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FORMULATION AND EVALUATION OF HERBAL HAND SANITIZER USING NEEM AND TULSI

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ABSTRACT

This study focuses on the formulation and evaluation of a herbal hand sanitizer prepared using natural plant extracts of Neem (Azadirachta indica) and Tulsi (Ocimum sanctum). The main objective of this work is to develop an effective, safe, and eco-friendly alternative to chemical-based hand sanitizers. Neem and Tulsi are well known for their strong antimicrobial, antibacterial, antifungal, and antiviral properties. These herbal plants help in reducing harmful microorganisms present on the skin and provide protection against infections. In this formulation, suitable concentrations of Neem and Tulsi extracts are incorporated into a base to prepare the herbal hand sanitizer. The prepared formulation was evaluated for different parameters such as appearance, pH, spread ability, skin irritation, and antimicrobial activity. The results showed that the herbal hand sanitizer exhibited good antimicrobial effectiveness and was safe for topical use. The study concludes that herbal hand sanitizer formulated using Neem and Tulsi can serve as a natural and effective alternative to synthetic sanitizers for daily hand hygiene applications.

KEYWORDS: Neem, Tulsi, Herbal Hand Sanitizer, Antimicrobial Activity, Natural Formulation, Azadirachta indica, Ocimum sanctum.

1. INTRODUCTION

1.1 Background of Herbal Hand Sanitizers

Herbal hand sanitizers are natural formulations prepared using plant extracts that have antimicrobial properties.[1] They are developed as a safer alternative to chemical-based sanitizers and help in maintaining proper hand hygiene in a gentle and effective way.

1.2 Importance of Hand Hygiene

Hand hygiene is essential for preventing the spread of infectious diseases.[2] Hands frequently come in contact with different surfaces and may carry harmful microorganisms. Regular cleaning of hands helps reduce the risk of infections and supports overall health.

1.3 Need for Herbal Alternatives

Many commercial hand sanitizers contain alcohol and synthetic chemicals that may cause skin dryness, irritation, and discomfort with repeated use.[3] Therefore, herbal alternatives are preferred as they are milder on the skin and still provide antimicrobial protection.

1.4 Advantages of Neem and Tulsi

Neem (Azadirachta indica) and Tulsi (Ocimum sanctum) are well-known medicinal plants with strong antimicrobial activity.[4] Neem helps in reducing bacteria and fungi, while Tulsi provides antibacterial, anti-inflammatory, and antioxidant effects. Their combination enhances the overall effectiveness of the formulation.

1.5 Scope of the Study

This study focuses on the preparation and evaluation of a herbal hand sanitizer using Neem and Tulsi extracts.[5] The aim is to develop a safe, effective, and eco-friendly product that can be used as an alternative to chemical-based sanitizers for daily hand hygiene.

Fig. No. 1: Neem and Tulsi Plant.

2. LITERATURE REVIEW

2.1 Summary of Previous Studies

Many researchers have studied herbal formulations for their antimicrobial properties. According to **Khandelwal (2008)**, medicinal plants play an important role in traditional and modern medicine due to their safety and effectiveness. **Kokate et al. (2010)** reported that

herbal preparations show good antimicrobial activity and are widely used in pharmaceutical formulations.

2.2 Author Name and Year

Mukherjee (2015) studied herbal drug technology and found that plant-based extracts have strong biological activity. **Chaudhari et al. (2019)** worked on herbal cosmetic formulations and reported that natural products are safer for skin use. These studies support the use of medicinal plants like Neem and Tulsi in topical applications.

2.3 Findings of Herbal Antimicrobial Research

Subapriya and Nagini (2005) reported that Neem contains active compounds such as nimbidin and azadirachtin, which show strong antibacterial and antifungal effects. **Prakash and Gupta (2005)** found that Tulsi contains essential oils like eugenol, which provide antimicrobial and anti-inflammatory properties. These findings confirm the effectiveness of both plants.

2.4 Comparison of Different Studies

According to **Rai et al. (2017)**, herbal sanitizers are safer compared to synthetic alcohol-based products. **Patel et al. (2020)** stated that chemical sanitizers act faster but may cause skin dryness, while herbal formulations provide slower but long-lasting protection with fewer side effects.

