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A COMPREHENSIVE REVIEW ON THE FORMULATION, CHARACTERIZATION, AND EVALUATION OF CALAMINE LOTION

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ABSTRACT

Calamine lotion is a popular antiseptic and skin protectant, known for its cooling and soothing effects. This study investigates the possibility of formulating calamine lotion with natural humectants, such as aloe vera gel and vitamin E, instead of semi-synthetic alternatives like glycerine. Herbal cosmetics are widely used to improve skin appearance and health. The objective of this research is to evaluate the moisturizing and emollient properties of natural humectants compared to glycerine, determining their suitability in calamine lotion. Calamine lotion is also recognized for its anti-itch properties, commonly used for treating skin conditions with minimal adverse reactions. While calamine consists of zinc oxide and ferric chloride, the specific ingredient responsible for rare allergic reactions remains unidentified.

Keywords: Calamine Lotion, Formulation, Zinc Oxide, Iron Oxide, Skin Irritation, Anti-Inflammatory, Suspension Stability, Dermatological Therapy, Physicochemical Characterization, Quality Control, Nanotechnology In Skincare.

I. INTRODUCTION

The concept of beauty and the use of cosmetics can be traced back to ancient civilizations, where natural substances were commonly employed to enhance appearance and treat skin conditions. Today, **herbal cosmetics**—products formulated using natural ingredients—are gaining popularity as consumers increasingly seek alternatives to synthetic products. These herbal cosmetics contain plant-based components like **aloe vera gel** and **vitamin E**, which offer therapeutic benefits while minimizing the risk of side effects associated with synthetic chemicals.

Unlike conventional cosmetic products that often contain synthetic chemicals and mineral oils, herbal cosmetics are designed to be natural, free from harmful additives. The growing consumer preference for natural ingredients reflects a shift toward products that are gentler on the skin and the environment.

One such ingredient widely used in skincare is **calamine**, a compound primarily made from **zinc carbonate** with iron oxide, which gives it a distinctive pink color. Calamine is known for its mild **astringent** and **anti-itch (antipruritic)** properties and is used in various forms, such as creams, lotions, and ointments, to treat a range of skin irritations.

Another commonly used agent in dermatological treatments is **diphenhydramine**, an **H1 antihistamine** that helps alleviate allergic reactions, including skin hypersensitivity. Additionally, conditions like **contact dermatitis**, which is characterized by skin inflammation due to contact with irritants or allergens, often benefit from treatments that incorporate antihistamines and soothing agents like calamine.

The focus of modern herbal cosmetics is not only on their aesthetic benefits but also on their ability to support skin health, offering consumers natural alternatives that are safe, effective, and aligned with growing environmental and health concerns.

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This version uses formal language, maintains a smooth flow, and emphasizes both the historical context and the benefits of herbal cosmetics in modern usage.

II. MATERIALS

1. Aloe Vera

- **Botanical Name**: Aloe barbadensis miller
- **Family**: Asphodelaceae
- **Common Names**: Aloe vera, Ghritkumari

CULTIVATION:

Aloe vera is primarily cultivated in arid regions across the world, including parts of Africa, Asia, Europe, and the Americas. In India, it is widely grown in states such as Rajasthan, Andhra Pradesh, Gujarat, Maharashtra, and Tamil Nadu.

ACTIVE INGREDIENTS: Aloe vera contains a rich variety of active compounds, including:

- **Vitamins**: A, C, E, and B12
- **Enzymes**
- **Minerals**
- **Sugars**
- **Lignin**
- **Saponins**
- **Salicylic acid**
- **Amino acids**
- **Folic acid**
- **Choline**

Chemical Formula: C16H13NO3

Drug Category: Antiseptic and Anti-inflammatory

DESCRIPTION:

Aloe vera gel is typically green or clear in color and is known for its hydrating, soothing, and healing properties.

KEY FEATURES:

- Provides deep hydration to dry skin
- Effectively combats acne
- Reduces dark circles
- Soothes skin irritations
- Treats sunburn
- Exfoliates dead skin cells
- Alleviates conditions like eczema and psoriasis

PREPARATION OF ALOE VERA GEL WITH VITAMIN E

STEP 1: PREPARING ALOE VERA LEAVES

1. Select a mature leaf from the aloe vera plant, cutting it from the outer edge. Alternatively, store-bought leaves can also be used.
2. Thoroughly wash the leaf to remove any dirt. Stand the leaf upright in a cup or bowl for 10-15 minutes to allow the yellow resin to drain out. This resin contains latex, which may cause skin irritation, so draining it is essential.
3. Once the resin has drained completely, rinse the leaf again to remove any remaining residue. Use a small knife or vegetable peeler to carefully remove the outer skin, exposing the inner gel.

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STEP 2: EXTRACTING AND PREPARING THE GEL

1. Using a spoon, gently scoop out the clear aloe vera gel from the leaf, ensuring no pieces of the outer peel are included.
2. Transfer the gel to a blender and blend for a few seconds until it becomes smooth and liquefied.
3. The prepared aloe vera gel is now ready for use. To enhance its benefits, Vitamin E can be added.

