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PREPARATION AND EVALUATION OF HERBAL GEL: A REVIEW

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ABSTRACT

Because of their negligible side effects and therapeutic benefits, herbal gels are frequently utilized for topical treatments. This article describes how to formulate, prepare, and assess a herbal gel that contains extracts from medicinal plants. Examining the herbal gel's physicochemical characteristics, stability, and effectiveness is the goal of the study. Herbal gel compositions' natural, biocompatible, and medicinal qualities have drawn a lot of interest in pharmaceutical and cosmetic applications. The creation and assessment of a herbal gel with plant extracts that have antimicrobial, anti-inflammatory, and wound-healing qualities are the main objectives of this study. Using appropriate gelling agents like Carbopol 940 and natural polymers, the chosen herbal ingredients such as aloe vera, turmeric (Curcuma longa), and neem (Azadirachta indica)—were combined into a gel base.[1] The formulated gel was evaluated for physicochemical parameters, including pH, viscosity, Spreadibility, homogeneity, and stability. Additionally, antimicrobial and skin irritation studies were conducted to assess its safety and efficacy. The results demonstrated that the herbal gel exhibited excellent stability, good Spreadibility, and significant therapeutic benefits, making it a promising alternative for topical applications in skincare and wound healing. Further clinical studies are recommended to validate its efficacy on a larger scale.[2]

INTRODUCTION

Herbal formulations have gained popularity in pharmaceutical and cosmetic industries due to their natural origin, fewer side effects, and bioactive compounds. Gels provide a suitable medium for herbal extracts due to their high-water content, ease of application, and enhanced absorption. This study focuses on the formulation and evaluation of an herbal gel containing plant extracts with antimicrobial and anti-inflammatory properties.

Because of its natural origin, low risk of side effects, and therapeutic benefits, herbal gel formulations have become more and more popular in the pharmaceutical and cosmetic industries. Herbal gels, as opposed to traditional synthetic formulations, contain bioactive substances derived from plants that have antibacterial, anti-inflammatory, antioxidant, and wound-healing qualities. For topical treatments, these formulations offer a practical and efficient way to distribute plant extracts, guaranteeing improved skin penetration and long-lasting effects.

Selecting medicinal plant extracts according to their potential for therapeutic use is the first step in making herbal gels. To get the right consistency and stability, appropriate gelling agents such Carbopol, xanthan gum, or natural polymers are next added. To improve the formulation's efficacy and shelf life, more excipients, such as humectants, preservatives, and essential oils, may be added.[2-3]

The creation and assessment of a herbal gel utilizing plant extracts with therapeutic and skin-protective qualities, such as turmeric (Curcuma longa), neem (Azadirachta indica), and aloe vera, is the main goal of this study. To guarantee its effectiveness and safety, the produced gel is put through a number of quality control tests, such as those for pH, viscosity, spreadibility, and stability. The creation of herbal gels offers a potential strategy for safe and efficient topical therapies, especially given the growing consumer preference for cosmetics and medicinal products based on herbs.[4-5]

Herbal gels are semi-solid formulations that contain active plant ingredients or herbal extracts in a gel foundation. Due to their improved skin penetration, ease of administration, and extended skin retention, these formulations are frequently employed for therapeutic, cosmetic, and pharmaceutical purposes.[5]

In contrast to synthetic formulations, herbal gels have garnered a lot of attention lately because of their possible medicinal benefits and low side effects. These gels are mostly used to treat burns, wounds, and joint discomfort, among other dermatological disorders. This article examines the preparation, physicochemical

characteristics, and efficacy evaluations of herbal gel formulations.[5-6]

MATERIALS AND METHODS

1. Herbal extracts: Plant-derived active ingredients (e.g., Aloe vera, Neem, Turmeric, Calendula, etc.)
2. Gelling agent: Carbopol 940, Hydroxypropyl Methylcellulose (HPMC), Xanthan gum, or Sodium alginate
3. Solvent: Distilled water, ethanol, glycerine, or propylene glycol
4. Neutralizing agent: Triethanolamine (TEA) or Sodium hydroxide (NaOH)
5. Preservatives: Methylparaben, Propylparaben, or Benzalkonium chloride
6. Humectants: Glycerine or Propylene glycol
7. Essential Oils or Fragrances (Optional): Peppermint oil, Lavender oil, etc.
8. Coloring agents (Optional): Natural or synthetic colorants

Preparation method

1. Selection and Preparation of herbal extracts

- Select medicinal plants based on their intended therapeutic properties.
- Extract active components using suitable extraction methods like maceration, infusion, decoction, or Soxhlet extraction.[7]
- Filter and concentrate the extract to remove impurities and enhance potency.