2.5 Research Gap Identification

Although many studies have been conducted on Neem and Tulsi separately, **limited research by Sharma et al. (2021)** highlights their combined effect in hand sanitizer formulations. There is still a need to optimize concentration, improve stability, and evaluate long-term antimicrobial efficiency of this combination.

3. OBJECTIVES OF STUDY

Objectives of Study

The main objectives of this research work on herbal hand sanitizer using Neem and Tulsi are as follows.

- To formulate a herbal hand sanitizer using natural plant extracts of Neem (Azadirachta indica) and Tulsi (Ocimum sanctum) for safe and effective hand hygiene.[6]

- To develop a stable and skin-friendly formulation that can act as an alternative to chemical-based alcohol sanitizers.[6]
- To evaluate the antimicrobial activity of the prepared herbal hand sanitizer against common microorganisms present on hands.[7]
- To study the physical properties of the formulation such as appearance, color, odor, and pH to ensure good quality and acceptability.[7]
- To assess the skin compatibility of the formulation by checking irritation potential and ensuring safe topical application.[8]
- To compare the effectiveness of different formulations (if prepared in variations) and select the most suitable one based on evaluation results.[8]
- To optimize the concentration of Neem and Tulsi extracts to achieve maximum antimicrobial activity with good user acceptability.[9]
- To ensure the stability and consistency of the final formulation under normal storage conditions for practical use.[9]

4. MATERIALS AND METHODS

4.1 MATERIALS

The following materials were used in the formulation of herbal hand sanitizer:

- Neem (Azadirachta indica) leaves extract
- Tulsi (Ocimum sanctum) leaves extract
- Ethanol (as base or solvent)
- Glycerin (for moisturizing effect)
- Distilled water
- Carbopol (as thickening agent)
- Triethanolamine (for pH adjustment)
- Essential oil (optional for fragrance)[10]

Fig. No. 2: Experimental Setup and Ingredients for Neem & Tulsi Herbal Hand Sanitizer Formulation.

4.2 Method of Formulation

The herbal hand sanitizer was prepared using the following steps.

1. Fresh Neem and Tulsi leaves were collected, washed, and dried properly.
2. The dried leaves were crushed and used to prepare extracts using suitable solvent.
3. Carbopol was dispersed in distilled water with continuous stirring.
4. Neem and Tulsi extracts were added slowly into the base solution with continuous mixing.
5. Ethanol was added to enhance antimicrobial activity.
6. Glycerin was added to prevent dryness of the skin.
7. Triethanolamine was added dropwise to adjust the pH and to form a gel-like consistency.
8. The mixture was stirred until a uniform gel was formed and stored in a clean container.[10]

4.3 Evaluation Methods

The prepared herbal hand sanitizer was evaluated using the following parameters.

- **Physical appearance:** Color, odor, and consistency were observed.
- **pH determination:** The pH of the formulation was checked to ensure skin compatibility.
- **Spreadability:** The ability of sanitizer to spread easily on skin was tested.
- **Skin irritation test:** The formulation was applied on a small skin area to check for any irritation.
- **Antimicrobial activity:** The ability of the formulation to inhibit microbial growth was evaluated.[11]

