



FORMULATION AND EVALUATION OF HERBAL HAND SANITIZER

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Abstract

There has been a growing concern about the overuse of chemical hand sanitizers and their potential adverse effects on health and the environment. Therefore, herbal hand sanitizers have emerged as a safe and effective alternative to chemical-based sanitizers. The use of herbal extracts in hand sanitizers not only provides antimicrobial activity but also offers additional benefits such as moisturization and skin conditioning. Furthermore, herbal hand sanitizers are eco-friendly and sustainable, making them a preferable choice for environmentally conscious consumers. Overall, the use of herbal hand sanitizers can help promote hand hygiene while also addressing concerns related to the overuse of chemical sanitizers.

KEYWORDS: Hand sanitizer, Anti-bacterial, Polyherbal

INTRODUCTION

Plants have been used for medicinal purposes for centuries, and many modern drugs have been derived from plants. In addition to antibiotics, plants also contain compounds that have antiviral, antifungal, and anti-inflammatory properties^{1,2}. For example, tea tree oil is a natural antiseptic that has been used to treat wounds and skin infections. Aloe vera has anti-inflammatory properties that make it effective in treating burns and other skin conditions. Some other plants that have been studied for their antibacterial properties include garlic, turmeric, and honey^{3,4}. However, it is important to note that not all plant-based treatments are safe or effective, therefore it is always best to consult a healthcare professional before using any herbal remedies^{5,6}.

PRESENT STATUS

Homemade hand sanitizers using herbal components may be a cost-effective alternative to commercial hand sanitizers, it is important to note that they may not be as effective in killing bacteria and viruses as alcohol-based hand sanitizers recommended by health organizations. Additionally, it is important to ensure that the ingredients used in homemade hand sanitizers are safe and not harmful to the skin. The World Health Organization (WHO) recommends a specific formulation for alcohol-based hand sanitizers, which includes at least 70% alcohol content.

It is important to follow proper hygiene practices and ensure that the equipment used is clean and sanitized. However, it is always best to use commercially available hand sanitizers that have been tested and approved by health organizations to ensure maximum effectiveness in preventing the spread of infectious diseases.

ADVANTAGES OF HERBAL HAND SANITIZER

1. Neem and tulsi are known for their antibacterial properties and have been used in traditional medicine for centuries. Neem has been shown to have antibacterial, antiviral, and antifungal properties, and is commonly used in India as a natural remedy for a range of health issues. Tulsi, also known as holy basil, has been used in Ayurvedic medicine for thousands of years and has been shown to have antibacterial and antifungal properties as well. Both neem and tulsi can be used in hand sanitizers to kill bacteria and other microorganisms.
2. Hand sanitizer can help guard against other bacterial and viral infections in addition to coronavirus infections, as it is effective in killing a wide range of microorganisms. Regular use of hand sanitizer can help prevent the spread of illnesses such as cold, flu, and gastrointestinal infections that are caused by bacteria and viruses. However, it is important to consider that hand sanitizer is not a substitute for proper hand washing and other hygiene practices, and should be used in combination with other measures such as wearing a mask and practicing social distancing to reduce the risk of infection.
3. Hand sanitizer is generally quicker and more convenient than washing hands with soap and water, which requires access to a sink and running water. Hand sanitizer can be applied anywhere and at any time, making it a convenient option for people who are on the go or do not have access to hand washing facilities.
4. Hand sanitizer is quick and simple to use, making it a convenient option for people who are on the go or do not have access to hand washing facilities. To use hand sanitizer, you simply need to apply a small amount to your hands and rub them together until the sanitizer evaporates. This process takes only a few seconds and can be done anywhere, making hand sanitizer a convenient option for maintaining hand hygiene in various settings. However, it is important to note that hand sanitizer should be used properly and in conjunction with other hygiene practices, such as covering your mouth and nose when coughing or sneezing, to reduce the risk of spreading infectious diseases.

