, fourth, fifth, and sixth instars, and 65.93 µg/cm2 (72 hours) for adults. The control group did not experience any mortality. Ultimately, they came to the conclusion that marigold flowers may act as a pesticide against Tribolium castaneum. [19]

WHY HANDWASH IS NECESSARY ?

Since hands are the primary means of spreading bacteria and illnesses, keeping hands clean is the best defense against the spread of harmful sources and conditions. Hand hygiene is the most popular, practical, easy, and economical way to prevent nosocomial infections in the healthcare industry. [20] One of the most crucial ways to stop the spread of respiratory and diarrheal illnesses, such as COVID-19, is to practice good hand hygiene. [21] It is possible for defiled hands to act as carriers of origins. When a food tutor contaminates their hands and distributes these bacteria to visitors by hand contact with food or beverages, outbreaks are spread from one person to another. [22]

Infectious diseases, high populations, unsuitable environments, and a lack of public understanding of sanitation and hygiene practices, such as hand washing, are some of the factors that have made health issues a problem in practically every location. After consuming these sources, the stoner is exposed, which may result in gastrointestinal issues. When individuals handle meals that are ready to consume, microorganisms infiltrate the food supply. [23]

Table No.1.Disease caused because of unhygienic hands

Sr. No.	Routes	Disease
1	Ring worm Infection	Dermatophytosis. [24]
2	Helminth Infection	Hookworm, Ascariasis. [25]
3	Rotavirus Infection	Rotavirus Gastroenteritis. [26]
4	Staphylococcal Skin Infections	MRSA (Methicillin-Resistant Staphylococcus aureus. [27]
5	Gastrointestinal Infection	Food Poisoning, Diarrhea. [28]
6	Respiratory Infection	Pneumonia, Common Cold. [29]
7	Eye Infections	Conjunctivitis. [30]
8	Fecal-Oral Diseases	Typhoid, Zika Virus, Malaria. [31]
9	Norovirus Infection	Typhoid, Zika Virus, Malaria. [32]
10	COVID-19	Coronavirus Disease. [33]
11	Hepatitis	Hepatitis A Virus Infections. [34]

REVIEW LITERATURE

1. Nameera H.A. et'al (2023) In order to stop illnesses and the transmission of dangerous bacteria, hand cleanliness is essential in the healthcare industry.Hand-washing herbs like nimba, gırınimba, tulsi, and kumari have

antibacterial, antiviral, anti-fungal, and skin hydration properties. These herbs were prepared using standard methods and incubated on Blood and Macconkey agar for 24 hours. The results showed that hand-washing herbs can create excellent suppression zones against skin pathogens. This may be the rationale for the use of herbs to prepare hand washing and the substitution of these components for chemicals in the manufacturing of soaps or lotions that disinfect. The analytical study showed that the drugs used in the herbal hand wash are suitable for hand washing and reduce the microbial load to protect against skin pathogens. [35]

