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Formulation and Evaluation of Herbal Hand Sanitizer

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ABSTRACT:

The formulation and evaluation of a hand sanitizer using herbal extracts of *Neem* (Azadirachta indica) and *Tulsi* (Ocimum sanctum) aim to provide a natural, effective alternative to synthetic alcohol-based sanitizers. Both *Neem* and *Tulsi* are renowned for their potent antimicrobial, anti-inflammatory, and skin-soothing properties. In this study, hand sanitizers were formulated by incorporating extracts of these herbs into a suitable gel base, ensuring optimal efficacy and skin compatibility. Herbal Ingredients Such as Neem, Aloe Vera, Tulsi, And Lemon Extract Were Selected For Their Potent Antibacterial, Antifungal, And Antiviral Effects. Additionally, the hand sanitizer was assessed for its stability, skin irritation potential, and sensory attributes, including texture, fragrance, and ease of application. The results indicated that the herbal hand sanitizer demonstrated significant antimicrobial activity, making it a promising natural alternative for hand hygiene. Furthermore, it was found to be gentle on the skin, offering protection without causing dryness. The findings suggest that a hand sanitizer formulated with *Neem* and *Tulsi* extracts can effectively combine hygiene with skin care, providing a safe and eco-friendly solution for everyday use.

KEYWORDS: Hand sanitizer, Hand hygiene, Anti-bacterial, Polyherbal, Antiviral

Introduction:

Hand sanitizer demand has increased recently as a result of increasing concerns about infectious diseases and the importance of good hygiene habits. While being widely utilized for their antibacterial qualities, alcohol-based hand sanitizers can cause dryness and irritation of the skin when used often. Finding natural substitutes that are both skin-compatible and antimicrobially effective has become more popular as a result. The potential of herbal extracts to function as natural antibacterial agents and their therapeutic effects in traditional medicine have attracted attention, especially those produced from Tulsi (Ocimum sanctum) and Neem (Azadirachta indica). [1]

Neem is a useful component in the fight against dangerous microbes because of its well-known antibacterial, antifungal, and antiviral qualities. Similar to this, Tulsi, also known as "holy basil," has strong antibacterial and anti-inflammatory qualities that help to maintain healthy skin and ward off infections. Rich in bioactive substances like flavonoids, alkaloids, and essential oils, these two plants have showed potential in a number of skin care and hygiene products.The purpose of this study is to create and assess a hand sanitizer with tulsi and neem extracts as important active components. The objective of using these plant extracts is to produce a solution that nourishes and shields the skin in addition to offering efficient microbiological protection. Choosing the right stabilizers, gelling agents, and solvents during the formulation process guarantees that the final product is non-irritating, easy to apply, and has a pleasing sensory profile. The antibacterial efficacy, skin compatibility, and general user experience of the hand sanitizer formulation will all be assessed. [2-3]

In addition to investigating the potential of tulsi and neem as useful ingredients for improving skin health and hygiene, this study aims to aid in the creation of natural, environmentally friendly substitutes for traditional hand sanitizers. The World Health Organization (WHO) has highlighted the significance of hand cleanliness in preventing the transmission of the COVID-19 virus due to the circumstances surrounding the COVID-19 pandemic. Alcohol-based hand sanitizer is typically provided in hand hygiene facilities. However, excessive alcohol consumption or frequent use of alcohol-based hand sanitizers exacerbates the elevated risk of skin infection by making the skin drier and more burned. To create a safe and effective alcohol-based hand sanitizer, a natural bioactive ingredient extracted from an available agricultural crop was selected. In contrast, herbal extracts provide a sustainable and natural substitute for traditional hand sanitizers. Traditionally, herbal extracts such as tulsi extract, neem extract, aloe vera gel, and tea tree oil have been utilized. [4]

Objectives:

1. To develop a natural and effective hand sanitizer using herbal extracts (such as Neem, Tulsi, Aloe Vera, and Lemon) that exhibit strong antimicrobial properties while being gentle on the skin.
2. To combine herbal ingredients with moisturizing agents like glycerin and Aloe Vera to mitigate the drying effects of alcohol, ensuring the product maintains skin hydration and comfort after use.
3. To create an alcohol-based hand sanitizer formulation that meets the recommended alcohol concentration of 60-70% to ensure proper antimicrobial efficacy, while incorporating herbal extracts to provide added skin benefits.
4. To evaluate the sensory attributes of the sanitizer (such as texture, fragrance, spreadability, and ease of use) to enhance user experience and satisfaction.
5. To ensure the safety and compatibility of the formulation with various skin types by conducting skin irritation tests and ensuring the product's non-toxicity.
6. To formulate a stable and effective product that meets industry standards for hand hygiene while offering an eco-friendly, sustainable alternative to synthetic sanitizers.
7. To assess the stability, shelf-life, and overall efficacy of the herbal hand sanitizer under varying storage conditions to ensure long-term quality and performance. [17-18]

Pharmacognosy Property Of Herbal Drug:

Pharmacognosy is the study of natural substances, particularly those derived from plants, with medicinal properties. The pharmacognostic properties of herbal drugs encompass a variety of characteristics, including their physical, chemical, and biological properties, which help identify and validate the use of these plants for therapeutic purposes. Here are the key pharmacognosy properties of herbal drugs. [5]

Aloe Vera:

Synonyms: Aloe barbadensis

Biological source: Aloe is the dried juice collected by incision, from the bases of the leaves of various species of Aloe.

Family: Asphodelaceae

Uses:

1. Soothes skin and reduces Inflammation.
2. Moisturizes skin and helps with dry Skin.

3. Aloe vera contains bioactive compounds like saponins and polysaccharides, which enhance antimicrobial effectiveness.

4. It promotes skin healing and repair, reducing the risk of irritation or damage from frequent sanitizer use.

Neem:

Synonym: Azadirachta indica

Biological source: It is obtained from fully matured seeds of Azadirachta indica Linn.

Family: mahogany family (Meliaceae).

Uses:

1. Neem contains compounds like nimbidin and azadirachtin that help eliminate harmful bacteria, making it effective in killing germs.
2. It helps fight viruses and prevents the spread of infections.
3. Neem prevents fungal infections, which is useful for maintaining hand hygiene.
4. Unlike chemical sanitizers, neem helps keep the skin hydrated and prevents dryness.
5. Its anti-inflammatory properties help reduce skin irritations and rashes.

Tulsi:

Synonyms: Ocimum sanctum

Biological source: Tulsi consists of the fresh and dried leaves of Ocimum species like Ocimum sanctum.

Family: Lamiaceae

Uses:

1. Tulsi contains essential oils like eugenol, which exhibit strong antibacterial activity, helping to kill harmful microbes on hands.
2. The bioactive compounds in Tulsi, such as ursolic acid and rosmarinic acid, provide antiviral protection, making it effective against certain viruses.
3. Tulsi is rich in antioxidants, which help protect the skin from oxidative stress and environmental pollutants.
4. It soothes irritated skin, reduces redness, and prevents inflammation caused by frequent use.
5. Tulsi has a pleasant, natural fragrance that gives a refreshing feel and eliminates bad odors from the hands.

Turmeric:

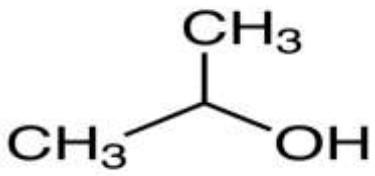
Synonym: Curcuma longa

Biological source: Turmeric is the dried rhizome of Curcuma longa Linn.

Uses:

1. Curcumin, the active compound in turmeric, exhibits strong antibacterial and antiviral properties, helping to eliminate germs and pathogens.
2. Helps soothe irritated skin and reduces inflammation caused by harsh sanitizing agents.
3. Protects the skin from oxidative stress and environmental damage.
4. Promotes faster healing of minor cuts or skin abrasions.

Isopropyl Alcohol:



Isopropyl alcohol is an essential component in herbal hand sanitizers for its disinfecting properties. When combined with herbal extracts and essential oils, it enhances skin protection while ensuring effective antimicrobial action. [7]

Uses:

a. Isopropyl alcohol (IPA) is the primary disinfecting ingredient in herbal hand sanitizers.

b. It effectively kills bacteria, viruses, and fungi by denaturing their proteins and dissolving lipids.

c. IPA evaporates quickly, leaving no residue on the hands.

d. It helps dissolve essential oils and herbal extracts, improving their stability and efficacy.

