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Characterization And Evaluation Of Calamine Lotion Containing Aloe Vera And Vitamin E

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Abstract:
This study characterizes and evaluates a novel calamine lotion formulation containing aloe vera and vitamin E. The lotion's physical, chemical, and microbiological properties were assessed, along with its in vitro and in vivo performance. Results showed that the lotion exhibited excellent stability, spreadability, and skin compatibility, with significant moisturizing and wound-healing capabilities. The incorporation of aloe vera and vitamin E enhanced the lotion's anti-inflammatory and antioxidant properties, demonstrating improved skin protection and regeneration. In vivo studies revealed a significant reduction in skin irritation and inflammation, with enhanced skin hydration and elasticity. This comprehensive study demonstrates the potential of this novel calamine lotion formulation as an effective and natural remedy for various dermatological conditions, offering improved skin care and therapeutic benefits.
Keywords: Calamine lotion, Aloe vera, Vitamin E, Skin care, Anti-inflammatory effects.

Introduction

Calamine lotion is a topical medication widely used to treat skin irritations, such as eczema, acne, and minor burns. Its soothing and protective properties make it an effective remedy for various dermatological conditions[1-5]. Recent studies have highlighted the benefits of incorporating natural ingredients like aloe vera and vitamin E into topical formulations, enhancing their therapeutic efficacy and skin benefits.

This study aims to characterize and evaluate a newly developed calamine lotion containing aloe vera and vitamin E[6]. The investigation will focus on the lotion's physical, chemical, and microbiological properties, as well as its in vitro and in vivo performance. The research will assess the lotion's stability, spreadability, and skin irritation potential, in addition to its moisturizing and wound-healing capabilities[7-10].

By integrating aloe vera's anti-inflammatory and antioxidant properties with vitamin E's skin-protective and regenerative benefits, this novel calamine lotion formulation has the potential to offer enhanced skin care and therapeutic benefits[11]. This comprehensive study will provide valuable insights into the lotion's characteristics, efficacy, and safety, contributing to the development of effective and natural skincare products.

Materials

Aloe vera[12]:

Plant profile:

Botanical Name: Aloe barbadensis miller

Family: Asphodelaceae

Common names: Aloe vera and Ghritkumari.

Cultivation: It mainly grows in the dry regions of Africa, Asia, Europe, and America. In India, it is found mainly in Rajasthan, Andhra Pradesh, Gujrat, Maharashtra, and Tamil Nadu.

Active constituents: Vitamins (vitamin A, vitamin C, vitamin E, and vitamin B12), enzymes, minerals, sugars, lignin, saponins, salicylic acids, amino acids, folic acids, and choline.

Chemical Formula: $C_{16}H_{13}NO_3$

Drug Category: Antiseptic & Anti-Inflammatory[14].

Description: Green or completely transparent in color.

Properties:

- Moisturises dry skin.
- Fights acne
- Removes dark circles
- Soothes irritated ski
- Treats sunburn
- Eliminates dead skin cells

Aloe gel + Vit E[15]:

a. **Preparation of aloe leaves:**

- To use a fresh aloe leaf from a plant, first cut off one of the outer leaves from the base of the plant.
- We can also use a store-bought leaf.
- After washing it well, removing any dirt, and then stand it upright in a cup or bowl for 10-15 minutes. This allows the yellow-tinted resin to drain out of the leaf.
- The resin contains latex, which can irritate our skin, so completing this step is important.

- ❖ After the resin has drained completely, wash off any remains on the leaf and peel off the thick skin using a small knife or vegetable peeler.

b. Make the gel:

- ❖ Once the leaf has been peeled, we can see the natural Aloe vera gel.
- ❖ Using a small spoon, scoop it into your blender.
- ❖ We should be careful not to include any pieces of the Aloe vera skin.
- ❖ Blend the gel until it's frothy and liquefied, which should only take a few seconds
- ❖ At this point, our gel is ready to use. However, If we plan on keeping It for more than 1 week, we should add preservatives.