2. Sanjana Kumar Sinha et' al(2022)The market is saturated with synthetic handwashes containing heavy metals, which can be absorbed by the hands. This manuscript focuses on the formulation and characterization of herbal handwash, comparing it to marketed herbal products in the Indian market. The study used leaves of Azadirachta indica, aloe vera, and fruit Gandaraj lemon for preparation. The results showed that the prepared herbal handwash was comparable to standard values and marketed formulations. Consumers are increasingly seeking natural-based cosmetics to avoid allergic reactions and adverse effects. Liquid hand washes are more commonly used than bar soap, as they are untouched and uncontaminated. Various types of handwashes claim to kill harmful germs at a considerable rate and in minimum time. The efficiency of handwash is crucial to determine its effectiveness. [36]
3. Souvik Giri et' al(2022)This study aimed to create poyherbal handwash formulations using ethanolic extracts of Mimosa pudica, Azadirachta indica, and lemon extract. Two formulations were tested against skin pathogens Bacilus subtilus, Staphylococcus aureus, Psuedomonas aeruginosa, and Escherichia coli using agar diffusion method. The results showed that the herbal hand wash formulations showed significant antimicrobial activity compared to marketed products. Compared to the formulation without lemon extract, the hand wash with lemon extract shown somewhat greater action. The study suggests that natural remedies are safer and have fewer side effects than synthetic ones, making herbal handwash formulations an effective and safe alternative to synthetic products. [37]
4. Nikita p. Aware et' al (2022) Using methanolic extracts from the leaves of Glycyrrhiza glabra, Azadirachta indica, and Mimosa pudica, the study sought to develop poyherbal handwash formulations. The formulations' antibacterial efficacy against skin infections and physical properties were assessed. Significant inhibitory zones were found in the results, indicating the potential for commercial usage of these plant components.Antimicrobial activity was investigated using the well diffusion method; formulation F3, which contained all three extracts, demonstrated the maximum zone of inhibition against Escherichia coli, Psuedomonas aeruginosa, Staphylococcus aureus, and Bacillus subtilus.Due to their affordability and lack of adverse effects, herbal formulations are in high demand. Good antibacterial action is demonstrated by a polyherbal handwash containing herbal components such as Azadirachta indica, Mimosa pudica, and Glycyrrhiza glabra. [38]
5. Patel JK et' al 2024. A study has developed a polyherbal hand wash gel, containing extracts from tulsi and neem, as a natural alternative to synthetic hand wash. The gel is effective and suitable for all skin types, making it a superior substitute for traditional handwash. The study used the agar plate method to investigate the antimicrobial activity of the gel on soil microorganisms. The soil extract was inoculated into nutrient agar media and cavities were created using the cup plate method. The gel is designed to be mild on sensitive skin and prevent bacteria growth, making it superior to synthetic hand wash and basic soaps. The gel's effectiveness and compatibility make it a promising solution for public health issues. [39]
6. Arun Kumar et' al 2022 The skin, which is most exposed to the sun, environmental pollutants, and pathogen defense, the area most affected by skin conditions like eczema, warts, acne, rashes, psoriasis, and allergies. Hand cleanliness is crucial in preventing, managing, and reducing diseases. Hand sanitizers, which come in various formulations, act as antimicrobials and come in various forms like gel, foam, liquid solution, and others. In the US, hand sanitizer products must have a "national drug code" designation. Plants have been used for many ailments before modern medicine, and as antibiotics become more resistant, researchers are exploring the value of

plants with antibacterial characteristics. The purpose of this study was to make herbal hand sanitizers by using Tulsi leaf extracts. and Eucalyptus globulus (Nilgiri) and evaluate their antimicrobial efficacy and safety. The formulation was tested against specific microorganisms and found to be more effective than commercially available hand sanitizers.Neem, eucalyptus, mint, tulsi, and aloe vera hand sanitizers can suppress bacterial and yeast germs by 2.5 percent (v/v). Natural herbal hand sanitizers are economical, efficient, and safe for the environment. [40]