Glycerin:

Glycerin is a crucial component in herbal hand sanitizers, offering skin protection, hydration, and formulation stability. Its natural origin and compatibility with herbal ingredients make it an excellent choice for maintaining hand hygiene while preventing dryness. [6]

Uses:

a. Acts as a thickening agent, giving the sanitizer a smooth consistency.

b. Improves the spreadability of the product, ensuring even application.

c. Reduces the harsh effects of alcohol and other antimicrobial agents.

d. Helps maintain the natural softness of the skin.

Lemon Essential Oil:

Lemon essential oil is commonly used in herbal hand sanitizers for its antimicrobial, antifungal, and antiviral properties. It enhances the effectiveness of the sanitizer while adding a fresh, citrusy fragrance. [8]

Uses:

1. Lemon oil contains compounds like limonene and citral, which help eliminate harmful bacteria, viruses, and fungi.
2. It provides a refreshing citrus scent, masking the strong smell of alcohol and enhancing the sensory appeal of the sanitizer.
3. Rich in antioxidants and vitamin C, lemon oil helps in skin hydration and prevents dryness caused by alcohol-based sanitizers.
4. It acts as a natural cleanser, removing dirt and impurities from hands while leaving a fresh, clean feel.

Material and Method:

Extraction Process: Preparation of Neem Extracts:

Collect fresh neem leaves and wash them with distilled water. Dry them in a hot air oven and then powder them. Take 5 gm of neem powder in 20 ml of ethanol at 100°C for 5 to 10 minutes. Then, it is filtered through filter paper, and a clear solution is obtained. [9]

Preparation of Tulsi Extract: Tulsi leaves were collected and washed with distilled water and dried in a hot air oven. Then, after proper drying, the leaves were powdered. Then 1 gm tulsi leaf powder+10 ml ethanol was taken in a beaker. Then, the solution was heated in a water bath at 80°C to 100°C for 5 to 10 minutes, then the solution was filter paper to clear the extract of tulsi leaves. [10]

Formula For Hand Sanitizer:

Sr No.	Ingredients	Quantity (100 ml)	Uses
1	Neem Extract	5 ml	Antibacterial and Antifungal
2	Tulsi Extract	5 ml	Antiviral
3	Aloe Vera	10 ml	Moisturizing and Soothing
4	Turmeric	2 ml	Antimicrobial
5	Lemon essential Oil	2 ml	Antiseptic and Refreshing Fregrance
6	Isopropyl Alcohol	70 ml	Antimicrobial agent
7	Glycerin	5 ml	Moisturizer and Skin Protector
8	Distilled Water	q.s	Vehicle

Formulation Of Hand Sanitizer:

Herbal Extract Preparation:

1. Prepare the herbal extract of the desired plant (e.g. Neem, Tulsi, Turmeric) by extracting its active components using a solvent like ethanol or water.
2. Strain and filter the extract to remove plant particles and obtain a clear solution.

Alcohol Solution:

1. Measure the required amount of ethanol or isopropyl alcohol. The alcohol concentration should be 60-70% to ensure proper antimicrobial action.

Mixing the Ingredients:

1. In a clean mixing container, add the herbal extract.
2. Slowly add the alcohol solution (ethanol or isopropyl alcohol).
3. Add glycerin and Aloe Vera gel to provide moisturizing properties.
4. If you are using essential oils, add them in small amounts (few drops for fragrance and extra antimicrobial benefits).

Blend and Homogenize:

1. Mix all ingredients thoroughly to obtain a uniform consistency.
2. Stir gently to avoid excessive foam formation.

Adjustment of pH:

1. Test the pH of the mixture. It should ideally be between 5.5 and 7 for skin safety.
2. If necessary, adjust the pH with a little triethanolamine.

Final Mixing:

1. Ensure everything is well-mixed and homogeneous.

Packaging:

1. The hand sanitizer can now be poured into bottles for storage and use. [11]

Evaluation Test For Hand Sanitizer:

Organoleptic Evaluation

Purpose: To assess the sensory attributes of the hand sanitizer.