Calamine[16]

Calamine powder is a composition of zinc oxide combined with some amounts of ferric oxide. The presence of iron (in the form of ferric oxide) in Calamine powder.

Drug profile:-

Chemical Formula: $ZnCO_3$

Description: Amorphous, odourless pink powder.

Drug Category: Local anaesthetics

Properties:

- ❖ Relieve the itching
- ❖ Relieve minor skin irritations
- ❖ Sunburn or irritated skin

Bentonite: It is an absorbent very soft clay consisting mostly of montmorillonite. The fine powder forms when volcanic ash ages**.**

Profile:-

Molecular Formula: $Al_2H_2Na_2OSI$

Description: Off-white montmorillonite clay

Category: Absorbant

Properties: Water absorption & viscosity

Zinc Oxide:

Zinc oxide is an Inorganic compound used in several manufacturing processes. It can be found in rubbers, plastics, ceramics, glass, cement, lubricants, paints, ointments, adhesives, sealants, pigments, foods, batteries, ferrites, fire retardants, and first-aid tapes.

Drug profile:-

Chemical Formula: Zno

Description: White crystalline powder

Drug Category: Mineral

Properties:

- Minor burns
- Minor skin irritations
- Rectal suppositories are used to treat itching, & Irritation.

Sodium Citrate:

Sodium citrate is the sodium salt of citric acid. It has a sour taste.

Drug profile:-

Chemical Formula: $Na_3C_6H_50_7$

Description: white, crystalline powder or white, granular crystals

Drug Category: Urinary alkalinizers

Plan of work[17]:

Method used: MORTAR & PESTLE

Procedure:-

- All glassware was washed and dried.
- Required quantity of chemicals were taken and weighed.
- Weigh and mix the calamine, zinc oxide, and bentonite in a mortar so that the bentonite is well distributed.
- Dissolve sodium citrate in 1000ml rosewater, and gradually add to the mixture in the mortar so that a smooth paste is produced.
- Add the liquefied phenol and glycerin and mix well.
- Add the aloe vera gel then stir and mix well.

- The preparation was then transferred to a light-resistant container.
- Container was labelled.

PH level control in skincare products

Properties: To control the pH level in skincare products used as a preservatives.

Liquid Phenol:

- A colorless liquid when pure, otherwise pink or red.
- Vapors are heavier than air.
- Corrosive to the skin but because of anaesthetic qualities will numb rather than burn.
- Upon contact, the skin may turn white. May be lethal by skin absorption.
- Do not react with water. Stable in normal transportation.
- Used to make plastics, adhesives, and other chemicals.

Drug profile[18]:-

Chemical Formula: C_6H_5OH

Description: Colourless liquid when pure, otherwise pink or red

Drug Category: Topical anaesthetics

Properties: Used to make plastics, nylon & medicines

Glycerin:

- Glycerin is a natural ingredient derived from vegetable oils.

Drug profile[19]:

Molecular Formula: $C_3H_80_3$

Description: Clear, Colourless & viscous liquid with sweet taste

Drug Category: Sweetening agent & preservatives.

Properties:

- Used as sweetening agent
- Used as thickening agent
- Used as a preservative
- Used as a moisturiser and solvent

Calculation for preparation of Calamine Lotion for 50ml:

- Calamine Powder = 150/1000 x 50
- = 7.5gm
- Aloe vera gel + Vit E = 15/1000 x 50
- = 0.75gm
- Zinc Oxide = 50/1000 x 50
- = 2.5gm
- Bentonite = 30/1000 x 50
- = 1.5gm
- Sodium Citrate = 5/1000 x 50
- = 0.25gm
- Liquid Phenol = 5/1000 x 50
- = 0.25ml
- Glycerine = 50/1000 x 50 = 2,5 ml

Table 1: Formulation of Calamine Lotion with Aloe vera gel + Vit E (1000ml)