7. Megha Bahuguna et' al 2016 Hygiene is a science that promotes health and prevents the spread of infections. Cleaning processes like hand washing and bathing remove dirt and soil, as well as infectious microbes. Maintaining hygiene is crucial for healthy living and preventing diseases. A study was conducted to formulate a hand wash using Calotropis gigantea as an active ingredient. The formulation was prepared using approved excipients and tested for antimicrobial activity. Hand hygiene is essential for maintaining a safe environment and preventing the spread of infections. Hand wash gels are designed to be gentle on the delicate skin, ensuring no irritation Calotropis gigantea was used as an active component in a hand wash formulation study. Overall, effective infection control measures, such as handwashing, are essential for preventing diseases and maintaining a healthy lifestyle. [41]
8. Mohamed Senouci Bereksi et' al 2018 The bactericidal properties of hydromethanolic extracts of nine medicinal plant parts used in Algerian traditional medicine were assessed in this study. The findings demonstrated that extracts of the root barks of Berberis vulgaris, the peels of Cinnamomum cassia, the aerial parts of Cistus monspeliensis, the fruit peels of Punica granatum, the aerial parts of Rhus tripartita, and the leaves of Withania frutescens may have antibacterial properties against the tested bacterial strains, particularly S. aureus. The efficacy in terms of minimum inhibitory concentrations . The extracts of B. vulgaris, C. monspeliensis, and P. granatum demonstrated relatively high activity against S. aureus, E. faecalis, and E. cloacae. This activity supports their use in treating infections caused by resistant bacteria. The use of antibiotics in clinical medicine, agriculture, and veterinary promotes the development of antibiotic resistances among infectious microbial strains. This has led to the search for new antimicrobial agents, mainly among plant extracts, to overcome these disadvantages. [42]
9. Krishnamurthy Kamlapurkar et' al 2022 The study aimed to formulate and evaluate an herbal handwash using the extract of Quercus infectoria galls, a shrub found in Iran, Asia Minor, Syria, and Greece. The extract contains tannic acid, gallic acid, and ellagic acid, which are known for their antibacterial properties. Glycerin serves as a humectant, sodium lauryl sulphate as a surface active ingredient, and carbopol as a gelling agent in this handwash gel. The antibacterial activity of the formulated handwash was evaluated against Staphylococcus aureus bacteria. According to the findings, Quercus infectoria gall extract exhibited good antibacterial activity against Staphylococcus aureus. The formulated handwash was found to be alcohol-free, easily spreadable, and had a pH of 6.8, which is nonirritant to the skin. The zone of inhibition of the prepared handwash was found to be 45mm, significantly greater than the commercial formulations. The study highlights the importance of antibacterial handwashing in healthcare settings, as infections are often spread via hands. [43]
10. Dyneshwar Ansarwade et' al 2023. The study aimed to evaluate the antibacterial activity of a polyherbal hand wash formulation against various skin infections. The hydroalcoholic extracts of Tridax procumbens, Azadirachta indica, Glycyrrhiza glabra, and Hibiscus rosa-sinensis were used to create two formulations. The agar plate method was used to compare the effectiveness against Staphylococcus aureus, Bacillus subtillis, and Escherichia coli. Comparing the herbal hand wash formulations to traditional antibiotics, the results indicated a significant zone of inhibition. [44]
11. Arpita Mukherjee et' al 2024. The demand for herbal and natural personal care products is increasing due to concerns about health risks associated with synthetic ingredients. A study aimed to develop and evaluate a herbal hand wash formulation using Ocimum tenuiflorum, an antimicrobial plant. Ocimum tenuiflorum methanolic extract was made using lemon juice and Sapindus mukorossi. The results showed

significant antimicrobial efficacy against B.subtilis and E.coli, with formulation one showing maximum inhibition. The hand wash also showed excellent skin compatibility, making it suitable for frequent use without adverse reactions. The study concludes that plant-based hand washes are safer than synthetic ones. [45]