ALOE VERA

CALAMINE OVERVIEW

COMPOSITION:

- Calamine is typically a mixture of **zinc oxide** and **ferric oxide** (iron oxide), which gives it a characteristic pink color.

CHEMICAL PROFILE:

- While the mention of **$ZnCO_3$** refers to zinc carbonate, calamine is more accurately associated with zinc oxide as its primary component.

PROPERTIES:

- **Appearance**: It is an **amorphous pink, odorless powder**.
- **Drug Category**: Classified as a **local anesthetic**.

USES:

- Calamine is commonly used to:
  - **Relieve itching**: Effective for soothing minor skin irritations.
  - **Treat sunburn**: Helps to calm irritated skin.
  - **Address rashes**: Useful for conditions like chickenpox and insect bites.

MECHANISM OF ACTION:

Calamine works by forming a protective barrier on the skin, which helps to alleviate discomfort and reduce irritation.

CALAMINE POWDER

BENTONITE

DEFINITION:

Bentonite is an absorbent, soft clay primarily made up of **montmorillonite**. It is created through the weathering of volcanic ash over time, resulting in a fine powder.

PHYSICAL CHARACTERISTICS:

- **Color**: Typically **off-white**.
- **Form**: Available in various forms, primarily as a fine powder.

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CLASSIFICATION:

- **Category**: Recognized as an **absorbent** material.

PROPERTIES

- **Water Absorption**: Bentonite has an exceptional capacity to absorb water, causing it to swell and increase in volume when hydrated.
- **Viscosity**: It can significantly increase the viscosity of liquids, serving as an effective thickening agent.

APPLICATIONS

1. **PHARMACEUTICALS**:
   - Used as an excipient in drug formulations for its ability to absorb excess moisture and enhance viscosity.
2. **COSMETICS**:
   - Commonly included in skincare products such as face masks and creams, where it helps absorb excess oil and impurities.
3. **INDUSTRIAL USES**:
   - Employed in various industries for:
     - **Drilling fluids**: Stabilizes boreholes during drilling operations.
     - **Foundry sands**: Acts as a binding agent in metal casting processes.
     - **Sealing applications**: Utilized in landfill liners and for soil stabilization.

BENTONITE

GLYCERIN OVERVIEW

DEFINITION:

Glycerin, also known as glycerol, is a natural compound typically derived from **vegetable oils**. It is a versatile substance commonly used in various industries, including food, cosmetics, and pharmaceuticals.

DRUG PROFILE

- **Molecular Formula**: $C_3H_8O_3$
- **Appearance**: A **clear**, **colourless**, and **viscous liquid** with a sweet taste.
- **Category**: Functions as both a **sweetener** and a **preservative**.

KEY PROPERTIES

- **Sweetening Agent**: Glycerin provides sweetness without the calories of sugar, making it popular in low-calorie and sugar-free products.
- **Thickening Agent**: It enhances the texture of food and cosmetic products, acting as a thickener.
- **Preservative**: Glycerin helps retain moisture, prolonging the shelf life of products by preventing spoilage.
- **Moisturizing Agent**: Known for its humectant properties, glycerine attracts moisture from the air, making it effective in skincare products.
- **Solvent**: It serves as a solvent in pharmaceuticals, helping dissolve active ingredients.

APPLICATIONS

1. **Food Industry**: Used as a sweetener and preservative in a variety of food products.
2. **Cosmetics**: Commonly found in lotions, creams, and soaps for its moisturizing benefits.
3. **Pharmaceuticals**: Employed in syrups and ointments for its role as a solvent and thickening agent.

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GLYCERIN

III. PLAN OF WORK

Method: Mortar and Pestle

PROCEDURE STEPS:

1. **Glassware Preparation**:
- Wash and dry all glassware to ensure a clean working environment.
2. **Chemical Preparation**:
- Collect the required chemicals and weigh them precisely to ensure accurate formulation.
3. **Combining Powders**:
- Use a mortar to weigh and mix **calamine**, **zinc oxide**, and **bentonite**.
- Ensure thorough distribution of bentonite throughout the mixture.
4. **Sodium Citrate Solution**:
- Dissolve **sodium citrate** in **1000 mL of rose water**.
- Gradually incorporate this solution into the powder mixture in the mortar, stirring until a smooth paste is formed.
5. **Adding Liquefied Ingredients**:
- Introduce **liquefied phenol** and **glycerin** to the paste, mixing until well combined.
6. **Incorporating Aloe Vera Gel**:
- Add **aloe vera gel** to the mixture and blend thoroughly for uniformity.
7. **Transfer to Container**:
- Transfer the final mixture to a **light-resistant container** to prevent light degradation.
8. **Labelling the Container**:
- Clearly label the container with relevant information regarding the contents and preparation date.