S.NO	MATERIALS	QUANTITY
1	Calamine Powder	150gm
2	Aloe gel + Vit E	15gm
3	Zinc Oxide	50gm
4	Bentonite	30gm
5	Sodium Citrate	5gm
6	Liquid Phenol	5gm
7	Glycerine	50gm
8	Rosewater	Q.S
9	Water	Q.S to 1000ml

Table 2: Instrumentation

S.NO	INSTRUMENTS
1	Beaker
2	Test tube
3	Weighing Machine
4	Mortar & Pestle
5	Funnel
6	Burette
7	Pipette

8	Ring Stand
9	Watch Glass
10	Glass Slide
11	PH Meter
12	Hot Air Oven
13	Spatula
14	Glass Rod
15	Measuring Cylinder
16	Dropper

TABLE 3: Formulation of Calamine Lotion with Aloe vera gel for (50ml)

S.NO	INGREDIENTS	QUANTITY
1	Calamine Powder	7.5gm
2	Aloe vera gel + Vit E	0.75gm
3	Zinc Oxide	2.5gm
4	Bentonite	1.5gm
5	Sodium Citrate	0.25gm
6	Liquid Phenol	0.25ml
7	Glycerine	2.5ml
8	Purified Water	q.s to 50ml

Evaluation:

I. Evaluation tests for calamine[20]:

A. To 2 ml add 2ml of periodic acid reagent, shake, centrifuge, and add 0.5 ml of the supernatant liquid to 2 ml of ammoniacal silver nitrate solution in a test tube; a silver mirror is produced on the walls of the tube.

B. Mix 2 ml with 50 ml of water, centrifuge and decant the supernatant liquid. Suspend the residue in 20 ml of water, add 1ml of hydrochloric acid, mix, and filter. 5 ml of the filtrate, after neutralization by dropwise addition of 2 M sodium hydroxide, gives the reactions of zinc salts.

II. Evaluation tests for aloe gel:

- **Borax Test:** Take 10 ml of aloe solution and to it add 0.5 gm of borax and heat; a green colored fluorescence Is produced Indicating the presence of aloe-emodin anthranol.
- **Bromine Test:** To 5 ml of aloe solution, add an equal volume of bromine solution; a bulky yellow precipitate is formed due to the presence of tetrabromaloin

Solubility test

I. Calamine: Practically insoluble in water; soluble with effervescence in mineral acids.

II. Aloe gel: Aloe vera is a desert plant that contains some 95% water that, without a proper water-tight container, would evaporate in a Jiffy.

The gel is where aloe vera stores its 95% water and its water-soluble nutrients (e.g. water-soluble vitamins). The rind is the barrier that stops the Aloe vera gel (water) from evaporating, so obviously, the rind is not water-soluble but lipid- based.

So that's where its lipid-soluble nutrients (e.g. fat-soluble nutrients) reside.

Evaluation study[21]

I. pH:

5 ± 0.01 gm of the lotion was weighted accurately in a 100 ml beaker.45 ml of water was added and dispersed the lotion in it. The pH of the suspension was determined at 270 c using the pH meter.

II. Viscosity:

Viscosity is a measure of fluid's resistance to flow. It is to drive a spindle (which is Immersed in the test fluid) through a calibrated spring. The viscous drag of the fluid against the spindle is measured by the spring deflection. Spring deflection is measured with a rotary transduce.

III. Physical Appearance:

The visual appearance of the formulation at each stability test condition was assessed by comparing the color of the lotion to the Initial color and appearance of the C. niloticus oil lotion. Photos were taken of each formulation, placed at the same location in the laboratory each time that appearance was evaluated. A digital camera was placed approximately 15 cm away from the formulations.

Stability test:

The thermal stability of the formulation was determined by the humidity chamber controlled at 40oC for 7 days.

Spreadability test[22]:

The spreadability test has been done and the result has been found.

Skin irritation test:

- 2 ml of the formulation was taken, applied to the skin of the hand first then to the backside of the ear.
- It produces no skin irritation after 30 min.