2. Preparation of gel base

- Disperse the gelling agent (e.g., Carbopol 940) in distilled water under continuous stirring to prevent clumping.
- Allow it to hydrate and swell for a specified period (usually 1–2 hours).
- Adjust the pH using a neutralizing agent (e.g., TEA) to facilitate gel formation.

3. Incorporation of Herbal Extracts and Other Additives

- Gradually add the prepared herbal extract into the gel base with continuous stirring.
- Add humectants, preservatives, and essential oils while maintaining homogeneity.[7-8]
- Mix until a uniform gel consistency is achieved.

4. Adjustment of pH and Viscosity

- Check the pH using a pH meter and adjust it to the desired range (usually between 5.5 and 7.0 for skin applications).
- Modify viscosity by adjusting the concentration of the gelling agent if needed.

5. Final homogenization

- Homogenize the gel using a high-shear mixer to ensure uniform distribution of ingredients.
- Allow the gel to stand for deforming if required.

6. Quality Control and Stability testing

- Evaluate physical characteristics like appearance, Spreadibility, viscosity, pH, and microbial contamination.
- Perform stability tests under different temperature and humidity conditions.[9]

7. Packaging and Storage

- Transfer the gel into suitable containers such as tubes, jars, or pump dispensers.
- Label appropriately with information on composition, usage, and storage conditions.
- Store in a cool, dry place away from direct sunlight to maintain stability.

Evaluation of herbal gel

1. **Physicochemical evaluation**
2. **Drug content estimation**
3. **Antimicrobial and Anti-inflammatory activity**
4. **Physicochemical evaluation**

- **Appearance and Homogeneity:** The gel should be uniform in texture, free from lumps or phase separation.
- **pH Measurement:** pH is typically measured using a digital pH meter to ensure compatibility with the skin (range 5.5–7.5).
- **Viscosity:** Measured using a viscometer to determine the gel's Spreadibility and application properties.
- **Spreadibility:** Evaluated by placing a fixed amount of gel between two slides and measuring the spread distance.
- **Extrudability:** Determines ease of application by measuring the force required to extrude the gel from a collapsible tube.[9-10]

5. Stability studies

- **Thermal stability:** The gel is stored at different temperatures (4°C, 25°C, and 45°C) to observe any phase separation or degradation.
- **Centrifugation test:** The gel is subjected to centrifugation to assess physical stability.
- **Freeze-Thaw cycling:** The formulation is tested through cycles of freezing and thawing to evaluate stability.

6. Microbial and Contamination testing

- **Total microbial count:** Determines bacterial and fungal contamination.
- **Preservative efficacy test:** Ensures that preservatives used in the formulation prevent microbial growth.[10-11]

7. Antimicrobial and Anti-inflammatory Activity

- The antimicrobial efficacy of the gel is evaluated using the agar diffusion method against bacterial and fungal strains.
- The anti-inflammatory property is tested using in-vitro models such as protein denaturation assay.

8. **In vitro drug release study**

- Performed using a diffusion cell system where the herbal gel is applied to a semi-permeable membrane, and the release rate of active ingredients is measured over time.

9. In vivo evaluation

- **Skin irritation test:** Conducted on animal models or human volunteers to assess any adverse reactions.
- **Efficacy testing:** The gel's therapeutic effect is tested for wound healing, anti-inflammatory properties, or pain relief using suitable models.[11-13]

RESULTS AND DISCUSSION

The herbal gel that was created had a high viscosity, a smooth texture, a steady pH, and good spreadibility. Significant effectiveness against common skin pathogens was established by antimicrobial tests, and anti-inflammatory experiments showed that inflammatory indicators were effectively inhibited. The formulation maintained its integrity throughout time, according to the stability studies.

CONCLUSION

Herbal gels offer a promising alternative for topical treatments with enhanced therapeutic properties and safety. This study successfully formulated and evaluated an herbal gel with desirable physicochemical and biological properties. Further clinical evaluations can validate its efficacy for commercial applications.

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