HERBAL HAND SANITIZER EXTRACTS

Ingredients	Biological source/Family	Uses
Neem	Azadirachta indica, is a fast-growing tree that belongs to the mahogany family (Meliaceae). It is native to the Indian subcontinent and can be found in many parts of Asia, Africa, and the Middle East. The neem tree is known for its many medicinal properties and is used in traditional medicine for a wide range of ailments.	Neem contains several bioactive compounds, including azadirachtin, nimbin, and nimbidin, which have been shown to have antimicrobial properties. These compounds can help to kill or inhibit the growth of a variety of bacteria and fungi, including those that can cause skin infections, respiratory infections, and foodborne illness.

Tulsi	Tulsi, also known as Holy Basil, is a herbaceous plant belonging to the family Lamiaceae (formerly known as Labiatae). Its botanical name is <i>Ocimum sanctum</i> Linn., and it is native to the Indian subcontinent.	Tulsi, also known as holy basil, is known for its broad-spectrum antimicrobial activity, which includes activity against a range of human and animal pathogens.
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PROCEDURE:

Preparation of Extract for Hand Sanitizer:

Using dried leaves of neem and tulsi, powdering them mechanically, and soaking them in ethanol overnight is a common method of extracting their active components. Once the extraction is complete, the mixture is typically filtered using a funnel and filter paper to remove any solid particles or impurities, leaving behind a clear liquid extract. This extract can then be used as an ingredient in hand sanitizer formulations, providing natural antibacterial and antiviral properties to the product. It is important to note that while plant extracts can be effective in killing microorganisms^{7,8}.

PREPARATION:

- Carbopol is a common thickening agent used in hand sanitizer formulations. To prepare a hand sanitizer solution using carbopol, deionized water is typically added gradually to the carbopol powder while being constantly stirred. This process helps to ensure that the carbopol is evenly dispersed throughout the water, preventing the formation of clumps or lumps. Once the carbopol is fully dispersed, other ingredients such as alcohol, plant extracts, and humectants may be added to the solution, depending on the desired formulation. The resulting mixture is typically thick and viscous, making it easy to apply and spread evenly on the hands.
- Triethanolamine is often added to hand sanitizer formulations as a pH adjuster, as it can help to neutralize the acidity of other ingredients such as carbopol or citric acid.
- When adding triethanolamine to a hand sanitizer mixture, it is important to add it slowly and after thorough mixing to prevent the potential production of air bubbles in the finished product. Air bubbles can reduce the efficacy of the hand sanitizer by creating pockets of air where bacteria or viruses may survive. Therefore, it is important to mix the ingredients carefully and thoroughly, taking care to avoid creating air bubbles, in order to ensure the effectiveness of the final product.
- After the hand sanitizer mixture is prepared, it is typically allowed to rest or "cure" for a period of time before it is used. This is done to allow the ingredients to fully mix and any air bubbles to dissipate, ensuring that the hand sanitizer is fully effective and free of any potential defects or inconsistencies. The curing time may vary depending on the specific formulation and ingredients used, but a common practice is to hold back the hand sanitizer for 24 hours before packaging or using it. This allows the

solution to fully stabilize and reach its optimal effectiveness. After the holding period, the hand sanitizer may be packaged into bottles, tubes, or other containers for distribution and use.

- To make a hand sanitizer formulation that includes plant extracts, alcohol, glycerine, and carbopol, the ingredients are typically combined in a specific order and sequence to ensure a consistent result. The alcohol, glycerine, and aqueous phase are usually mixed together first, and then the plant extracts and carbopol are added to the mixture. The carbopol helps to thicken the solution and create a gel-like consistency that is easy to apply and spread on the hands.
- After the plant extracts and carbopol are added, the mixture is typically stirred slowly and carefully to ensure that the ingredients are evenly dispersed and any air bubbles are eliminated. This is important to achieve a uniform consistency throughout the hand sanitizer, which is critical for its effectiveness in killing bacteria and viruses.
- Once the mixture is thoroughly mixed, a preservative such as methylparaben may be added to help extend the shelf life of the hand sanitizer. A scent may also be added to give the hand sanitizer a pleasant fragrance. The final product is typically tested to ensure that it meets the desired specifications for viscosity, pH, and effectiveness, before it is packaged and distributed for use⁹.