12. Rohini m Nikam et' al 2024 A polyherbal handwash was developed using extracts from herbs with antimicrobial properties, including neem, turmeric, reetha, lemongrass, orange peel, and glycerin. The handwash exhibited greater antimicrobial activity than existing commercial handwashes, with stability studies showing no color change or phase separation. The handwash was evaluated against skin pathogens like Staphylococcus aureus and E. coli using the dipwell method. The formulation with lemon juice showed enhanced antimicrobial activity. The intended antibacterial effect was produced by the combined action of phytoconstituents from the herbal extracts, which are known to have no negative effects on human tissues while boosting cleanliness. This study successfully formulated a polyherbal handwash by combining extracts from these plant sources, demonstrating desirable physicochemical properties, stability, and significant antimicrobial activity against relevant skin pathogens. [46]
13. Shital Mahesh Rathi et' al 2023 This review article explores the preparation of polyherbal hand wash gels for germ-free hand markets. Various formulations are available, including hand sanitizer, handsoap, soap paper, and hand wash gel. Polyherbal hand wash is a cost-effective and effective method of eliminating germs, as it is easily available in both urban and rural areas. The ingredients used in the preparation are herbal plants with specific medicinal uses. The hand wash can be prepared at home using homemade recipes, such as neem, orange peel, and aloe vera pulp. Commercial polyherbal hand wash preparations include medimix herbal hand wash and aloe vera herbal hand wash. Handwashing is crucial in healthcare to prevent the spread of diseases and prevent nosocomial infections. The review highlights the antimicrobial properties of certain Indian medicinal plants and the increasing demand for herbal formulations in the market. [47]
14. Aniket Patel et' al 2016 The study focuses on the development and evaluation of a herbal hand wash containing ethanolic extract of liquorice root (Glycyrrhiza glabra). Handwashing is crucial in daily life, as hands are major sources of microbial infections. Herbs have antimicrobial properties, making them a common practice. The study evaluated the antimicrobial activity of the prepared herbal hand wash using the Disc diffusion method. Results showed that the extract of liquorice root was more efficient in reducing organisms from the hands-based handwash with less or no side effects. This implies that because of their greater antibacterial activity effectiveness, these herbal extracts can be utilized to make a herbal hand wash on a commercial basis. Hand hygiene is essential to prevent the transmission of harmful germs and prevent nosocomial infections. Traditional healers have long used plants with antimicrobial properties, and Glycyrrhiza glabra root extract holds antimicrobial potency. The study aimed to formulate and evaluate a ready-to-use herbal hand wash using alcoholic extracts and other suitable excipients. [48]
15. Aniket G. Karodade et' al 2024 This study aims to develop and assess a poly-herbal hand wash formulation incorporating aloe vera and lemon juice to create a product with minimal side effects and effective hand cleansing. Hands are primary sites for microbial infections, especially in children and pharmaceutical industry employees. The formulation focuses on safety and efficacy, using natural ingredients like aloe vera and lemon juice for their antimicrobial and cleansing properties. The inclusion of these herbal extracts enhances cleansing action and offers potential benefits for skin health.The evaluation of the hand wash involved various parameters, including color, odor, pH level, viscosity, and stability. The results indicated that the formulated hand wash meets the desired standards for use as an antiseptic hand wash solution. [49]
16. Mashood Ahmed Shah et' al 2014 Hand hygiene is crucial in preventing the transmission of microbes and infections, as it is the single most important, simplest, and least expensive means of preventing nosocomial infections. Contaminated hands can serve as vectors for the transmission of pathogenic microorganisms, which can cause gastrointestinal illness. Food

handlers who touch unwrapped foods, such as ready-to-eat foods, are at a higher risk of contracting these microorganisms. Hand washing is an important precaution to protect the skin from harmful microorganisms and prevent the spread of contagious diseases. Cinnamon oil, an active constituent of the formulated herbal hand wash gel, has shown great activity against different bacterial isolates, producing the widest zone of inhibition against S. aureus, E.coli, and Salmonella. This suggests that cinnamon oil can be used as an antibiotic-resistant method to provide safe and healthy living through germ-free hands. [50]

17. Arjun G.G. et' al The goal of creating a herbal liquid hand wash is to improve personal hygiene in care and food facilities. This hand wash, which is created from extracts of Ocimum Sanctum and Moringa oleifera leaves, avoids side effects including itching, dryness, irritation, dermatitis, and allergic responses, in contrast to alcohol-based solutions. Numerous factors were assessed, including pH, colour, odour, appearance, cleaning action, and stability. The hand wash's physicochemical characteristics, such as pH (6.38), colour, and odour, were all within predetermined parameters, and it proved both effective and devoid of adverse effects. [51]
18. Aditi shrinivasan et' al 2022 The scientific study of pharmacognosy looks at the structural, chemical, biological, and physical properties of medications. Handwashing is a crucial aspect of maintaining personal cleanliness and protecting the skin from various microorganisms, especially in children. Using key extracts of botanicals including aloe vera, turmeric, honey, tulsi, and lemon, this study attempts to develop a skin-friendly handwash. Several factors, including odor, color, viscosity, pH, foam height and retention, and grittiness, were used to assess this handwash's antibacterial and antiseptic effectiveness. Synthetic soap-containing products, which are widely available on the market, perform better in reducing the spread of infectious diseases and pathogens in healthcare settings but can make infections more resistant and cause skin irritation when used frequently. [52]

