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Research Article

Formulation And Evaluation of Acne Gel Using Ephedra Extract

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ABSTRACT

Ephedra Herba (Ephedra), known as “MaHuang” in China, is the dried straw stem. At present, more than 60 species of Ephedra plants have been identified, which contain more than 100 compounds, including alkaloids, flavonoids, tannins, sugars, and organic phenolic acids. This herb has long been used to treat, skin disease, and other diseases, and has shown unique efficacy in the treatment of COVID-19 infection. Because alkaloids are the main components causing toxicity, the safety of Ephedra must be considered. However, the nonalkaloid components of Ephedra can be effectively used to replace ephedrine extracts to treat some diseases, and reasonable use can ensure the safety of Ephedra. We reviewed the phytochemistry, pharmacology, clinical application, and alkaloid toxicity of Ephedra, and describe prospects for its future development to facilitate the development of Ephedra.

INTRODUCTION

Ephedra Herba (Ephedra), known as “MaHuang” in China, is the dried straw stem. At present, more than 60 species of Ephedra plants have been identified, which contain more than 100 compounds, including alkaloids, flavonoids, tannins, sugars, and organic phenolic acids. This herb has long been used to treat, skin disease, and other diseases, and has shown unique efficacy in the Treatment of COVID-19 infection. Because alkaloids are the main components causing toxicity, the safety of Ephedra must be considered.

However, the nonalkaloid components of Ephedra can be effectively used to replace ephedrine extracts to treat some diseases, and reasonable use can ensure the safety of Ephedra. We reviewed the phytochemistry, pharmacology, clinical application, and alkaloid toxicity of Ephedra, and describe prospects for its future development to facilitate the development of Ephedra. Ephedra in China, grows mostly in dry desert environments and has been used in traditional Chinese medicine for more than 5000 years. In the 2020 edition of the Pharmacopoeia of the People's Republic of China, Ephedra include the dried straw stems of

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Ephedra sinica Stapf, *Ephedra intermedia* Schrenk et C. A. Mey., or *Ephedra equisetina* B. The whole plant is acrid, slightly bitter, warm in nature, and associated with the lung and bladder meridians. It is often used in the clinical treatment of asthma, increasing blood pressure, and analgesia. Moreover, *Ephedra* can also be used to treat COVID-19 infections to improve the symptoms. Many beneficial components in *Ephedra*, including alkaloids, flavonoids, polysaccharides, and so on, have unique pharmacological effects. The development and use of *Ephedra*-containing antiseptic gels should be approached with caution. It's essential to consult with healthcare professionals and adhere to regulatory guidelines before considering such products for therapeutic use. While *Ephedra* has been traditionally used in herbal medicine, its role as an antiseptic is not well-documented in modern scientific literature. However, some studies suggest that *Ephedra* extracts may have mild antimicrobial properties, which could theoretically contribute to antiseptic effects.

Important considerations:

Carefully select the appropriate concentration of *ephedra* extract based on its potential skin irritation and desired antimicrobial activity.

Skin sensitivity testing:

Perform patch tests on a small area of skin before full application to monitor for any allergic reactions. One of the oldest medicinal herbs known to mankind Probably *Ephedra*, or *ma huang* as it is known in traditional Chinese Medicine (TCM). A member of Family *Ephedraceae*, *Ephedra sinica* is the primary species That has been used in China for more than 5000 year And is still being used in *Ephedra* preparations and Extracts all around the world (Chen and Schmidt, 1926;

2. LITERATURE REVIEW

1. Songyuan tang (2023)

Ephedra Herba (*Ephedra*), known as “MaHuang” in China, is the dried straw stem that is associated with the lung and urinary bladder meridians. At present, more than 60 species of *Ephedra* plants have been identified, which contain more than 100 compounds, including alkaloids, flavonoids, tannins, sugars, and organic phenolic acids. This herb has long been used to treat asthma, liver disease, skin disease, and other diseases, and has shown unique efficacy in the treatment of COVID-19 infection. Because alkaloids are the main components causing toxicity, the safety of *Ephedra* must be considered. However, the nonalkaloid components of *Ephedra* can be effectively used to replace ephedrine extracts to treat some diseases, and reasonable use can ensure the safety of *Ephedra*.

