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Research

Formulation and Evaluation of Herbal (*Nelumbo Nucifera*) Anti-Inflammatory Gel

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Abstract:
The gel has the safest, easily applicable and most effective due to its directly applicable to the infected part of the skin with minimal adverse effect. This research explores the development and characterization of an anti-inflammatory gel using lotus stem, a plant that has long been valued for its therapeutic qualities, especially its ability to reduce inflammation. Dried ethanolic extract of lotus stem was carefully blended with essential components like Carbopol 934, propylene glycol 400, methylparaben, propylparaben, and distilled water in precisely the right amounts to create the gel formulation. Triethanolamine was gradually added in order to maintain the ideal pH range (6.8–7) for skin compatibility. The developed product was subjected to extensive testing, which included analyses of its physical characteristics, pH, spreadability, viscosity, homogeneity, and potential for skin irritation in animal models. The results highlighted the gel's positive qualities, such as its visually pleasing look, even dispersion, and effective spreadability, indicating bright futures for its use in anti-inflammatory treatment.

Keywords: *Characterization, Dried Ethanolic Extract, Extensive Testing, Effective Spreadability.*

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Introduction:

Gels: Traditional medicine and conventional medicine play a major role in health service around the globe. The herbal medicine is still the mainstay of about 75-80% of the world's population, mainly in developing countries. Herbal drugs and medicines consist of plant and its parts to treat illness, injuries, and diseases and promote healing. Gels are new form of medicine in order to achieve greater therapeutic efficacy and higher patient compliance. Direct applicable to the damage or disease part without going to the first pass metabolism and less side effect.

Applications

i. Since they can direct applicable to the skin, they can give maximum amount of therapeutic action.
ii. They can be used for skin irritation, promoting healing, reducing inflammation, and providing a natural alternative to conventional medicine.
iii. Some gels are formulated for specific purposes, such as joint pain relief or muscle relaxation.

Advantages

i. Gels have targeted application, rapid absorption
ii. Reduced systemic side effects compared to oral medications.
iii. They are easy to applicable, and suitable for localized conditions like joint pain or skin disorders.

Disadvantages

i. Gels have the limited ability to deliver certain drugs deeply into to the body.
ii. Gels causes skin irritation or allergic reaction in some individuals.

Mechanism of gel penetration into the skin

It involves a combination of process, primarily driven by the properties of the gel and skin. Here are the key factors:

1. **Diffusion**: The drug molecules in the gel move from an area of higher concentration (the gel) to lower concentration (the skin). This process occurs through the skin's outer layer, the stratum corneum.

2. **Solubility**: The drug in the gel needs to be soluble in both the gel matrix and the skin to facilitate penetration. This is crucial for effective diffusion through the skin layers.
3. **Size of Molecules:** Smaller drug molecules generally penetrate the skin more easily. The gel formulation should allow for the optimal size of drug particles for efficient skin absorption.
4. **Enhancers:** Some gel formulations include chemical enhancers that temporarily alter the structure of the stratum corneum, facilitating better penetration of the drug.
5. **Hydration of Skin:** Gels may hydrate the skin, temporarily reducing the barrier function of the stratum corneum and enhancing drug penetration.
6. **Temperature:** Higher temperatures can increase skin permeability, aiding the penetration of the drug from the gel