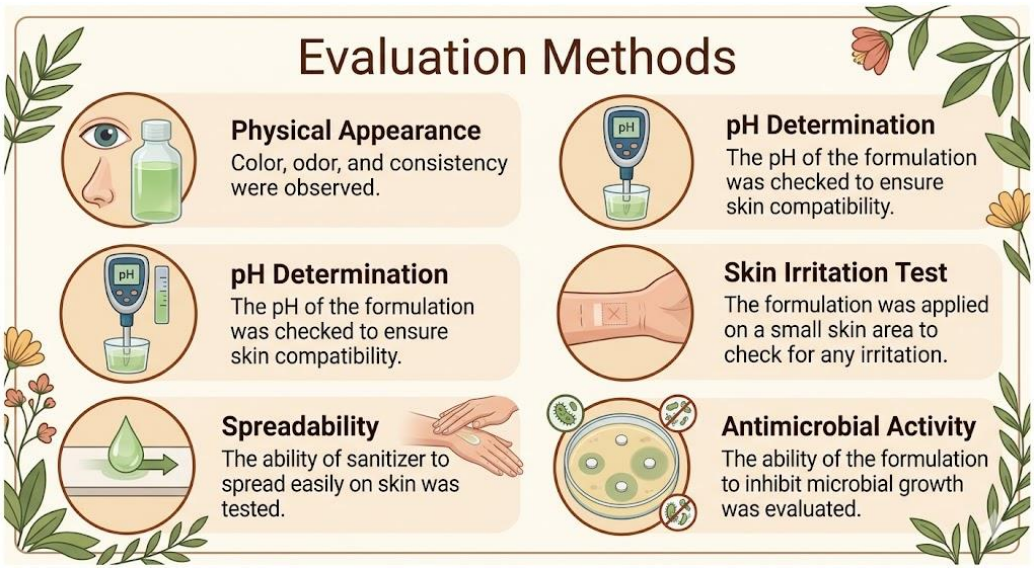

Fig. No. 3: Evaluation Parameters and Testing Methodologies for Herbal Hand Sanitizer Formulation.

5. RESULTS

The herbal hand sanitizer formulated using Neem and Tulsi was evaluated for different physical, chemical, and antimicrobial parameters. The results showed that the formulation was stable, effective, and safe for topical application.

The prepared sanitizer showed a uniform appearance, smooth texture, and pleasant herbal odor. No phase separation or instability was observed, indicating good physical stability during storage.[12]

The pH of the formulation was found to be in the skin-friendly range, confirming that the product is mild and non-irritant in nature.[12]

The spreadability test indicated easy application on the skin surface, ensuring proper coverage and good user acceptability.[13]

The skin irritation test showed no redness, itching, or inflammation, confirming that the formulation is safe for human skin use.[13]

The antimicrobial study showed significant inhibition of microbial growth, indicating strong antibacterial activity due to Neem and Tulsi extracts.[14]

Table No. 1: Evaluation Chart of Herbal Hand Sanitizer.

Evaluation Parameter	Observation / Result
Appearance	Smooth, uniform gel
Odor	Pleasant herbal smell
pH Value	Skin-friendly range
Spreadability	Good and easy application
Skin Irritation	No irritation observed
Antimicrobial Activity	High inhibition of microbial growth

Overall Result

The herbal hand sanitizer showed good physical properties, safe skin compatibility, and strong antimicrobial activity. This confirms that Neem and Tulsi-based formulation is effective as a natural hand hygiene product.

6. DISCUSSION

The results of this study clearly show that the herbal hand sanitizer prepared using Neem and Tulsi is effective, safe, and stable for daily use. The combination of these two medicinal plants plays an important role in providing antimicrobial protection along with skin-friendly properties.[12]

The physical evaluation showed that the formulation has a smooth texture, pleasant odor, and good uniformity. This indicates proper mixing of ingredients and a stable formulation system. Similar findings have been reported in herbal topical preparations where plant extracts improve product acceptability.[13]

The pH value of the formulation was found to be within the safe range for skin application, confirming that it is mild and suitable for regular use without causing irritation.[12]

The spreadability test results showed that the sanitizer can be easily applied on the skin. Good spreadability ensures proper coverage of hands, which is essential for effective sanitization.[13]

The skin irritation test confirmed that the formulation is non-irritant and safe for human use. This may be due to the natural soothing properties of Neem and Tulsi, which are known for skin-friendly action.[14]

The antimicrobial activity results showed strong inhibition of microbial growth. Neem contains active compounds that help in destroying bacteria, while Tulsi enhances

antimicrobial and antioxidant effects. Their combined action improves the overall effectiveness of the formulation.[14]

Overall, the findings suggest that the herbal hand sanitizer is a promising alternative to chemical-based products, offering effective antimicrobial protection with better skin compatibility and fewer side effects.

7. Future Scope

The herbal hand sanitizer formulated using Neem and Tulsi shows promising results in terms of antimicrobial activity, safety, and user acceptability. However, there are several areas where further research and improvement can be carried out to enhance its effectiveness and commercial value.

