Formulation And Evaluation of Jasminum Sambac Emulgel for Skin Applications.

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Abstract—**Herbal medicines have gained significant attention in dermatological preparations because of their safety, effectiveness, and minimal adverse effects. Jasminum sambac (Mogra), a medicinal plant belonging to the Oleaceae family, possesses several pharmacologically active constituents such as flavonoids, alkaloids, tannins, terpenoids, and essential oils that exhibit antimicrobial, anti-inflammatory, antioxidant, and wound-healing activities. The present study was aimed at formulating and evaluating an herbal emulgel containing Jasminum sambac leaf extract for topical skin application. Ethanolic extracts of the plant were incorporated into an emulgel base prepared using suitable gelling and emulsifying agents. The antimicrobial activity of the extract was evaluated against common pathogenic microorganisms including Staphylococcus aureus, Bacillus cereus, Escherichia coli, Pseudomonas aeruginosa, and Candida albicans using the agar disc diffusion method. The prepared emulgel was further assessed for physicochemical characteristics such as appearance, pH, homogeneity, spread ability, washability, consistency, and stability. The developed formulation demonstrated satisfactory physical properties with good stability and skin compatibility. The presence of herbal constituents contributed to enhanced antimicrobial and soothing effects, indicating that the formulated emulgel may serve as a promising natural alternative for the treatment and management of skin infections and acne-related conditions.**

Index Terms— **Jasminum sambac, phytochemical-loaded emulgel, anti-microbial, antibacterial, topical delivery, skin infection.**

I. INTRODUCTION

Skin disorders such as acne, rashes, fungal infections, and inflammation are among the most common health problems affecting individuals worldwide. Topical therapy remains one of the preferred approaches for the treatment of such conditions because it allows direct application of therapeutic agents at the affected site while minimizing systemic side effects. In recent years, herbal formulations have gained increasing popularity due to their natural origin, improved safety profile, and therapeutic effectiveness.

India has a rich heritage of traditional medicinal plants that are widely used for treating various skin ailments. Among them, Jasminum sambac L., commonly known as Arabian jasmine or Mogra, is recognized for its medicinal and aromatic properties. The leaves and flowers of the plant contain several important bioactive compounds including alkaloids, flavonoids, tannins, phenolic compounds, glycosides, and volatile oils. These constituents contribute to various pharmacological activities such as antimicrobial, anti-inflammatory, antioxidant, antibacterial, and wound-healing effects.

Microbial skin infections are commonly caused by bacteria and fungi such as Staphylococcus aureus, Escherichia coli, and Candida albicans. Continuous use of synthetic antibiotics may lead to resistance and adverse reactions. Therefore, there is growing interest in developing herbal alternatives that are safer and effective. Herbal topical formulations provide prolonged contact time with the skin and can improve therapeutic outcomes.

An emulgel is a modern topical drug delivery system that combines the advantages of emulsions and gels. It possesses good spread ability, ease of application, non-greasy nature, improved stability, and controlled drug release properties. Incorporation of herbal extracts into an emulgel base can improve patient compliance and therapeutic efficiency.The present research focuses on the formulation and evaluation of a Jasminum sambac-loaded emulgel intended for topical application. The study aims to assess its physicochemical characteristics and antimicrobial effectiveness for potential use in skin care and management of microbial skin infections.

II. THE THERAPEUTIC POTENTIAL OF JASMINUM SAMBAC L.

Bioactive Compounds: Leaves of Jasminum sambac contain important phytochemicals such as alkaloids, flavonoids, terpenoids, essential oils, phenolics, and tannins. These bioactive compounds contribute to its strong antimicrobial properties. They help to inhibit the growth of harmful microorganisms responsible for skin infections. Due to these effects, Jasminum sambac leaves are useful in treating conditions like acne and maintaining healthy skin.
Mechanism of Action: jasminum sambac exhibits antimicrobial action by disrupting bacterial cell membranes, increasing permeability and causing leakage of intracellular components, leading to cell death. It also inhibits key microbial enzymes and reduces inflammation, thereby controlling acne-causing bacteria and supporting skin healing.

Plant Profile – Jasminum Sambac L.

- Plant Name: Arabian Jasmine
- Scientific Name: Jasminum Sambac L.
- Image:

Fig. No. 1

- Taxonomical classification:
- ✓ Kingdom: Plantae
- ✓ Division: Magnoliophyte
- ✓ Class: Magnoliopsida
- ✓ Order: Lamiales
- ✓ Family: Oleaceae
- ✓ Genus: Jasminum
- ✓ Species: Jasminum sambac
- ✓ Biological source: Jasminum sambac consists of the fresh or dried leaves and flowers of Jasminum sambac (L.) Aiton, belonging to the family Oleaceae.
- ✓ Family: Oleaceae

- Chemical constituents:
- ✓ Alkaloids: Indole
- ✓ Flavonoids: Quercetin, Kaempferol, Rutin
- ✓ Terpenoids & Essential Oils: Linalool, Benzyl acetate, Methyl jasmonate
- ✓ Tannins: Caffeic acid, Ferulic acid, Tannic acid

- Uses: antimicrobial, anti-inflammatory, antioxidant, wound-healing, and aromatic properties in skincare.
- Category: Antimicrobial

Therapeutic Application:

1. Antimicrobial activity: Inhibits the growth of various microorganisms (bacteria and fungi) due to essential oils like linalool.
2. Reduces acne: Helps control acne by reducing excess oil, inflammation, and microbial infection on the skin.
3. Antibacterial activity: Effective against common skin bacteria (e.g., acne-causing bacteria), promoting cleaner and healthier skin.
4. Dermatological benefits: Soothes skin irritation, improves skin texture, and provides antioxidant protection, making it useful in general skin care.

Aim And Objectives

Aim- To Formulate and Evaluate Jasminum sambac Emulgel for Skin Applications. Derived from Jasminum sambac leaf extract for the effective management of skin infection.

Objectives-

- Successful Formulation of Emulgel

- Stable phytochemical-loaded emulgel prepared.

- Physicochemical Evaluation

- Non-greasy and non-irritant formulation

- Antifungal Activity

- Effective disruption of fungal cell membrane and reduce fungal infection.

- Anti-microbial Activity

- Disruption of bacterial cell membrane and inhibits bacterial growth.

- Stability in Formulation

- Maintained stability at room temperature (25 ± 2 °C)

III. METHOD & MATERIAL

Material:

Ingredients	Quantity for 30 gm	Role
Jasminum sambac leaf extract	3 g	Active ingredient
Xanthum Gum	10 g	Gelling agent
Gum Acacia	2 g	Emulsifier/Thickener
Glycerin	2 g	Humectant
Propylene glycol	1 g	Penetration Enhancer
Liquid paraffin	4 g	Oil phase
Citric acid	0.5 g	pH adjuster
Distilled Water	q.s	Vehicle
Methyl paraben	0.045 g	Preservative

Method: The emulgel formulation was prepared using a stepwise method involving the preparation of separate aqueous and oil phases followed by their emulsification. Initially, methyl paraben was dissolved in a small quantity of warm distilled water to ensure complete solubility. Glycerin and gum acacia were then added with continuous stirring to obtain a smooth and uniform mucilage, forming the aqueous phase. Separately, coconut oil was slightly warmed to a temperature of approximately 40–50°C to prepare the oil phase. The warmed oil phase was gradually added into the aqueous phase under constant stirring to form a stable emulsion. Subsequently, aloe vera gel was incorporated slowly into the prepared emulsion with gentle mixing to achieve the desired gel-like consistency. After obtaining a uniform base, Jasminum sambac leaf extract and neem extract were added as active herbal ingredients and mixed thoroughly to ensure even distribution throughout the formulation. The pH of the emulgel was adjusted to an appropriate skin-compatible range of 5.5–6.5 by adding citric acid solution dropwise. Finally, the volume was adjusted with distilled water, mixed uniformly to obtain a homogeneous emulgel, and transferred into airtight containers for storage in a cool and dry place.

Collection and Authentication

During the study period, mature, fresh Jasminum Sambac L. leaves were gathered from Samarth Institute of Pharmacy's medicinal garden. A certified botanist from New Arts and Commerce College of Paraner verified the authenticity of the gathered plant material. The leaves were washed, shade-dried, and utilized for additional experimental research following authentication.

Fig. No. 2 Collected leaves

Drying and Pulverization: To get rid of any dust and other surface contaminants, the gathered leaves were first thoroughly rinsed under running water and then cleaned with distilled water. Following washing, the leaves were spread out in a spotless, well-ventilated space and allowed to dry for ten to twelve days at room temperature (25 ± 2°C) in the shade until they were crisp and had less than 10% moisture. A mechanical grinder was used to roughly crush the dried leaves, and the resulting powder was then run through sieve No. 40 (425 µm) to achieve a consistent particle size. Ultimately, the powdered substance was kept at room temperature in an airtight container until it was needed for extraction and more research.

Fig no. 3 Dried leaves

Fig no .4 powdered drug

Procedure for Extraction

A 500 mL conical flask was filled with precisely weighed 10 grams of dried Annona squamosa leaf powder. An enough amount of ethanol was poured to fully submerge the powder. To help extract the phytoconstituents, the mixture was shaken every hour for 24 hours at room temperature. The mixture was filtered via filter paper and placed in a sanitized container after a full day. The filtrate (ethanolic extract) was gathered and kept for further use while the leftover marc was thrown away.

Fig no. 5 filtration

Fig no. 6 filtered extract

Initial Phytochemical Evaluation

To determine the main classes of secondary metabolites included in the ethanolic extract of Jasminum Sambac L. leaves prepared by the maceration process, a preliminary phytochemical screening was conducted. Alkaloids, phenolic substances, flavonoids, tannins, glycosides, and triterpenoids were all subjected to standard qualitative testing. The findings verified the existence of each of these phytoconstituents, with relatively greater concentrations of phenolic compounds, flavonoids, and tannins. These constituents are well known for their antioxidant, anti-inflammatory, antimicrobial, and wound-healing activities, which support the therapeutic value of the extract in herbal hydrogel formulations. Previous research on Jasminum Sambac L. leaves has revealed similar phytochemical profiles, suggesting that the plant is a significant source of physiologically active substances.

Sr. No.	Phytochemical Constituent	Test Performed	Result
1	Phenolic compounds	Ferric chloride ($FeCl_3$) test	Positive (+)
2	Flavonoids	Shinoda test	Positive (+)
3	Tannins	Ferric chloride test	Positive (+)
4	Saponins	Foam test	Positive (+)
5	Alkaloids	Mayer's test	Positive (+)
6	Terpenoids	Salkowski test	Positive (+)
7	Glycosides	Keller–Killiani test	Positive (+)
8	Steroids	Liebermann–Burchard test	Positive (+)
9	Organic acids	Sodium bicarbonate ($NaHCO_3$) test	Positive (+)
10	Proteins and amino acids	Ninhydrin test	Negative (−)
11	Coumarins	NaOH fluorescence test	Positive (+)

Rationale for Polymer and Excipient Selection

For the preparation of the Jasminum sambac leaf extract emulgel, suitable polymers and excipients were selected to obtain a stable, safe, and effective topical formulation with desirable physicochemical and therapeutic properties. Hydroxypropyl methylcellulose (HPMC K4M) was selected as the primary gelling polymer because of its excellent viscosity-enhancing, film-forming, and bioadhesive characteristics. Being a non-ionic cellulose derivative, HPMC K4M shows minimal interaction with the bioactive phytoconstituents present in Jasminum sambac leaf extract, thereby helping to maintain the stability and efficacy of the herbal actives. In addition, the polymer possesses good compatibility with a wide pH range and exhibits favorable skin tolerability, making it appropriate for topical drug delivery systems. Xanthan gum was incorporated as a secondary polymer and viscosity modifier to improve the rheological behavior of the emulgel.

The combination of xanthan gum with HPMC K4M contributes to the formation of a stable and uniform gel network. This polymer blend provides pseudoplastic or shear-thinning behavior, allowing the formulation to spread smoothly on the skin during application while retaining adequate viscosity during storage. Furthermore, xanthan gum enhances formulation stability and helps prevent phase separation in the emulsion-based gel system.Aloe vera gel was included because of its moisturizing, soothing, and skin-protective properties. It also possesses mild anti-inflammatory and wound-healing activities that may complement the therapeutic potential of Jasminum sambac leaf extract. Additionally, aloe vera can improve skin hydration and may facilitate better penetration of phytoconstituents through the skin surface, thereby supporting enhanced topical activity.

Citric acid was used to adjust and maintain the pH of the emulgel within the normal skin-compatible range. Maintaining an appropriate pH is important to minimize skin irritation and to ensure the stability of both the polymeric system and herbal constituents. A mildly acidic to neutral pH also improves patient acceptability for long-term topical application. Methyl paraben was employed as a preservative to protect the formulation from microbial contamination during storage and repeated use. Due to its broad-spectrum antimicrobial effectiveness and compatibility with hydrogel and emulgel systems, methyl paraben is widely used in topical pharmaceutical and cosmetic formulations. Its incorporation helps in prolonging the shelf life and maintaining the microbiological stability of the product.

Formulation Composition:

BATCH	F1	F2 (Increased viscosity)	F3 (Increased stability)
Jasminum sambac leaf extract	3 g	3g	3 g
Xanthan gum	10 g	12 g	9 g
Gum Acacia	2 g	2g	3 g
Glycerin	2 g	2g	2 g
Propylene glycol	1 g	1 g	1 g
Coconut oil	4 g	4 g	4 g
Citric acid	0.5 g	0.5 g	0.5 g
Distilled Water	q.s	q.s	q.s
Methyl paraben	0.045 g	0.045 g	0.045 g

Formulation Procedure of Phytochemical-Loaded Emulgel

Step 1: Preparation and Hydration of Polymer Gel Base (q.s. to 30 g)

The primary hydrophilic polymer, Hydroxypropyl Methylcellulose (HPMC K4M), was accurately weighed and dispersed gradually in a measured quantity of distilled water under continuous stirring to avoid lump formation. The dispersion was kept undisturbed for 24 hours to allow complete hydration and swelling of the polymeric chains, resulting in the formation of a clear and stable gel matrix.

After complete hydration of HPMC K4M, xanthan gum was slowly incorporated into the swollen polymer base with continuous mechanical stirring. The mixing process was maintained at a controlled speed to obtain a smooth, uniform, and lump-free gel structure with improved viscosity and consistency suitable for topical application.

Step 2: Preparation of Bioactive Phase and Final Formulation

In a separate beaker, the ethanolic leaf extract of Jasminum sambac, aloe vera gel, glycerin, and methyl paraben was mixed thoroughly until a uniform bioactive mixture was obtained. Glycerin was included to improve moisturization and enhance the spreadability of the emulgel, while methyl paraben served as a preservative to maintain microbiological stability.The prepared bioactive phase was then added

gradually to the hydrated polymer gel base under continuous stirring to ensure uniform distribution of the phytoconstituents throughout the formulation. The pH of the formulation was adjusted to a skin-compatible range using citric acid solution. Finally, the total weight of the formulation was adjusted with distilled water, and stirring was continued until a smooth, homogeneous, and stable emulgel was formed.

Evaluation of Emulgel

A Type-I topical emulgel system was selected for the Jasminum sambac formulation because of its suitability for localized skin application and enhanced patient acceptability. The emulgel combines the advantages of both emulsions and gels, providing improved drug penetration, non-greasy texture, ease of application, and good skin retention. The prepared formulation exhibited desirable physicochemical characteristics such as suitable viscosity, smooth consistency, adequate spreadability, and skin-compatible pH, making it appropriate for topical therapeutic use.

1. Organoleptic Evaluation

- Color: The prepared emulgel showed a pale creamy white to light greenish appearance, attributed to the natural constituents present in the Jasminum sambac extract.
- Odor: The formulation possessed a mild and pleasant floral aroma characteristic of Jasminum sambac, without the presence of any irritating or unpleasant smell.
- Texture: On gentle rubbing between the fingers, the emulgel demonstrated a smooth, soft, and uniform consistency free from coarse particles or lump formation.

2. Physicochemical Evaluation

a. Determination of pH

The pH of the prepared emulgel was measured using a calibrated digital pH meter to ensure compatibility with normal skin pH and minimize the possibility of irritation. For the analysis, 1 g of emulgel was dispersed in 20 mL of distilled water and allowed to stand for approximately 2 hours at room temperature to achieve equilibrium. The electrode of the pH meter was then immersed into the dispersion, and the reading was recorded. All measurements were performed three times, and the average value with standard deviation was calculated for accuracy.

b. Spreadability

The spreadability of the emulgel was determined using the glass-slide technique to evaluate ease of application on the skin surface. Approximately 2 g of the formulation was placed between two clean glass slides to form a thin layer while avoiding air entrapment. An 80 g weight was applied over the upper slide, and the time required for the slide to move a fixed distance of 7.5 cm was recorded. Better spreadability was indicated by a shorter separation time. The spreadability coefficient was calculated using the applied weight, distance moved, and time taken for movement of the upper slide.

c. Viscosity Determination

The rheological behavior of the prepared emulgel was assessed using a Brookfield digital viscometer. The measurement was performed at room temperature (25°C) using Spindle No. 7 operated at 50 rpm. The spindle was carefully immersed into the sample without touching the container walls or base. After stabilization of the reading, the viscosity value was noted and expressed in centipoise (cP) using the appropriate conversion factor provided by the instrument manual.

d. Washability

Washability testing was conducted to determine the ease of removal of the emulgel from the skin after application. A small quantity of the formulation was applied uniformly over the skin surface and left for a few minutes. The treated area was then rinsed gently with lukewarm water. The emulgel was removed easily without leaving behind oily residue or stickiness, indicating good washability and patient convenience.

e. Evaluation of Drying Time

The drying time of the emulgel was evaluated by spreading a thin film of the formulation over a clean glass slide and exposing it to air at room temperature. The time required for the film to become dry and non-tacky was recorded. The prepared emulgel formed a dry film within approximately 7–9 minutes.

f. Assessment of Homogeneity

The homogeneity of the Jasminum sambac emulgel was examined visually and by touch to confirm uniform distribution of the extract within the formulation. The prepared emulgel was placed in a transparent glass container and inspected under proper lighting for any signs of phase separation, aggregation, or color inconsistency. A small amount was also rubbed between the fingers to check for smoothness and absence of gritty particles. The formulation showed excellent uniformity with no evidence of lumps or coarse matter.

IV. RESULTS AND DISCUSSION

The developed Jasminum sambac emulgel was successfully formulated and showed desirable characteristics for topical skin application. The final preparation had a smooth, uniform, and appealing appearance without any visible lumps, grittiness, or phase separation, indicating proper mixing and stability of the formulation. The emulgel possessed a soft and non-greasy texture, making it easy to apply and spread evenly on the skin. Its good spreadability and consistency suggest improved patient acceptability and convenient topical use.

The pH of the formulation was maintained between 5.5 and 6.5, which is considered suitable for skin compatibility and helps reduce the risk of irritation. Aloe vera gel contributed moisturizing and soothing effects, while coconut oil provided emollient properties that may help maintain skin hydration. In addition, the incorporation of Jasminum sambac leaf extract and neem extract enhanced the therapeutic value of the formulation due to their well-known antimicrobial, antioxidant, and anti-inflammatory activities.

The prepared emulgel also exhibited satisfactory washability and extrudability, confirming its practical applicability. During the stability study, no noticeable changes were observed in color, odor, texture, or homogeneity under normal storage conditions. Overall, the herbal emulgel demonstrated good stability, aesthetic quality, and potential effectiveness as a natural formulation for skin care and topical application.

V. CONCLUSION

The study successfully developed a herbal emulgel containing Jasminum sambac leaf extract intended for topical skin application. The prepared formulation showed desirable qualities such as smooth texture, uniform consistency, good spreadability, and a skin-friendly pH, which indicate its suitability for easy and comfortable application on the skin. The emulgel remained physically stable throughout the study period, with no noticeable changes in appearance, odor, or consistency.

The use of natural ingredients such as aloe vera gel, coconut oil, neem extract, and Jasminum sambac extract added beneficial properties to the formulation, including moisturizing, soothing, antimicrobial, and anti-inflammatory effects. These herbal components may support skin protection and improve overall skin health. In addition, the non-greasy nature and good washability of the emulgel can enhance user acceptability and convenience during use.

Overall, the developed herbal emulgel can be considered a promising and effective natural formulation for skincare applications. The study highlights the potential of herbal-based topical preparations as safer alternatives to synthetic products. Further experimental and clinical investigations may help to confirm its therapeutic effectiveness and long-term safety for regular skin use.

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CONFLICT OF INTEREST

The authors declare that there is no conflict of interest regarding the publication of this research work titled "Formulation and Evaluation of Jasminum sambac Emulgel for Skin Applications." The study was conducted without any commercial, financial, or personal relationships that could be interpreted as influencing the research outcomes

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