Table 1: Formulation Calamine Lotion With Aloevera Gel. For (1000ml)

SR.NO	INGREDIENTS	QUANTITY
1.	Calamine powder	150gm
2.	Aloe gel + Vitamin E	15gm
3.	Zinc oxide	50gm
4.	Bentonite	10gm
5.	Sodium citrate	5gm
6.	Liquid Phenol	As required

CALCULATION FOR PREPARATION OF CALAMINE LOTION OF 50ML:

1. Calamine powder= 150XSO

1000=7. SGM

2. ALOE-VERA GEL+ Vitamin E. = x SO

1000 =0.7SGM

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3. ZINC OXIDE= so 1000XSO

2. SGM

4. BENTONITE=1000Xo

1.5GM

5. Sodium Citrate=SX50

1000

0.25GM

6. Liquid phenol=-x550

1000

0.25ml

7. Cerine GI =x50

1000

2.5ml

IDENTIFICATION TESTS FOR CALAMINE

TEST 1: SILVER MIRROR TEST

1. **Procedure**:

- Mix **2 mL** of calamine with **2 mL** of periodic acid reagent.
- Shake the mixture and centrifuge.
- Take **0.5 mL** of the supernatant and combine it with **2 mL** of ammonium silver nitrate solution in a test tube.

2. **Observation**:

- A silver mirror will form on the test tube walls, indicating the presence of calamine.

TEST 2: ZINC SALT DETECTION

1. **Procedure**:

- Dissolve **2 mL** of calamine in **50 mL** of water.
- Centrifuge the solution and decant the supernatant.
- Suspend the remaining residue in **20 mL** of water.
- Add **1 mL** of hydrochloric acid, mix, and filter the solution.

2. **Neutralization**:

- Take **5 mL** of the filtered solution and neutralize it with **2M sodium hydroxide** dropwise.

3. **Observation**:

- The presence of zinc salts is confirmed by a reaction after neutralization.

CALAMINE IDENTIFICATION TEST

IDENTIFICATION TESTS FOR ALOE GEL

1. BORAX TEST

- **Procedure**:
- Add **0.5 g** of borax to **10 mL** of aloe solution.
- Gently heat the mixture.

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- **Result**:
- A green fluorescence will appear, confirming the presence of **aloe-emodin anthranol** in the aloe gel.

2. BROMINE TEST

- **Procedure**:
- Mix **5 mL** of aloe solution with **5 mL** of bromine solution.
- **Result**:
- A bulky yellow precipitate forms, indicating the presence of **tetrabromoalin**.

SOLUBILITY TEST RESULTS

CALAMINE

- **Water Solubility**: Practically insoluble in water.
- **Acid Solubility**: Soluble in mineral acids, where it may exhibit a pearling effect.

ALOE GEL

- **Water Content**: Aloe vera gel is composed of approximately **95% water**, along with water-soluble nutrients, like certain vitamins.
- **Gel and Bark**:
- **Gel**: The gel within aloe vera stores water and water-soluble nutrients.
- **Bark**: The outer layer of aloe vera is lipid-based, creating a natural barrier to retain water and fat-soluble nutrients; it is **not water-soluble**.

SKIN COMPATIBILITY TEST

- **Procedure**:
  - Apply **2 mL** of aloe preparation on the hand and behind the ear.
- **Observation**:
  - After **30 minutes**, there should be no signs of irritation, indicating skin compatibility.

SKIN IRRITATION TEST

ADVANTAGES OF CALAMINE LOTION

1. **Cooling and Soothing Effect**

- When calamine lotion is applied, the water component evaporates from the skin, pulling heat away and creating a **cooling sensation** that helps **soothe itchiness** and minor skin irritations.

2. **Enhanced Drying Action**

- The inclusion of powder in the lotion improves its evaporation rate, making it especially effective at **drying and calming** damp, irritated, or weeping skin areas.

3. **Easily Spreadable for Large Areas**

- Calamine lotion spreads smoothly and evenly, which makes it suitable for **application on large skin surfaces**.

4. **Absorbs Minor Exudates**

- Calamine lotion allows a certain amount of secretions to be absorbed and helps manage mild skin exudations.

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5. **Safe for Children**

- Calamine lotion is widely regarded as **safe for children**, commonly used to relieve mild skin irritations. However, formulations containing **phenol** should be avoided in infants due to skin sensitivity.

DISADVANTAGES OF CALAMINE LOTION

1. **Skin Dryness**

- Calamine lotion can lead to **dryness on the skin** due to its high water content that evaporates quickly. This can result in uncomfortable dryness, particularly for individuals with already dry or sensitive skin.

2. **Reduced Tolerance in Folded Skin Areas**

- In areas where the skin folds or stays moist (like underarms or behind the knees), calamine lotion may **become grainy** and feel uncomfortable. Some users may find it unsuitable in these areas, where friction can further irritate the skin.

3. **Abrasive Residual Particles**

- As calamine lotion dries, its powder component may clump and form **abrasive particles**. Patients should be cautious to gently remove any remaining particles before reapplying, as they can cause irritation if left on the skin.

4. **Unappealing Appearance**

- The distinctive pink color of calamine lotion can be **visually unappealing** for daily use, especially on areas like the face, as it may be difficult to conceal under makeup or look unnatural.

5. **Limited Skin Penetration**

- Calamine lotion mainly affects the skin's surface and does not penetrate deeper layers. This limits its **effectiveness** for treating conditions that may benefit from a deeper-penetrating cream or ointment.

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