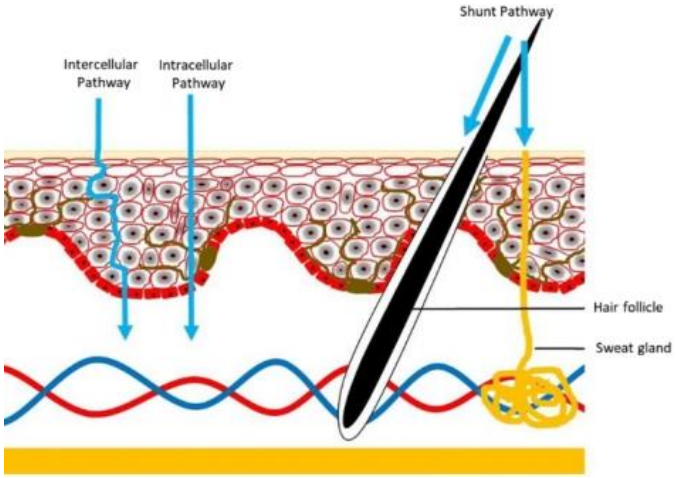

Figure 1 Skin Penetration of gel

Method of prepration of herbal anti-inflammatory gel

To prepare an herbal anti-inflammatory gel, follow these general steps:

1. **Select Anti-Inflammatory Herbs**:
   Choose herbs known for their anti-inflammatory properties. Common options include aloe vera, chamomile, turmeric, arnica, or calendula.
2. **Gather Ingredients:**
   Acquire essential ingredients such as the selected herbs, distilled water, a natural thickening agent (like xanthan gum or guar gum), a carrier oil (such as coconut or jojoba oil), and a preservative (like grapefruit seed extract).
3. **Prepare Herbs:**
   Clean and prepare the chosen herbs. If using dried herbs, you might need to infuse them in a carrier oil or water.
4. **Create Herbal Extract:**
   Infuse the herbs in hot water or oil to extract the anti-inflammatory compounds. Strain the mixture to obtain a clean herbal extract.
5. **Thickening Agent:**
   Gradually add a natural thickening agent to the herbal extract, stirring continuously until you achieve the desired gel consistency.
6. **Carrier Oil:**
   Incorporate a carrier oil for additional skin benefits. Make sure the oil is well-mixed into the gel.
7. **Preservation:**
   Add a natural preservative to prevent microbial growth and prolong the shelf life of the anti-inflammatory gel.
8. **Adjust Consistency**:
   Fine-tune the gel's consistency by adding more water or thickening agent if needed.
9. **Cooling:**
   Allow the mixture to cool completely.
10. **Packaging:**
    Transfer the herbal anti-inflammatory gel into a clean, airtight container suitable for storage.

Always research the anti-inflammatory properties of the selected herbs and consider potential interactions or allergies. If you have any medical conditions or concerns, consult with a healthcare professional before using herbal products. Conduct a patch test to check for any adverse reactions before applying the gel more widely.

