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Formulation and Evaluation of Semi-Synthetic Anti -Microbial Cream

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Abstract

The objective of this study was to investigate the antimicrobial properties of the Umbelliferae family of plants. Previous research has shown that extracts from fennel, coriander, and cumin exhibit significant antimicrobial effects. To further explore these properties, we formulated and evaluated a cream containing extracts of alovera, coriander, and cumin oil, focusing on its antimicrobial activity. The cream was created using various excipients, including borax, beeswax, white soft paraffin, and additional ingredients such as methylparaben, propylparaben, and distilled water. Each formulation was assessed for pH, viscosity, spreadability, washability, homogeneity, physical characteristics, stability, irritancy, and antimicrobial efficacy. The prepared cream underwent evaluations of its physical, rheological, and antimicrobial properties, along with phytochemical screening for terpenoids and microbial assays. Stability studies were also conducted. The findings revealed promising antimicrobial activity, indicating the potential of the herbal cream as a natural alternative for combating microbial infections. Antimicrobial susceptibility testing confirmed the cream's effectiveness against a range of microbial pathogens. Throughout the research, formulation F2 was identified as the most effective, exhibiting no phase separation and demonstrating significant antimicrobial activity, leading to its selection as the preferred formulation.

Keywords: Herbal cream, Antimicrobial Activity, Alovera, coriander extract, Cumin extract

INTRODUCTION

Microbes encompass a variety of microorganisms, particularly those that can lead to disease or infection. This group includes bacteria, archaea, viruses, fungi, protozoa, and algae, collectively referred to as microbes. Antimicrobials are substances that eliminate microbes, inhibit their growth or reproduction, or obstruct their pathogenic effects. The Umbelliferae family, which includes drugs derived from Alovera, coriander, and cumin, exhibits notable antimicrobial properties. Nature has long served as a vital source

of medicinal resources, aiding humanity in maintaining health throughout history. Medicinal and aromatic plants have garnered significant attention from researchers globally, as they provide essential raw materials for the pharmaceutical, cosmetic, flavoring, and perfumery industries. For centuries, various cultures have utilized spices and herbs to enhance the taste and aroma of their culinary creations. There is a growing interest in the use of natural substances, such as spices and herbs, along with their extracts, due to their safety for both handlers and consumers, as well as their lower incidence of side effects and toxicity. Coriander (*Coriandrum sativum L.*) is an annual herb known for its culinary, aromatic, and medicinal attributes. It is recognized for its antiemetic, anti-inflammatory, antiseptic, emmenagogue, antidiabetic, and antihypertensive properties. Historically, natural products and their derivatives have been invaluable sources of therapeutic agents. Today, many pharmaceuticals are derived from natural sources or are semi-synthetic derivatives of these products, commonly used in traditional medicine systems. Nature is abundant with various enchanting fragrances that are both magical and pleasing to our senses. Aloveraoil, an essential oil, has numerous applications across different industries.Alovera serves as a spice and is also a key ingredient in various traditional medicines worldwide. This plant has been extensively studied for its medicinal and therapeutic benefits, demonstrating properties such as carminative, flavoring, antioxidant, antibacterial, antifungal, and mosquito-repellent effects.

Figure No. 1: Microbial Infection

DRUG PROFILE:-

1. Alovera

Figure No. 2: Alovera

Synonyms

1. Aloe barbadensis
2. Aloe indica
3. Indian aloe
4. Burn plant

Scientific Name

Aloe barbadensis Mill. (syn. Aloe vera (L.) Burm.f.)

Biological Source

Aloe vera is derived from the leaves of the Aloe barbadensis plant.

Family

Asphodelaceae (previously Liliaceae)

Geographical Source

Aloe vera is native to Africa, the Mediterranean region, and the Indian subcontinent. It is now cultivated in many parts of the world, including:

1. India
2. China
3. Mexico
4. South Africa
5. United States

Macroscopic Characteristics

1. Leaves: Thick, fleshy, and green, with serrated edges.

2. Gel: Clear, jelly-like substance found inside the leaves.

3. Colour: The outer skin of the leaf is green or greenish-gray, while the inner gel is clear or translucent.

4. Odor: Aloe vera has a mild, slightly bitter or earthy odor.

5. Taste: The gel has a mild, slightly bitter or neutral taste.

Size and Shape

1. Leaves: Aloe vera leaves are typically 2-3 feet long and 2-3 inches wide, with a thick, fleshy texture.

2. Plant: The plant can grow up to 2-3 feet tall and wide.

Chemical Constituents

1. Anthraquinones: Aloin, aloe-emodin, and anthranol.

2. Polysaccharides: Glucomannans and acemannan.

3. Vitamins: A, C, E, and B vitamins.

4. Minerals: Calcium, potassium, magnesium, and zinc.

5. Amino acids: Essential and non-essential amino acids.

Uses

1. Skincare: Aloe vera gel can soothe burns, acne, and other skin irritations.

2. Wound healing: Aloe vera's antimicrobial properties can help prevent infection and promote wound healing.

3. Skin protection: Aloe vera's antioxidant and anti-inflammatory properties can help protect the skin from damage and reduce inflammation.

4. Antimicrobial activity: Aloe vera has been shown to be effective against a range of microorganisms, including bacteria, viruses, and fungi.

2. Coriander

Figure No. 3: Coriander

Synonyms:-

Coriander fruits Cilauthto leaves, Dhaniya

Scientific name:-

Coriandrum sativum

Biological source:-

These are the fully dried ripe fruits of the plant known as Coriandrum sativum Linn the fruit should contain not less than 0.3 per cent of the volatile oil

Family :-Umbelliferae

Geographical source:-

Plant is cultivated throughout European countries principally in Russia Hungary and holland it is also cultivated in India Egypt and Morocco in India it is widely cultivated in Andhra Pradesh Maharashtra, west bengal, uttar Pradesh

Microscopic characters:-

Color:-yellowish brown to brown

Odor:-Aromatic

Taste:-Spicy and characteristic

Size:-fruits are2-4 mm in diameter and 4-30mm in length

Shape:-Coriander is a sub-globular stemocarnous fruit. about 10 primary ridges and 8 secondary ridges are present

Chemical constituents:-

coriander yields from 0.3-1 per cent of volatile oil.volatile oil of the drug contains 90 per cent of D-linalool (coriander) and Coriandryl acetate, and small quantities of L-borneol geraniol and pinene.

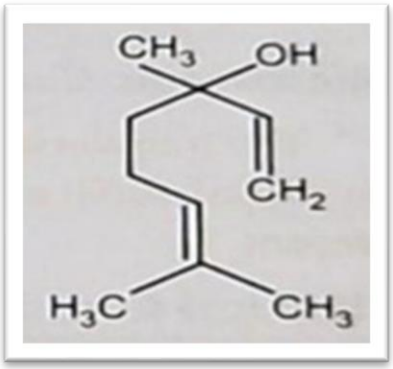


Fig No. 4 Structure of Coriandrol

Uses:-

Aromatic Carminative, stimulant, flavouring agents, anti-inflammatory agent, digestive issues lowering cholesterol level. Antioxidant Anticancer. Antidiabetic

2. Cumin

Figure No. 5: Cumin

Synonyms:-Jira

Scientific Name:-Cuminum cyminum L

Biological source:-It consists of dried ripe fruits of Cuminum cyminum Linn.

Family:-Umbelliferae

Geographical source:-It is indigenous to nile territory It is cultivated In Morocco sicily, india, Syria and china In India except assam and west Bengal, it is cultivated in all states about 90 per cent of the world production is from India and most of it comes rajasthan and Gujarat.

Macroscopic characters:-

Colour:-Brown coloured ridges are light in colour

Odor:-characteristics and aromatic

Taste:-characteristics and aromatic

Size:-4-6mm in length and 2 mm thick

Shape:-elongated and tapering at both ends cremocarps generally separate each mericarp has finelongitudinal ridges.

Chemical constituents:-Cummin fruits contain 2.5-4 per cent volatile oil, 10 per cent fixed oil and proteins volatile oilmainly consist of 30-50 per cent cuminaldehyde small quantities of phellandrene cuminic alcohol, hydrated cuminaldehyde and hydro-cumimine.

Uses:-Stimulant carminative, Diarrhoea dyspepsia, blood sugar regulation

MATERIAL AND METHODS:

Materials:

Materials are Use for Formulation Alovera Wear CollectedfromSaikrupa Collage in Botnical Garden , coriander and cumin in powder Purches in Near Ayurveda Shop. Borax, Propyl Paraben, White Soft Peraffin, bees wax, Glycerin use in the Formulation of Herbal Antimicrobial cream Were analytical garde.

Table No .1 Role of Ingredients

SR. NO	INGREDIENTS	ROLE
1.	Alovera	Antimicrobial Activity and Skin care
2.	Coriander	Antimicrobial Activity
3.	Cumin	Antimicrobial Activity
4.	Borax	Emulsifying Agent
5.	Bees Wax	Stabilizer
6.	Propyl Paraben	Preservative
7.	White Soft Peraffin	Moisturizer, Softening
8.	Glycerin	Skin -repairing

Figure No. 6: Materials

ANTI MICROBIAL ACTIVITY

1. Sample details :

Standard: Metronidazole

Test samples: Samples-

A] F4

2. Bacterial strains

1. *Pseudomonas Aerginosa*

2.Clostridium Perfringrens

3. Reagent preparation (agar preparation)

i)Sabouraud Dextrose Agar and Mueller Hinton agar preparation.

Ii)Dissolve 9 gms of Mueller Hinton agar and 15 gms of Sabouraud Dextrose agar in 250 mL distilled water.

iii)After preparation of media heat/boil the media by using water bath/sonicator till media dissolves properly.

iv)After media dissolves properly and autoclave the media at 15 lbs. (121˚C) pressure for 15 min.

v)Cool the media at 45-50˚C mix well and pour to the petry plates.(don't allow media to get cool at room temperature)

vi)Keep the plates at room temperature to gets solidify. (1/1:30 hrs)

4. Preparation of test solution:

i)Prepare samples with concentration 100 µg/ mL

ii)Prepare 100µg/mL stock sample –weigh 10mg of given sample and standard dissolved in DMSO solution make up the volume with DMSO up to 10 mL

iii)100µg/mL-Dissolve 1mL of stock in 9mL of DMSO solution.

5. Procedure:

i)A swab of pure bacterial culture is evenly spread over Mueller-Hinton agar/ Sabouraud Dextrose agar.

ii)Using cork borer boor the wells on media, the100µl of samples were pour on the media plate.

iii)This petri plate is kept for incubation for 18-24 hours at 37°C along with other optimal conditions for bacterial growth.

iv)After the incubation period, a clear area (zone of inhibition) around the antibacterial product sample is observed and measured.

v)Use antibacterial as standard.

vi)Report the data in format given below.

Extraction process by maceration method:

1. **Extraction of Coriander**:

In this process, the coriander seeds powder (21g) is placed with whole of the solvent (90 ml) in closed vessel for 2 days. During this period shaking in done occasionally. After 2 days the liquid is strained and marc is pressed.

2. **Extraction of Cumin**:

In this Process, the cumin seeds powder (10g) is placed with whole of the solvent (55ml) in closed vessel for 4hr .During this period shaking in done occasionally. After 4hrs the liquid strained and marc is pressed.

3. **Alovera oil**

The aloe vera gel is mixed with a carrier oil (like coconut) and heated gently to extract the beneficial compounds.

Fig No. 6: Maceration Method

Fig No. 7: Filtered The Drug

Table No.2 Test for Terpeniods

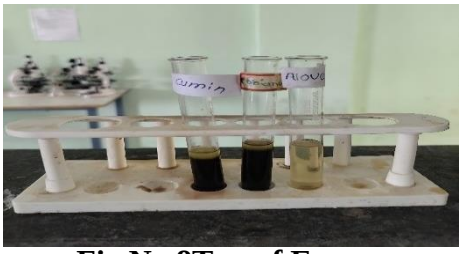
Test	Observation	Inference	Picture
Extract [5ml] Was Mixed With Chloroform [2ml] and Concentration Sulphuric acid [3ml] was Carefully Added To From Layer	Coloration Junction 2 Layer	Presence of Terpenoid	 **Fig.No.8Test of Extract**

Table No 4. Formulation of cream

Sr. No	INGREDIENTS	F1	F2	F3	F4	F5
1.	Alovera	2ml	1.5ml	1ml	1.5ml	1.5ml
2.	Coriander	2ml	1ml	1.5ml	1ml	1.5ml
3.	Cumin	2ml	1.5ml	1.5ml	1.5ml	1ml

4.	Borax	0.80gm	0.50gm	0.50gm	0.40gm	0.30gm
5.	Bees Wax	2.00gm	2.00gm	3.00gm	2.00gm	2.00gm
6.	Propyl Paraben	0.20gm	0.20gm	0.30gm	0.30gm	0.40gm
7.	White Soft Peraffin	5.00gm	3.00gm	2.00gm	3.00gm	3.00gm
8.	Glycerin	1ml	0.30ml	0.20ml	0.30ml	0.30ml

Evaluation Parameters:-

PH:-

0.5 g of cream was taken and dissolved in 50 ml water and pH was measured with the help of pH meter (digital).

Physical Appearance:-

In this test, the cream was observed for color, odor, texture, state .

Irritancy:-

Mark the area (1 cm?2;) on the left-hand dorsal surface. Then the cream was applied to that area and the time was noted. Then it is checked for irritancy, erythema, and edema if any for an interval up to 24 h and reported .

Washability:-

A small amount of cream was applied on the hand and it is then washed with tap water.

Greaisness: -

Here the cream was applied on the skin surface in the form of smear and checked if the smear was oily or grease-like.

Spreadability:-

Spreadability of the formulation was done by using two sets of glass slides of standard dimensions. The herbal cream formulation was placed over one of the slides. The other slide was placed on the top of the formulation, such that the cream was sandwiched between the two slides weight was placed upon the upper slides so that the cream between the two slides was pressed uniformly to form a thin layer. The weight was removed and the excess of formulation adhering to the slides was scrapped off. The upper slide allowed slipping off freely by the force of weight tied to it. The time taken for the upper slide was noted & calculated by using the formula Spreadability = mx1/t.

Stability:-

The stability of cream refers to its ability to maintain its properties, such as texture, appearance, and composition, over time and under various conditions. It involves assessing factors like phase separation, viscosity, microbial growth, and oxidation. Stability testing helps determine the shelf life and quality of the cream product.

Homogeneity:-

Homogeneity in cream refers to the uniform distribution of its components, such as fat globules and water, throughout the product. Cream should exhibit a consistent texture and appearance without any visible separation or clustering of its constituents. Homogeneity ensures a smooth and consistent product quality, enhancing its sensory attributes and overall appeal.

RESULTS AND DISCUSSION:-

The present Investigation attempted to develop the herbal Antimicrobial cream using Alovera, coriander and cumin seeds oil. Formulated cream were subjected for Visual Observation for all formulation was found to be homogenous faint yellowish colored semi-solid with characteristics odor of the raw materials, then formulation were subjected for evaluation such as PH, Spread-ability, Stability, irritancy, Washability, Greasiness and Antimicrobial Activity.

1. PH:-

According to the result, the PH of all the three formulation that is F1 –5.00,F2-5.47, F36.1,F4 -6.25,F5-6.25 were found to be nearer to skin PH so it can be safely used on the skin.

2. Physcial Evaluation:-

In these test color-faint yellow, odor-pleasant, texture-smooth and state-semisolid of three formulation were checked.

3. Irritancy :-

Mark the area (1cm) on the left hand dorsal area surface. The cream was Applied to that area the time was noted. Then it checked for irritancy, Erythema and Edema if any for an interval up to 24hrs and reported. According Result all three formulation that is F1, F2, F3 ,F4 ,F5 slowed no sign of Irritancy.

4. Washability:-

Wash ability test was carried out by applying a small amount of cream on the hand them washing it with tap water. All three formulation were easily washable.

5. Greasiness:-

Here the cream was applied on the skin surface in the form of smear and checked if the smear was oily or grease-like. According to the results, we can say that all three formulation were non-greasy.

6. Spreadability:-

The Spreadability of the three formulation that is F1, F2 ,F3,F4 and F5 was carried out and out of that for F2 the time taken by the 2 slides to separate is less so as said in the description of evaluation test

lesser the time taken for separation of the two slides better the Spreadability so according to this statement F2 slowed better Spreadability.

7. **Stability :-**

The stability test of the cream is assess creams physical, chemical and microbiological stability over time.

8. Homogeneity :-

The appearance and touch of the cream were found to be good

ANTIMICROBIAL ACTIVITY

Observation:

Figure 1: Test samples Dispersion against Pseudomonas aeruginosa

Figure 2: Test samples Dispersion against Clostridium Perfringrens

1. **Observation:**

Figure 1: Test samples Dispersion against *Pseudomonas aeruginosa*

Figure 2: Test samples Dispersion against *Clostridium Perfringrens*

• Zone size: < 10 mm

• The drug is ineffective or has poor activity against the microorganism. The microorganism is resistant to the drug.

• Moderately Active (Intermediate):

• Zone size: 10–15 mm

• The drug shows moderate activity, but it may not be sufficient to fully inhibit the microorganism under clinical conditions. This suggests intermediate resistance.

• Good Activity (Susceptible):

• Zone size: > 15 mm

•The drug is considered effective, with good antimicrobial activity against the microorganism. This indicates that the microorganism is susceptible to the drug, and it can be used to treat infections caused by this microorganism.

Observations:

Table 1. Zone of inhibition of Samples and standard

Sr.no	Sample name	zone of inhibition in mm
1	CONTROL	NA
2	STANDARD (*Pseudomonas aeruginosa* , Metronidazole)	21.43 mm
3	F4 (*Pseudomonas aeruginosa*)	14.66 mm
4	STANDARD (*Clostridium Perfringrens* , Metronidazole)	23.53 mm
5	F4 (*Clostridium Perfringrens*)	13.73 mm

The zone of inhibition for the standard drug Metronidazole against Pseudomonas aeruginosa was recorded at 21.43 mm, whereas the test sample F4 showed a slightly lower inhibition zone of 14.66 mm. Similarly, for Clostridium perfringens, the standard exhibited a zone of inhibition of 23.53 mm, while F4 demonstrated a 13.73 mm inhibition zone. The control did not show any zone of inhibition.

Discussion:

The test compound F4 exhibited moderate antimicrobial activity against both Pseudomonas aeruginosa and Clostridium perfringens when compared to the standard drug Metronidazole. Although the inhibition

zones of F4 were slightly smaller, the results indicate that F4 has promising antimicrobial potential and could serve as a lead compound for further development.

Table No.5 Results of cream (All Batches)

Sr. No.	Result	F1	F2	F3	F4	F5
1.	Colour	Faint Yellow	Faint Yellow	Faint Yellow	Faint Yellow	Faint Yellow
2.	Odor	Pleasant	Pleasant	Pleasant	Pleasant	Pleasant
3.	Texture	Smooth	Smooth	Smooth	Smooth	Smooth
4.	State	Semi-Solid	Semi-Solid	Semi-Solid	Semi-Solid	Semi-Solid
5.	PH	5.00	5.47	6.1	6.25	6.25
6.	Washability	Easily Washable	Easily Washable	Easily Washable	Easily Washable	Easily Washable
7.	Irritancy	Nil	Nil	Nil	Nil	Nil
8.	Phase Separation	No	No	No	No	No
9.	Spread-ability	14.10	14.00	15.15	15.50	16.10
10.	Greasiness	Non greasy	Non greasy	Non greasy	Non greasy	Non greasy
11.	Stability	Stable	Stable	Stable	Stable	Stable
12.	Homogeneity	Good	Good	Good	Good	Good
13	Antimicrobial activity	NA	NA	NA	VERY GOOD	NA

SUMMARY AND CONCLUSION:-

The concept of above formulation was to incorporate the extract of Alovera, coriander and cumin Seeds in powder form in the cream, as cream as widely accepted and better absorb by skin with is Moisturizing and emollient effect Hence in the present investigation we prepared Alovera, coriander and cumin cream by using conveniently Excipients. Results of evaluation demonstrate the pH of the cream we're normal range of the skin with good Viscosity, Spread-ability, wash ability, greasiness, stability, irritancy, antimicrobial activity , phase separation which indicated cream were capable to remain in the site Application for prolonged time. Thus we concluded that Alovera, coriander and cumin cream would

provide safe and healthy germ free skin. In conclusion, the formulation of the herbal antimicrobial cream demonstrated promising results in inhibiting microbial growth. Through a comprehensive evaluation process involving various tests such as antimicrobial activity, stability, and sensory analysis, the formulated cream exhibited significant efficacy and stability. The incorporation of herbal extracts not only enhanced the antimicrobial properties but also provided potential benefits such as skin hydration and soothing effects.

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