EVALUATION TEST

1. PH : A standardized digital pH meter was used to measure the formulations' pH at room temperature. Mali et al., 2020.[53]
2. Foam Height : 1 gram of the produced polyherbal handwash mixture was added to 50 ml of distilled water was dispersed. After that, it was put into a 500 ml stoppered measuring cylinder, which was filled with water to reach a volume of 100 ml. It was given 25 strokes and left to stand until the aqueous volume reached 100 ml. Next, the height of the foam above the aqueous volume was measured (Kuril et al.2020). [54]
3. Organoleptic : Assessment of Organoleptic Color, texture, and odor were among the parameters that were tested. Visual and sensations of touch were used to assess color and texture, respectively.TheOdour was inspected by sensing the formulation. [55]
4. Appearance And Homogenecity : Using visual inspection, appearance and homogenicity were assessed. [56]
5. Grittiness: After applying a 1 ml of gel to the tips of two fingers and rubbing them together, then formulation was evaluated. [57]
6. Skin irritancy test: The formulations were applied to the skin and watched for 30 minutes to conduct the skin irritancy test. [58]
7. Spreadability: Between two slides, 0.5g of the Polyherbal Hand Wash Gel sample was placed. It fell for around five minutes, after which no further spreading was expected. Comparative figures for spread ability were obtained by measuring the spreaded circle's diameter. [59]
8. Viscosity: The Ostwald viscometer was used to measure the viscosity of Polyherbal Hand Wash.[60]

CONCLUSION

The study investigated on the skin-nourishing and antibacterial properties of Marigold, Neem, Tulsi in a herbal hand wash formulation. The combination of Marigold, neem, Tulsi extracts shown strong antibacterial activity against a variety of diseases, according to the results, which made it a useful tool for hand hygiene. Further, by adding these organic components, the skin was nourished and hydrated, providing advantages beyond mere washing.

Because of their antibacterial, antifungal, and anti-inflammatory qualities, Marigold, Neem, Tulsi have been extensively studied for their potential usage in skincare products. The study also underlined how important herbal hand washes are for promoting hand cleanliness while lowering the risk of synthetic

chemicals included in traditional solutions. Overall, the outcome showed how crucial it is to include Marigold, Neem, Tulsi in hand wash formulas in order to offer a healthy, safe, and efficient alternative for preserving personal hygiene.

FUTURE PERSPECTIVE

Marigold, with its rich history of traditional use and established antimicrobial properties, holds great promise for the development of effective herbal handwashes. As the demand for natural and sustainable products continues to grow, Marigold-based handwashes may become an increasingly popular choice for consumers seeking alternatives to synthetic antimicrobial agents.

Emerging Trends and Opportunities

Nanotechnology-based formulations: Incorporating Marigold extracts into nanotechnology-based formulations could enhance their antimicrobial efficacy and stability.

Combination therapy: Investigating the synergistic effects of combining Marigold with other herbal extracts or essential oils could lead to the development of more effective handwash formulations.

Sustainable and eco-friendly production: Exploring sustainable and eco-friendly methods for cultivating and processing Marigold could reduce the environmental impact of handwash production.

Clinical trials and efficacy testing: Conducting rigorous clinical trials and efficacy testing to evaluate the performance of Marigold-based handwashes against various microorganisms could provide valuable insights for product development and regulatory approval.

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