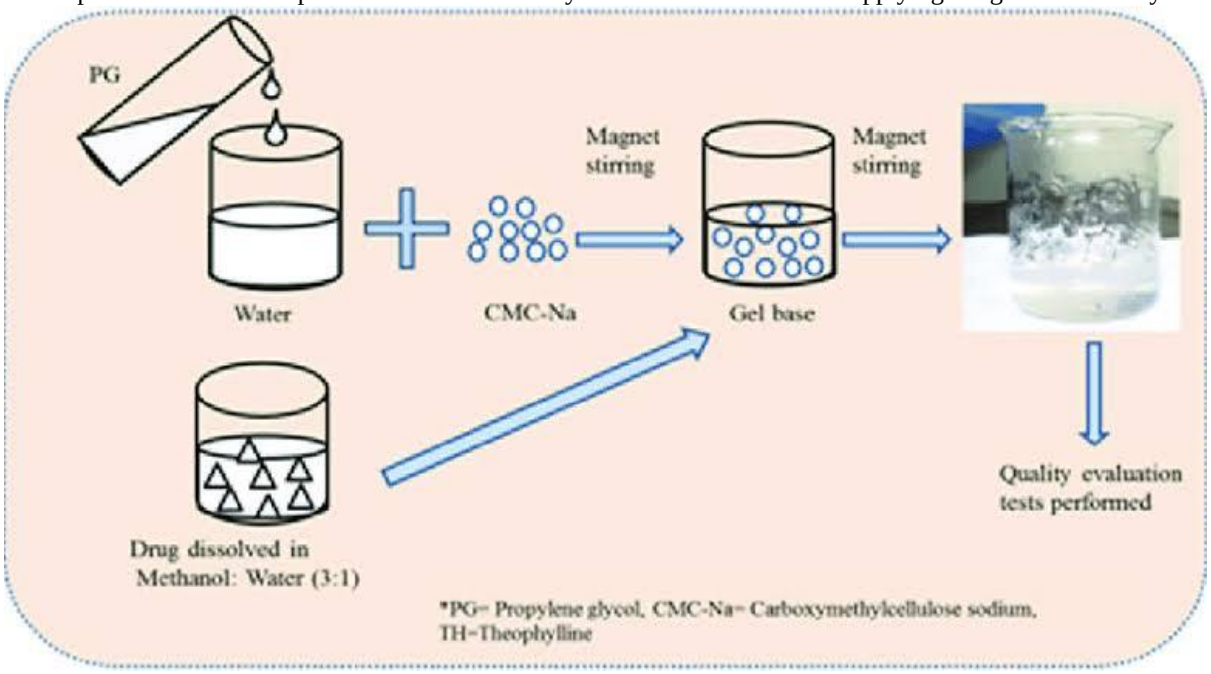

Figure 2 Preparation of Gel

The evaluation parameters for herbal medicinal gel include:

1. **PH measurement** –
   The gel's pH was determined using a digital pH meter, submerging the glass electrode fully into the gel to encompass the electrode. The pH measurement was conducted three times, and the average of these three readings was documented
2. **Viscosity** –
   The viscosity of the polyherbal gel was assessed using a Brookfield viscometer (Model RVTDV II) with readings recorded at 100 rpm employing spindle no. 6.
3. **Extrudability**-
   In a controlled experiment, approximately 20 g of gel within a sealed collapsible tube underwent extrusion after firm pressure was applied to the crimped end. To prevent any retraction, a clamp was utilized after removing the cap. The quantity of the extruded gel was meticulously collected and weighed. Subsequently, the percentage of the gel that was successfully extruded was calculated.
4. **Ingredient Analysis**-
   Verify the presence and concentration of active herbal ingredients.
5. **Stability**-
   Assess the stability of the gel under various storage conditions.
6. **Physicochemical Properties**-
   Evaluate pH, viscosity, and consistency for desired application.
7. **Microbial Analysis**-
   Ensure the product is free from harmful microorganisms.
8. **Skin Irritation**-
   Conduct patch testing to assess skin compatibility and potential irritation.
9. **Penetration Ability**-
   Evaluate the gel's ability to penetrate the skin for effective absorption.
10. **Antioxidant Activity**-
    Measure the gel's ability to neutralize free radicals.
11. **Anti-inflammatory Effects**-
    Assess the gel's impact on reducing inflammation.
12. **Safety**-
    Confirm the absence of heavy metals, pesticides, and other contaminants.
13. **Clinical Efficacy**-
    Conduct clinical trials to validate the gel's therapeutic benefits.

14. **Odor and Color**-
    Ensure the product has an acceptable odor and color.
15. **Packaging Compatibility**-
    Assess the compatibility of the gel with its packaging material.
16. **Shelf Life**-
    Determine the product's shelf life under specified storage conditions.
17. **Regulatory Compliance**-
    Ensure adherence to local regulations and standards for herbal products.
18. **Gel Spread ability** The gel spreadability was assessed by measuring the spread diameter of 1 g of placed between two horizontal plates (20 cm × 20 cm) within one minute. A standard weight of 125 g was applied to the upper plate during the evaluation.

Conclusion:

Gel presents a promising solution for addressing discomfort and swelling associated with various condition. Their lightweight texture easy adsorption and customizable formulation make them a popular choice for consumer seeking quick and effective result. The gel give cooling sensation after application in skin. Evalution, including testing for safety and skin compatibility, ensure that the gel meets quality standards and provides reliable relief without adverse effects.

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