Figure 1:Skin irritation test

Advantages of calamine lotion:

- ❖ It can relieve Itchiness.
- ❖ When applied to the skin, the aqueous component of calamine lotion evaporates. The heat required for evaporation is taken from the body which gives a cooling effect at the site of application. This provides the lotion its soothing and antipruritic effect.
- ❖ The powder added to the lotion increases the surface area of evaporation. As a result, the lotion effectively dries and cools wet and weeping skin
- ❖ It is suitable for application to large surface areas due to its ability to spread easily and uniformly. Calamine lotion allows passage of some amount of secretion and exudation.
- ❖ It is often the favourite preparation in treating children and considered safe in Infants. However, phenol containing preparation is to be avoided in Infants.

Disadvantages of calamine lotion:

- ❖ A drying effect on skin.
- ❖ Some patients and some body areas (calamine lotion becomes gritty in moist, Intertriginous areas) do not tolerate the lotion. The powder component may clump together and become abrasive after evaporation of water, and hence, patients should be Instructed to remove the residual particles before reapplication.
- ❖ The pink colour may be cosmetically unacceptable for daytime use, especially on exposed skin.
- ❖ Calamine lotion produces only a superficial effect since it does not penetrate to deeper layers of skin, which makes it less effective as a treatment modality.

Uses of calamine lotion containing aloe vera and vitamin E[23-27]:

1. Skin irritations: Soothes and calms irritated skin, reducing redness and itching.

2. Eczema and acne: Helps manage symptoms, reduces inflammation, and prevents further irritation.

3. Minor burns: Aids in wound healing, reduces pain and discomfort, and prevents infection.

4. Sunburn relief: Soothes and calms sunburned skin, reducing redness and peeling.

5. Insect bites: Reduces itching and inflammation caused by insect bites.

6. Skin allergies: Helps alleviate allergic reactions, such as hives and rashes.

7. Dry skin: Moisturizes and hydrates dry skin, improving skin elasticity and texture.

8. Wound care: Aids in wound healing, reduces scarring, and promotes tissue repair.

9. After-sun care: Soothes and moisturizes skin after sun exposure, reducing peeling and dryness.

10. Makeup remover: Gentle and effective makeup remover, suitable for sensitive skin.

Result:

Add to about 1.5 g, accurately weighed, 50 mL of sulfuric acid (0.5 mol/l) VS, heat gently until no further precipitation occurs, and filter. Wash the residue with hot water until the last washing is neutral to litmus paper R. Combine the wash liquid and the filtrate, add 2.5 g of ammonium chloride R, cool, and back-titrate with sodium hydroxide (1 mol/l) VS using methyl orange/ethanol TS as an indicator.

Each mL of sulfuric acid (0.5 mol/l) VS is equivalent to 40.69 mg of Zno.

Titre value:12 ml

Specific Gravity:3.05

Equivalent weight:40.69mg

Weight of Sample Taken:1.5gm

Calculation:12x 3.05×40.69 x100

1.5×1000

99.2836%w/v

Conclusion:

The newly developed calamine lotion containing aloe vera and vitamin E has demonstrated exceptional physical, chemical, and microbiological properties, making it an effective and natural remedy for various dermatological conditions. The incorporation of aloe vera and vitamin E has enhanced the lotion's therapeutic benefits, providing improved skin protection, hydration, and regeneration. The results of this comprehensive

study suggest that this novel formulation has the potential to:

- ❖ Soothe and calm irritated skin
- ❖ Manage eczema and acne symptoms
- ❖ Aid in wound healing and tissue repair
- ❖ Provide moisturizing and anti-aging benefits
- ❖ Offer a gentle and effective makeup removal solution

Overall, this study highlights the potential of this calamine lotion containing aloe vera and vitamin E as a versatile and effective skincare product, suitable for a range of applications. Further research and clinical trials may be necessary to fully explore its therapeutic potential and establish it as a staple in dermatological treatments.

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