Tests:

Appearance: Check if the sanitizer is clear, free from any sediment or cloudiness, and has a consistent texture (gel or liquid).

Odor: Evaluate the fragrance. It should be pleasant and not overpowering. There should be no off-putting smells or chemical odors.

Feel: Assess the consistency—whether the gel flows easily and does not feel too sticky or too runny. [12]

Viscosity Test

Purpose: To determine the thickness of the product, especially important for gel-based sanitizers.

Method:

Use a viscometer to measure the viscosity of the product.

For a gel hand sanitizer, the viscosity should be thick enough to stay on the hands without dripping excessively.The result should be consistent with the desired product characteristics (gel or liquid). [13]

Spreadability Study:

Spreadability is an important factor to consider when developing hand sanitizer formulations, as it can affect both customer compliance and the effectiveness of the product. A hand sanitizer with poor spreadability may not be applied evenly, which can result in areas of the skin being missed and potentially leaving areas of the skin unprotected.To test the spreadability of the hand sanitizer formulations, a spreadability test was conducted in this study. The test measures the time it takes for the gel to spread over a surface and the force required for spreading. The optimum gel formulation should have a quicker spreading time and require less force to spread (i.e., high spreadability). [14]

3. pH Measurement

Purpose: To ensure the sanitizer is skin-friendly and will not cause irritation.

Method:

Measure the pH of the sanitizer using a pH meter or pH test strips.

The ideal pH range for hand sanitizers is typically between 5.5 and 7.

A pH outside this range could cause skin dryness, irritation, or discomfort.

4. Alcohol Content Determination

Purpose: To verify the alcohol concentration, which is crucial for the sanitizer's antimicrobial activity.

Method:

Alcohol content can be measured using an alcohol meter or hydrometer to ensure it falls within the 60-70% alcohol content range.

The sanitizer should contain at least 60% ethanol or isopropyl alcohol for it to be effective at killing germs. [15]

Skin Sensitivity Testing:

- **Patch Testing:** To determine if the herbal sanitizer causes irritation, conduct a patch test on a small area of skin to check for allergic reactions or irritation.
- **Moisturizing Effect:** Evaluate how well the sanitizer keeps the skin moisturized after use, especially since alcohol can dry out the skin. [16]

Result And Discussion:

The present study was carried out to formulate an Azadirachta indica (Neem), Ocimum tenuiflorum (Tulsi), Aloe barbadis (Aloe Vera), and turmeric-based hand sanitizer. The formulation was prepared by using herbal ingredients and excipients that are compatible with any similar hand-cleansing formulations. It was organoleptically evaluated to ensure product stability, and an In-vitro antimicrobial test was performed to demonstrate its efficacy against infectious bacteria collected from volunteers.

Evaluation Parameter:

Sr No.	Evaluation Test	Observation
1	Colour	The colour of the sanitizer was reported as **Yellowish-White.**
2	Odour	Aromatic and Characteristic.
3	Feel	The gel flows easily and does not feel too sticky

4	PH	Ranging Between 5.5 to 7
5	Spreadability	High-Spreadability
6	Viscosity	It should be Non-Sticky and Easy to Spread.
7	Skin Irritancy Test	No Skin Irritancy
8	Alcohol Content	60-70%

Conclusion:

The herbal hand sanitizer can be an effective and skin-friendly alternative to chemical-based sanitizers. The combination of alcohol for antimicrobial action and herbal extracts for skin nourishment and additional antimicrobial benefits creates a balanced product. However, ongoing testing and quality control are essential to ensure that the final product remains safe and effective over time. Hands are the most common mode of transmission of pathogens to patients, and proper hand hygiene can prevent healthcare-associated infections and the spread of antibiotic resistance. Scientific evidence and support of alcohol based hand sanitizer during patient care. It may be concluded that herbal hand sanitizer has a significant bacterial effect on the specified microorganism.

Herbal hand sanitizer is the best alternative for chemically prepared containing active silver nitrates. Herbal hand sanitizers are effective and environment friendly biodgredable, inexpensive in this research work herbal hand sanitizer were formulated successfully.

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