2. Julia afrakoma ansong (2023)

Acne vulgaris is an inflammatory skin condition that affects virtually everyone at some point. Papules, comedones, pustules, scarring, and nodules are standard features of the disease and can have a detrimental social and psychological impact on an individual. Although allopathic acne treatments are available, they have adverse side effects, are expensive, and are prone to cause antibiotic resistance. The present study is aimed at formulating and evaluating topical gels containing *Aloe vera*, *Allium cepa*, and *Eucalyptus globulus* extracts as potential antiacne drugs. Six formulations containing the herbal extracts were prepared using 1% Carbopol 940 as a gelling agent. The phytochemical composition of the plant extracts was determined. The extracts and gels’

3. Sri agung fitri kusuma (2018)



Acne is a skin disease with the highest prevalence among other skin disorders. Almost everyone has experienced acne prone skin, especially in an adolescent. Although it is considered not as a dangerous disease, but in fact, almost all acne sufferers feel disturbed appearance that often leads to lower levels of confidence and interfere with the daily activities. No wonder, if most patients who come to the skin care clinic are those who seek a solution to overcome the acne.

3. METHOD OF FORMULATION GEL

Step 1: Preparation of Gel Base

Table no.0.1 formulation of Carbopol

INGREDIENTS	G1	G2	G3
Carbopol 940	1%	1.5%	2%
Propylene glycol	5ml	5ml	5ml
Methyl paraben	0.15gm	0.15gm	0.15gm
Propyl paraben	0.30gm	0.30gm	0.30gm
Triethanolamine	5ml	5ml	5ml
Water	q. s	q. s	q. s

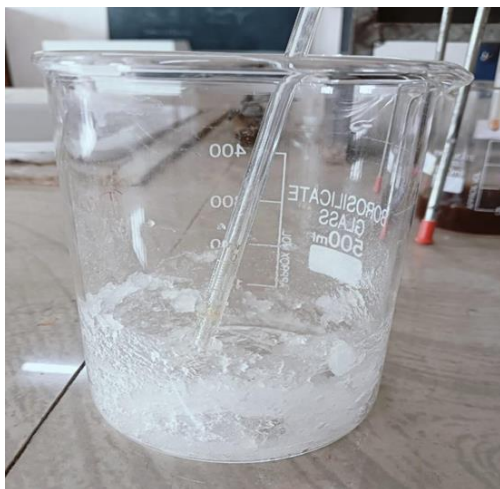


Fig no 5. Carbopol gel base

Step 2: Addition of Ephedra Extract

1. Weigh 3% Ephedra Extract and transfer it to the gel base mixture.

1. Weigh 1.5% Carbopol 940 and transfer it to a clean and dry mixing vessel.
2. Gradually add 50-60°C distilled water to the mixing vessel while stirring with a glass rod or a mechanical stirrer.
3. Continue stirring until the Carbopol 940 is fully dispersed and the mixture is uniform.
4. Add 5% Glycerine and 5% Propylene Glycol to the mixture and stir well.
5. Continue stirring until the mixture is clear and free of lumps.

2. Mix the Ephedra Extract with the gel base using a glass rod or a mechanical stirrer.
3. Continue stirring until the Ephedra Extract is fully incorporated and is uniform.

Step 3: pH Adjustment

1. Add 1% Triethanolamine (TEA) to the mixture and stir well.
2. Continue stirring until the pH of the mixture is adjusted to 5.5 ± 0.5 .
3. Use a pH meter to verify the pH of the mixture.

Step 4: Preservation

1. Add preservatives (Parabens/Phenoxyethanol) to the mixture and stir well.

2. Continue stirring until the preservatives are fully incorporated.

Step 5: Filling and Packaging

1. Fill the gel mixture into clean and dry tubes or jars.
2. Seal the tubes or jars tightly and label them properly.
3. Store the tubes or jars in a cool, dry place away from direct sunlight.

Step 6: Quality Control

1. Check the pH of the gel using a pH meter.
2. Evaluate the viscosity of the gel using a viscometer.
3. Check the texture and appearance of the gel.
4. Perform microbial testing to ensure the gel is free of contamination

4. RESULT AND DISCUSSION

Active pharmaceutical ingredient in API charectrisation

Appearance -greenish-brown semi solid gel

Colour -pale green

Odour -herbal charectrisation

Table no:06 physical Parameters of gel

Parameters	Observations
Ph (at25c)	6.2
Viscosity	1800,500cps
Spreadability	Uniform
Extrudability	Good
Drug content	97.8%