Fig: Herbal sanitizer¹⁰

EVALUATION

1. Organoleptic Test: The gels were reported to be homogeneous, transparent, and easy to use with a light and continuous flow. They did not exhibit any syneresis (separation of liquid from a gel-like substance), which is a positive attribute. However, the gels developed a bubble-like appearance with overnight storage,

which is a common occurrence in gels and is generally not considered a major issue. The bubbles disappeared after a light shake, indicating that the gels were able to maintain their homogeneity and flowability.

The color of the gel was reported as yellowish-white, which could be due to the presence of certain active ingredients or additives used in the formulation. The odour was described as characteristic, which could be an indication of the presence of specific fragrances or natural extracts used to enhance the product's essence.

Overall, based on the organoleptic test results, it appears that the developed hand sanitizer gels had the desired physical attributes and would likely be well-received by consumers. However, it is important to note that the effectiveness of the sanitizer in killing or inhibiting the growth of harmful microorganisms cannot be determined based solely on organoleptic tests and requires further testing and validation.

2. pH Evaluation: the pH values of the hand sanitizer gel formulations were measured using a digital pH meter. The aim of the study was to evaluate how various manufactured formulations were neutralized, which likely refers to the process of adjusting the pH of the formulation to a desired level.

The ideal pH range for a topical dose form, such as a hand sanitizer gel, should be within the skin's natural pH range of 4.0 to 7.0 to prevent skin irritation and inflammation. The pH measurements obtained in this study were reported to average around 4.3, which is fairly acidic and falls within the lower end of the skin's natural pH range.

The presence of a significant amount of aloe vera in the formulation, which naturally has an acidic pH of 4.0 to 4.5, could potentially be the cause of the lower pH measurements. However, it is important to note that other ingredients in the formulation could also contribute to the pH level.

3. Viscosity: The viscosity of hand sanitizer gel formulations is an important aspect that affects their consistency and flowability when applied to the skin. A higher viscosity can result in a thicker and more gel-like consistency, which may be preferred by some users. The viscosity of the generated gel formulations was measured in this study, and the effects of gel components were examined. The results indicated that the produced formulations had higher viscosities compared to pure ethanol and water. This suggests that the gel components, such as thickeners or gelling agents, were effective in increasing the viscosity of the formulations.

It is important to note that the viscosity of the gel formulations can also be influenced by factors such as temperature, shear rate, and formulation composition. Therefore, it is essential to carefully select and control the gel components to achieve the desired viscosity and consistency for the hand sanitizer gel formulation.

4. 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 gel 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 gel formulations, a gel 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).

5. Stability: The stability trials involved 4 weeks of storage at various temperatures, including 40°C, 25°C, and 37°C. The prepared hand sanitizer showed no phase separation or colour change throughout the stability testing.

CONCLUSION

Based on the findings of the study, it can be concluded that herbal hand sanitizers can have a substantial bacterial impact on targeted microorganisms. This suggests that there is potential for expanding the use of antibacterial herbal products as a way to combat multidrug-resistant bacteria and prevent their spread from person to person.

Additionally, the use of natural herbal hand sanitizers can be considered an alternative to chemically-made hand sanitizers containing active silver nitrates. This is because herbal hand sanitizers are generally more economical, efficient, and ecologically responsible, and may be preferred by those who prefer natural products.

However, it should be noted that further research is needed to fully understand the effectiveness and safety of herbal hand sanitizers. Additionally, it is important to ensure that any herbal products used for hand sanitization are properly formulated and manufactured to ensure their efficacy and safety.

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