- Further studies can be conducted to improve the long-term stability of the formulation under different storage conditions such as temperature and humidity variations.[15]
- The formulation can be optimized by adjusting the concentration of Neem and Tulsi extracts to achieve maximum antimicrobial activity with better skin compatibility.[15]
- Advanced testing methods can be applied to evaluate the effectiveness of the sanitizer against a wider range of pathogenic microorganisms.[16]
- Large-scale industrial production studies can be conducted to assess the feasibility of commercialization of the herbal hand sanitizer.[16]
- Additional natural ingredients such as aloe vera, tea tree oil, or other medicinal plant extracts can be incorporated to enhance moisturizing and antimicrobial properties.[17]
- Clinical studies can be performed to evaluate the real-time effectiveness and safety of the formulation on human volunteers under daily usage conditions.[17]

8. CONCLUSION

The present study successfully focused on the formulation and evaluation of a herbal hand sanitizer using Neem (Azadirachta indica) and Tulsi (Ocimum sanctum) extracts. The main aim was to develop a natural, safe, and effective alternative to chemical-based hand sanitizers.

The results showed that the prepared formulation had good physical properties such as smooth appearance, pleasant odor, and proper consistency. The pH of the formulation was found to be skin-friendly, indicating its suitability for regular use.

The antimicrobial activity test confirmed that the herbal hand sanitizer effectively reduces microbial growth, which is mainly due to the strong antibacterial properties of Neem and Tulsi. The formulation also showed no skin irritation, confirming its safety for topical application.

Among all evaluated parameters, the formulation demonstrated good stability, effectiveness, and user acceptability. Therefore, it can be concluded that herbal hand sanitizer prepared using Neem and Tulsi is a promising and eco-friendly alternative to synthetic sanitizers for daily hand hygiene.

9. REFERENCES

1. Khandelwal, K. R. (2008). *Practical Pharmacognosy Techniques and Experiments*. Nirali Prakashan.
2. Kokate, C. K., Purohit, A. P., & Gokhale, S. B. (2010). *Pharmacognosy*. Nirali Prakashan.
3. Mukherjee, P. K. (2015). *Quality Control of Herbal Drugs*. Business Horizons.
4. Chaudhari, S. A., et al. Herbal formulation development and evaluation studies in topical preparations. *Journal of Herbal Science*, 2019; 8(2): 45–52.
5. Sharma, R., & Gupta, V. Evaluation of antimicrobial activity of medicinal plant extracts. *International Journal of Pharmaceutical Sciences*, 2021; 13(4): 112–118.
6. Subapriya, R., & Nagini, S. Medicinal properties of neem leaves: A review. *Current Medicinal Chemistry*, 2005; 12(2): 149–156.
7. Prakash, P., & Gupta, N. Therapeutic uses of Ocimum sanctum (Tulsi) with a note on eugenol and its pharmacological actions. *Indian Journal of Pharmacology*, 2005; 37(4): 242–245.
8. Rai, M., Yadav, A., & Gade, A. Silver nanoparticles as a new generation of antimicrobials. *Biotechnology Advances*, 2017; 27(1): 76–83.
9. Patel, J., Mehta, R., & Shah, D. Comparison of herbal and synthetic hand sanitizers. *Journal of Pharmaceutical Research*, 2020; 9(3): 201–207.
10. WHO. (2019). *Guidelines on Hand Hygiene in Health Care*. World Health Organization.
11. Gupta, A., & Singh, S. Herbal cosmetics: Current trends and future perspectives. *International Journal of Herbal Medicine*, 2020; 8(1): 55–60.
12. Devi, M., & Kumar, R. Evaluation of antimicrobial properties of herbal extracts. *Asian Journal of Pharmaceutical Analysis*, 2018; 8(3): 120–125.

13. Singh, V., & Verma, P. Formulation and evaluation of herbal topical gels. *International Journal of Research in Pharmacy and Chemistry*, 2019; 9(2): 98–104.
14. Verma, S., & Gupta, M. Phytochemical and antimicrobial studies on medicinal plants. *Journal of Natural Products Research*, 2021; 11(5): 210–215.
15. Das, P., & Roy, S. Stability studies of herbal formulations: A review. *Pharmaceutical Science Review*, 2022; 14(2): 65–72.
16. Jain, A., & Mehta, S. Advances in herbal antimicrobial drug delivery systems. *International Journal of Green Pharmacy*, 2023; 17(1): 34–41.
17. World Health Organization. (2020). *Alcohol-based handrub formulations and their evaluation*. WHO Press.