Phytochemical investigation of The Ephedra extract

The phytochemical investigation of Ephedra extract involves the systematic extraction, identification, and analysis of bioactive compounds present in the plant. The process begins with the collection of Ephedra plant material, which is typically cleaned, shade-dried, and ground into a fine powder. This powdered material is then subjected to solvent extraction using solvents such as methanol, ethanol, or water to obtain crude extracts. Preliminary phytochemical screening of the extract reveals the presence of various secondary metabolites including alkaloids, flavonoids, tannins, saponins, and glycosides

Table no .7 phytochemical constituents of ephedra

Constituents	Test	End point	Result
Alkaloids	Dragendorff reagent	Orange-red precipitate	++
Flavonoids	Ferric chloride	Green color	++
Tannins	Gelatin test	White precipitate	++
Proteins	Ninhydrin	Blue precipitate	++
Amino acids	Ninhydrin	Purple color	++
Phenols	Ferric chloride	Deep blue	++
Carbohydrates	Keller-kiliani test	Reddish brown	++
Organic acids	Phosphoric acid test	Light yellow Precipitate	++

++indicates presence of active constituents



Optimization of gelling gel

The gel base typically includes ingredients like Carbopol 940 as a gelling agent, glycerin as a humectant, triethanolamine for pH adjustment, and preservatives like methylparaben and propylparaben to ensure microbial stability. The Ephedra extract is incorporated into the gel base under continuous stirring to achieve uniform distribution. The formulation is optimized for pH (ideally between 5.5 and 6.5), viscosity, spreadability, and stability. Additionally, essential oils such as tea tree or lavender may be added to enhance the therapeutic efficacy and improve the aesthetic appeal of the product. The final gel is evaluated for physical parameters, microbial load, skin irritation potential, and in vitro antibacterial activity.



Fig no.6 formulation of gel

Evaluation of anti -acne gel using ephedra extract

Physical appearance

This formulated gel was checked visually for color ,appearance,and homogeneity and results wear listed table no .9

Table no.9 physical appearance of formulated gel

	F1 (1%ethanolic extract of ephedra)	F2 (1.5%ethanolic extract of ephedra)	F3 (2%ethanolic extract of ephedra)
Physical appearance	Transparent yellowish	Transparent yellowish	Slightly turbid yellow
Color	Pale yellow	Pale yellow	Bright yellow
Homogeneity	Absence of aggregates	Absence of aggregates	Slight aggregates

Measurement of pH

The ph of prepared formulation of ranged 5.7-5.9. the ph of the prepared gel formulation was considered to be acceptable to avoid the risk of irritation upon application to the skin. The result wear shown. In table no .1

Table no .1measurement of pH

FORMULATION CODE	pH
F1	5.9
F2	5.7
F3	5.8

Determination of viscosity

Viscosity is a critical rheological property that defines a gel's resistance to flow and its internal friction. It directly influences the consistency, spreadability, and drug release profile of the topical formulation. In this study, the viscosity of

the polyherbal gel containing different concentrations of Ephedra extract was measured using a Brookfield viscometer (spindle no. 62) at room temperature. The measurement was conducted at a constant speed, and the results were recorded in centipoise (cps). A higher viscosity indicates better gel stability and controlled drug diffusion. The viscosity values obtained for the formulations are presented in table no ,11

Table no. 2 measurement of viscosity

FORMULATION CODE	VISCOSITY [CPS]
F1	1425+0.10
F2	1450+0.75
F3	1458+0.25

Spreadability

Spreadability denotes the extent of area to which the gel readily spreads on application to skin or the affected part. The spreading was expressed in terms of time in seconds taken by two slides to slip off from the gel, placed in between the slides, under certain load. Lesser the time taken for separation of the two slides, better the spreadability. Two sets of glass slides of standard dimensions were taken. The gel formulation was placed over one of the slides. Spreadability of different gel formulations were studied. The formulation [e.g., E2] produced good spreadability than the other formulations. The results were shown table no.15

Table no. 12 Measurement of Spreadability

FORMULATION OF CODE	SPREADABILITY (gm.cm/sec)
E1	20.45
E2	23.12
E3	21.78

Antimicrobial activity testing of cup plate Method

The antimicrobial activity of Ephedra extract was evaluated using the cup plate method. Nutrient

agar (for bacteria) and Sabouraud dextrose agar (for fungi) were prepared and poured into sterile Petri dishes. After solidification, microbial cultures were evenly spread over the surface using sterile swabs. Wells (cups) of uniform diameter were then made in the agar using a sterile borer, and each well was filled with a measured volume of the Ephedra extract. Standard antibiotics served as positive controls, while solvents used for extraction acted as negative controls. The plates were incubated at 37°C for 24 hours for bacterial strains and at 28°C for 48–72 hours for fungal strains. The zones of inhibition around the wells were measured in millimeters, indicating the antimicrobial efficacy of the extract. The result. demonstrated the potential antimicrobial properties of the Ephedra extract, with variation in effectiveness depending on the microorganism tested.

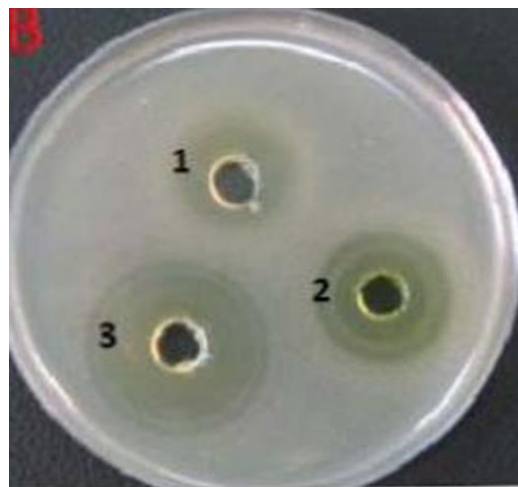


Fig no.6 zone of inhibition of ephedra extract gel

5. DISCUSSION CONCLUSION

The formulation and evaluation of an acne gel using Ephedra extract focused on developing a topical herbal treatment with anti-acne and antimicrobial properties. Ephedra, known for its bioactive compounds such as ephedrine and flavonoids, was extracted and incorporated into a gel base using suitable gelling agents. The

formulated gel was evaluated for its physical properties, including pH, viscosity, spreadability, and stability. Additionally, antimicrobial activity was tested against acne-causing bacteria like *Propionibacterium acnes*. Results indicated that the Ephedra-based gel had desirable consistency, acceptable pH for skin application, and demonstrated significant antibacterial activity, suggesting its potential as an effective and natural alternative for acne treatment. The Ephedra extract was obtained through suitable extraction methods and incorporated into a carbopol-based gel formulation. Various concentrations of the extract were used to determine the optimal therapeutic effect. The prepared gel was subjected to a series of physicochemical evaluations including pH, viscosity, spreadability, homogeneity, and stability over time. Microbiological tests were conducted to assess its antibacterial activity against acne-causing microorganisms such as *Propionibacterium acnes* and *Staphylococcus aureus*. The results demonstrated that the gel had good physical characteristics suitable for topical application, remained stable under different storage conditions, and exhibited significant antimicrobial activity. These findings support the use of Ephedra extract in topical gel formulations as a promising natural remedy for the treatment and prevention of acne vulgaris, offering a safer alternative to synthetic drugs with fewer side effects.

CONCLUSION

The formulation of an anti-acne gel using Ephedra extract proved to be effective, stable, and suitable for topical application. The gel demonstrated good physicochemical properties, including appropriate pH, viscosity, and spreadability, ensuring user acceptability and ease of use. Furthermore, the antimicrobial studies confirmed that the Ephedra extract possesses significant antibacterial activity against acne-causing bacteria, particularly

Propionibacterium acnes and *Staphylococcus aureus*. These results indicate that Ephedra-based gel can serve as a promising natural alternative for acne treatment, offering therapeutic benefits with potentially fewer side effects compared to conventional synthetic formulations. Further clinical studies are recommended to confirm its efficacy and safety in long-term use. The development and evaluation of an acne gel using Ephedra extract have demonstrated the plant's potential as an effective herbal ingredient in topical acne treatment. The formulated gel showed desirable physicochemical properties such as optimal pH, good viscosity, uniformity, and excellent spreadability, making it suitable for regular skin application. Microbial studies confirmed the presence of strong antibacterial activity, particularly against *Propionibacterium acnes* and *Staphylococcus aureus*, which are key contributors to acne pathogenesis. The stability studies also revealed that the formulation remained physically and chemically stable over the testing period, suggesting good shelf-life potential. Overall, the results validate the therapeutic potential of Ephedra extract in acne management due to its natural bioactive compounds with anti-inflammatory and antimicrobial effects. Compared to conventional chemical-based acne treatments, the herbal formulation offers a safer and more skin-friendly alternative, minimizing the risk of irritation or adverse effects. However, to fully establish its clinical efficacy and safety profile, further in vivo studies and clinical trials are recommended. study paves the way for the use of Ephedra in herbal skincare and supports its integration.

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