

Herbal Based Gel Delivery System: A Promising Approach For Recurrent Aphthous Stomatitis Treatment

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ABSTRACT:

Recurrent Aphthous Stomatitis (RAS) is a common oral mucosal disorder characterized by recurrent, painful ulcers that interfere with eating, speaking, and overall quality of life. The condition has a multifactorial etiology involving immune dysregulation, oxidative stress, nutritional deficiencies, local trauma, psychological stress, and genetic predisposition, making its management challenging. Conventional therapies primarily offer symptomatic relief and are often associated with frequent recurrence and adverse effects upon prolonged use. In recent years, herbal-based gel delivery systems, particularly mucoadhesive formulations, have gained attention as safer and effective alternatives for RAS management due to their ability to provide localized and sustained drug delivery. Herbal gels formulated with Ashwagandha (*Withaniasomnifera*), Tulsi (*Ocimum sanctum*), Betel leaves (*Piper betel*), Turmeric (*Curcuma longa*), and Honey exhibit significant anti-inflammatory, antimicrobial, antioxidant, analgesic, and wound-healing properties, supporting ulcer healing and symptom relief. This review discusses the pathophysiology of RAS, limitations of conventional treatment approaches, selection of medicinal plant ingredients, extraction techniques, formulation strategies, and evaluation parameters of herbal gels, highlighting their potential as cost-effective, patient-friendly, and promising therapeutic options that warrant further clinical validation.

KEY WORDS: Recurrent aphthous stomatitis, Herbal gel, Oral drug delivery, Medicinal plants, Mucoadhesive gel.

INTRODUCTION:

Recurrent aphthous stomatitis (RAS), commonly known as canker sores, is one of the most prevalent chronic oral mucosal disorders, affecting approximately 5-25% of the global population. It is characterised by recurrent, painful, round or oval ulcers occurring on non-keratinized oral mucosal surfaces such as the lips, cheeks, tongue, floor of the mouth, and soft palate. These lesions significantly interfere with daily activities including eating, speaking and oral hygiene, thereby reducing overall quality of life.

Symptoms of Recurrent Aphthous Stomatitis:

Painful, whiteness, burning, soreness, swelling, inflammation.

Etiology of RAS:

Genetic factors, Local trauma, Nutritional deficiency, Immune factors, Stress, Hormonal changes, Food allergy, Systemic diseases

Conventional management strategies for RAS primarily include topical anaesthetics, corticosteroids, antiseptic mouthwashes and antimicrobial agents. While these treatments offer symptomatic relief and temporary control of inflammation, they do not address the be associated with adverse effects such as mucosal irritation, altered oral flora, delayed healing and recurrence after treatment withdrawal. These limitations highlight the need for safer, more effective and patient- friendly therapeutic alternatives.

In recent years, increasing attention has been directed toward herbal- based therapies for oral ulcer management due to their wide availability, biocompatibility and reduced side-effect profile. Herbal gel delivery systems, provide localized drug delivery, prolonged mucosal contact and enhanced patient compliance. Medicinal plants such as Ashwagandha (*Withaniasomnifera*), Tulsi (*Ocimum sanctum*), Betel leaves (*piper betel*), Turmeric (*Curcuma longa*) and Honey have been extensively documented in the literature for their anti-inflammatory, antimicrobial, antioxidant, analgesic and wound-healing properties.

The present review aims to critically summarize analyze existing literature on the pathophysiology of recurrent aphthous stomatitis and the therapeutic potential of herbal-based gel delivery systems in its management. It Emphasis on the selection of herbal ingredients, their pharmacological properties, extraction methods, formulation strateiges and evaluation parameters, thereby highlights herbal gels as a promising alternative approach for effective and safe management of RAS.

Herbal Gels as Drug Delivery Systems

Herbal formulations are preferred in oral therapy due to their safety, cost-effectiveness, and fewer side effects compared to synthetic drugs. They exhibit multiple pharmacological actions, including anti-inflammatory, analgesic, antiseptic, and wound-healing effects, and also to help maintain oral hygiene by reducing plaque and soothing inflamed tissues without disturbing the normal oral microflora. When formulated as gels, these herbal agents become

highly suitable for treating oral lesions because gels are easy to apply, adhere well to the oral mucosa, and provide good retention at the site of action, enabling localized and sustained drug release and thereby improving therapeutic effectiveness.

Advantages of Gel Formulations:

- Easy application to affected area
- Prolonged retention at site of action
- Good adhesion to oral mucosa
- Sustained and controlled drug release
- Localized drug delivery with reduced systemic side effects
- Improved patient compliance

Mucoadhesive Property of Herbal Gels: Mucoadhesive herbal gels possess the ability to adhere to the oral mucosal surface, allowing prolonged contact time and sustained release of active herbal constituents. This enhances therapeutic efficacy, maintains drug concentration at the lesion site, and reduces the frequency of application, making mucoadhesive gels an ideal drug delivery system for oral lesions such as recurrent aphthous stomatitis.

• MATERIALS AND METHODS:

HerbalActives: The herbal ingredients selected for this formulation are known for their strong anti-inflammatory, antimicrobial, soothing and wound healing properties.

Sr. No	Ingredients	Type	Role In Formulation
1.	Ashwagandha	Herbal active	It acts as an adaptogen; reduce stress-related flare-ups, anti-inflammatory, promotes mucosal healing.
2.	Betel leaves	Herbal active	It provides strong antiseptic and wound healing action; reduce ulcer irritation & speeds recover.
3	Tulsi	Herbal active	It is strong antimicrobial & anti-inflammatory agent; helps reduce pain, swelling & prevents infection.
4.	Turmeric	Herbal active	It is rich in curcumin; provides anti-inflammatory, antioxidant & antimicrobial benefits; accelerates healing.
5.	Honey	Herbal active	It is natural humectant, antibacterial and soothing agent; forms a protective layer & reduce pain.

Table no. 1.1 Herbal Ingredients

Excipients: Along with herbal actives, suitable pharmaceutical excipients are incorporated to ensure proper gel consistency, spreadability, stability and patient acceptability.

Sr. No	Excipients	Type	Role In Formulation
1.	Carbopol 940	Gelling agent	It forms gel structure; provides viscosity, smooth texture & stability.
2.	Glycerin	Humectant	It prevents dryness, retains moisture, improves spreadability and softness.
3.	Propylene glycol	Penetration Enhancer	It enhances penetration of actives through oral mucosa; also acts as a humectant.
4.	Methyl paraben	Preservative	It prevents microbial growth & improves shelf- life.
5.	Propyl paraben	Preservative	It enhances preservation along with methyl paraben.
6.	Sodium hydroxide	Ph adjusting agent	It is used to neutralize the Carbopol gel & maintain ideal pH for oral mucosa.
7.	Purified water	Processing medium	It is used to dissolving ingredients & preparing the gel base

Table no. 1.2 Excipients

MORPHOLOGY

1. ASHWAGANDHA:

Common name: Indian Ginseng

Scientific name: Withania Somnifera

Genus: Withania.

Species: Somnifera

Family: Solanaceae



Source: Roots leaves are also used **Fig. 1 Ashwagandha**

Active constituents: withaferin A, withanolides A-Y, withanone

Pharmacological action: Anti-inflammatory effect

2. BETEL LEAVES:

Common name: Betel

Scientific name: Piper betel. L

Genus: Piper

Species: Betel

Family:Piperaceae

Source: Obtained from dried leaves of betel

Active constituents: chavicol, eugenol

Pharmacological action: Antimicrobial Properties, Antioxidant Properties, Antifungal Properties, Anti-inflammatory



Fig. 2 Betel Leaves

3. TULSI:

Common name: Holy basil

Scientific name: Ocimumtenuiflorum/Ocimum sanctum

Genus: Ocimum

Species: O. tenuiflorum

Family: Lamiaceae

Source: Obtained from dried leaves of Tulsi

Active constituents: eugenol, ursolicacid, rosmarinicacid)

Pharmacological action: Antioxidant, Anti-bacterial, Anti-inflammatory, