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Formulation and Evaluation of Polyherbal Gel for Anti-Acne Treatment

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ABSTRACT

Topical gels are homogenous, semi-solid preparations used in the treatment and cure of skin conditions. Because gels are more hydrophilic by nature, the medicine or active component was released quickly. Herbal formulations mean a dosage form containing one or more herbs to give various cosmetic or therapeutical activity. In the present study, due to its antibacterial properties, moringa is helpful in preventing acne breakouts on the skin. It also helps in removing blemishes, dark spots, pimples and blackheads. While, Withania Somnifera (Ashwagandha) having anti-inflammatory and anti-oxidant properties it is used for acne treatment. Ashwagandha can help to cure hyperpigmentation by controlling the over production of melanin in the skin. Thus, it is used to remove acne scars. Hence these two trees are used for the preparation of anti-acne gel. F1 to F6 batches are prepared of the anti-acne gel. From these F4 batch is the optimized batch, since its homogeneity is very good, there is no grittiness. The F4 batch has viscosity 4470 cp, Spreadability is 16.66 gm.cm /sec. F4 batch shows moderate activity against Staphylococcus aureus which is responsible for formation of acne.

INTRODUCTION

2.1 Acne

One frequent chronic inflammatory skin disorder is acne vulgaris. Approximately 80% of young adults and adolescents have it. It is a condition that affects the skin's pilosebaceous units and can cause lesions that are either inflammatory or not. Acne is characterized by open comedones (blackheads), closed comedones (whiteheads), and inflammatory lesions such nodules, pustules, and papules. According to Thiboutot et al, acne ought to be treated like a chronic condition that can have psychological effects on its sufferers.[1] Acne vulgaris is caused by three microorganisms: Propionibacterium acnes, Staphylococcus aureus, and Staphylococcus epidermis. Acne develops from the fast proliferation of microorganisms.

2.2 Types of acne– [2]

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a) Whiteheads -

Remain beneath the skin's surface and are very small.

b) Blackheads –

Though they do not originate from dirt, they have a vivid black appearance and rise to the skin's surface. The colour of black heads is black; it isn't black because of the dirt. In most cases, keratin is an oxidized protein.

c) Papules -

They are tiny, sensitive pink pimples that are easily noticeable on the skin.

d) Nodules –

Evidently apparent on the skin's surface. These are big, painful pimples that are visible on the skin's surface and are embedded deeply in the skin.

e) Cysts –

Easily noticeable on the skin's surface. They are painful, pus-filled, highly ingrained, and readily scar.

f) Pustules –

Pustules, often known as zits or pimples, are visible on the skin's surface and are red at the base with pus at the top.

2.1 Moringa Oleifera

Moring tree shows the great potential and has passed every test for nutritional value, medicinal qualities, environmental suitability, and safety for food is the evergreen, softwood, perennial "Moringa oleifera" of the Monogenetic Moringaceae family.[3]

Table 1: Traditional Medical Properties of Moringa Oleifera

Plant Part	Traditional medicinal use
Leaves	Antibacterial infection, urinary tract infection, HIV-AIDS, fever, hepatic, anti-tumor, anti-hypertensive, thyroid, diarrhoea, dysentery, ulcer, headache, antioxidant, protein, iron deficiency, scurvy.
Roots	Dental caries/toothache, common cold, fever, asthma, diarrhoea, flatulence, epilepsy, hysteria headache, gout, low back/kidney pain, scurvy.
Bark	Dental caries/toothache, common cold, sore/ulcer, antitumor, snakebite, scorpion bite, digestive, epilepsy, hysteria, headache, birth control and scurvy.
Flowers	Throat infections, common cold, antitumor, rheumatism, tonic abortion, hysteria.

2.3.1 Uses of Moringa as a skin care –

Moringa has many healthy nutrients for skin such as – Vitamin A & Vitamin E. Moringa leaves contain antioxidant and antibacterial properties. Due to these properties, moringa is helpful in preventing acne, it also helps in removing dark spots, pimples and blackheads.

2.1 Ashwagandha

Common names for ashwagandha (W. somnifera, fam. Solanaceae) include "Indian Winter cherry" and "Indian Ginseng." Due to its numerous health advantages, it has been used as a Rasayana for millennia and is considered one of the most significant herbs in Ayurveda, the traditional medical system of India. Ashwagandha belonging to the family Solanaceae.

Table 2: Traditional Medicinal Applications of Various Parts of Withania Somnifera [4]

Plant Part Used	Uses
Roots	Treatment of asthma, bronchitis, leukoderma, tuberculosis, liver problems, heart disorders and arthritis. Act as an antibacterial, antitumor, antioxidant, immunomodulatory, and neurotic regenerator. Show adaptogenic activity, nootropic effect, hypothyroid activity, herbicidal potential, abortifacient astringent, aphrodisiac, and emmenagogue.
Leaves	Treatment of ulcers, painful swelling, external pains, syphilis, haemorrhoids, eyesores, boils, and edema. Act as aphrodisiac, anti-inflammatory, diuretic, hepatoprotective, anti-arthritic, anti-cancerous, and pesticidal
Seeds	Act as a diuretic, narcotic, and hypnotic
Fruits	Treatment of ulcer and tuberculosis Act as anthelmintic
Leaves, roots, and stem	Act as antibacterial, antitumor, and herbicidal
Whole plant	Act as an antidote, insecticidal, larvicidal, antioxidant, immunomodulatory, neurotic regenerator, adaptogenic hepatoprotective, and cardioprotective

2.4.1Uses of Ashwagandha as a skin care –

Ashwagandha also having antibacterial and anti-inflammatory properties which makes ashwagandha is a natural remedy for reducing acne and pimples. Ashwagandha helps to moisturizes and nourishes your skin, reducing the wrinkles.

1. Experimental Work:

a. MATERIALS

Distilled water, HPMC K4M, Carbopol 934, Methyl Paraben, Propyl paraben, triethanolamine,70% ethanol, rose oil. Above all the ingredients used were obtained from Satara college of Pharmacy, Satara.

b. METHODOLOGY

Collection of plant material

A) Moringa oleifera

Fresh moringa leaves were collected from farm. Leaves were dried under sunlight. Then dried leaves were powdered coarsely. The plant was authenticated by the botany department of LBS College of arts, science, and commerce, Satara.

Extraction of moringa leaves powder –

Powdered moringa oleifera leaves (100 gm each; 1:10 w/v) extracted by infusion (30 min) under room temperature (25-30 ℃) and boiling water (100 ℃), classified as cold extraction.[5]

B) Ashwagandha

Ashwagandha powder is collected from local market of Satara. (Waghdole Ayurvedics, Satara.)

Extraction of Ashwagandha powder –

100-gram W. Somnifera dried root powder exhaustively extracted with ethanol, using drug-solvent ratio 1: 10 by maceration method (10 hours). Then the extract was filtered and concentrated.[6]

Method For Preparation of Anti-Acne Gel:

Table 3: Formulation Table

Sr.no.	Ingredient	F1	F2	F3	F4	F5	F6
1	Carbopol 934	0.5gm	1gm	1.5gm	0.5gm	1gm	1.5gm
2	HPMC K4M	1.5gm	2gm	2.5gm	2.5gm	2gm	1.5gm
3	Methyl paraben	0.2gm	0.2gm	0.2gm	o.2gm	0.2gm	0.2gm
4	Propyl paraben	0.1gm	0.1gm	0.1gm	0.1gm	0.1gm	0.1gm
5	Moringa extract	3%	6%	9%	6%	3%	9%
6	Ashwagandha extract	6%	4%	2%	6%	6%	2%
7	Rose oil	Q.S.	Q.S.	Q.S.	Q.S.	Q.S.	Q.S.
8	Triethanolamine	Q.S.	Q.S.	Q.S.	Q.S.	Q.S.	Q.S.
9	Distilled water up to	50 ml	50 ml	50 ml	50 ml	50 ml	50 ml

Procedure [6]

Required quantity of Carbopol 934 was dispersed in 45 ml distilled water. Kept the beaker aside to swell the Carbopol 934 for half an hour and then stirring should be done to mix the Carbopol 934 to form gel.

⬇

Then add required quantity of HPMC K4M with continuous stirring.

⬇

Take 5 ml of distilled water and required quantity of methyl paraben and propyl paraben were dissolved by heating on water bath

⬇

Cool the solution and then add extract of moringa and ashwagandha (Withania somnifera) and mixed the ingredients

⬇

Finally full mixed ingredients were mixed properly to the beaker containing Carbopol 934 and HPMC K4M with continuous stirring.

⬇

Then triethanolamine was added dropwise to the formulation for adjustment of required skin pH

⬇

The gel is ready to use.

Evaluation Of Herbal Gel:

Organoleptic evaluation

The resulting gel's organoleptic properties, such as color, odor and state have been evaluated. The appearance of the gel was judged by its color and roughness and graded.[7]

Homogeneity

After the generated gel were placed in the container, they were all visually inspected for homogeneity. They had examinations to check for aggregates and to see how they looked.[8]

Measurement of pH

pH of the gel was measured by using pH meter.[9]

Spreadability

It indicates the extent of area to which gel readily spreads on application to skin or affected part. The therapeutic potency of a formulation also depends upon its spreading value. Spread ability is expressed in terms of time in seconds taken by two slides to slip off from gel which is placed in between the slides under the direction of certain load. Lesser the time taken for the separation of two slides, better the spreadability. It is calculated by using the formula :

S = M. L / T where,

M= weight tied to upper slide

L= length of glass slide

T = Time taken to separate the slide[10]

Washability

Formulation was applied on the skin and then ease and extent of washing with water were checked observations manually.[11]

Skin Irritation test

Make a 1 square centimetre mark on the dorsal surface of the left hand. When applying the gel, the designated area was noted along with the time. At regular intervals for up to 24 hours, irritability, erythema, and edema were assessed and reported.[5]

Viscosity

Viscosity of the gel is measured by Brookfield viscometer.[12]

Antimicrobial activity of prepared gel against Staphylococcus aureus.

1. Preparation of Bacterial Culture: Obtain a culture of Staphylococcus aureus from a reliable source. Grow the bacteria in a suitable medium until reaching the desired cell density.

2. Inoculation of the Gel: Apply the gel containing moringa and ashwagandha onto agar plates using sterile techniques. Ensure even distribution of the gel.

3. Incubation: Incubate the agar plates at an appropriate temperature (usually around 37°C) for a specific period (typically 24 hours) to allow bacterial growth.

4. Measurement of Bacterial Growth: After the incubation period, assess the growth of Staphylococcus aureus on the agar plates. This can be done by observing colony formation or by measuring turbidity using a spectrophotometer.

5. Comparison: Compare the growth of Staphylococcus aureus on agar plates containing the gel with those without the gel (control). This allows you to determine if the gel has a bacteriostatic effect by inhibiting bacterial growth.

RESULT AND DISCUSSION:

I. Organoleptic evaluation

Organoleptic evaluation revealed that formulation of herbal gel has semisolid in nature, greenish & smooth in appearance.

Table 4: Organoleptic Evaluation

Sr.no.	Evaluation parameter	Results
1	State	Semisolid
2	Oduor	Characteristics
3	Colour	Greenish
4	Texture	Smooth

Homogeneity

The prepared gel was visually inspected, and it was found that homogeneity is good.

III. Measurement of pH

The pH of gel was found to be in the range of 5.5 to 5.9 which is desirable because studies show that the pH of topical formulations must be close to that of skin.

IV. Spreadability

Spreadability = Mass * length / time

Where, m =20 gm

l = 5 cm

t =6 sec

S = 20 * 5 /6 = 16.66 gm.cm/sec

Spreadability of the gel was found to be 16.66 gm.cm/sec

V. Washability

Washability test was carried out by applying a small amount of gel on the hand then washing it with help of tap water. Formulation was easily washable.

Figure No. 1: Before Gel Wash

Figure No. 2: After Gel Wash

VI. Skin irritation test

The skin shows no redness, edema, inflammation and irritation after application of gel. It indicates the formulation is safe to use.

VII. Viscosity

Viscosity of the prepared gel was found to be 4470 cp.

Antimicrobial activity of prepared gel against Staphylococcus aureus.

According to microbiological study, the gel has positive effects on microbial development, and the zone reader was used to determine the zone of inhibition for Staphylococcus aureus the zone of inhibition measured 15 mm.

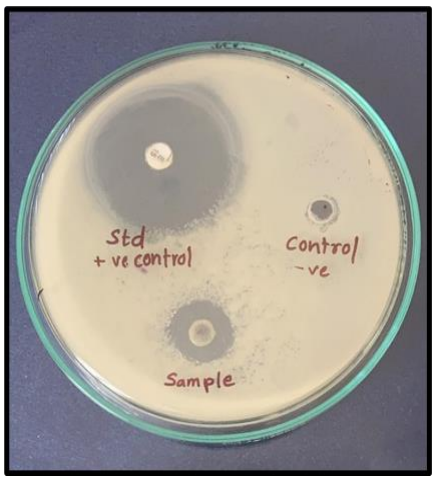

Figure no. 3: Formulated gel showing zone of inhibition against Staphylococcus aureus

Table 5: Antimicrobial activity against Staphylococcus aureus

Sr.no.	Sample name	Pharmaceutical preparation (Anti acne gel)	Standard drug (Clindamycin)
1	Zone of Inhibition	15 mm	27 mm

Zone of inhibition for the antibacterial activity of anti-acne gel were compared with the standard clindamycin, formulation 4 has shown comparable zone of inhibition to that standard drug i.e. clindamycin. The formulation having antibacterial agents inhibiting the Staphylococcus aureus, may also reduce the development of inflammatory acne.

CONCLUSION:

The formulation and evaluation of moringa oleifera and Withania somnifera anti acne gel have been successfully developed, underscoring the potential of these traditional medicinal plants in modern drug delivery systems. Herbal formulations have growing demand in the world market. It is an attempt made to establish the herbal gel containing Moringa oleifera leaves extract and Withania somnifera root powder extract. (6% and 6% respectively). The studies revealed that the developed F4 batch is the optimized batch, since its homogeneity is very good, there is no grittiness. The F4 batch has viscosity 4470cp, spread ability is 16.66 gm.cm /sec. Zone of inhibition for the antibacterial activity of anti-acne gel were compared with the standard clindamycin, formulation 4 has shown comparable zone of inhibition to that of standard drug i.e. clindamycin. The formulation having antibacterial agents inhibiting the Staphylococcus aureus, may also reduce the development of inflammatory acne. As a result, it can be concluded that the formulated gel containing Moringa oleifera and Withania somnifera is appropriate and efficient for treating acne.

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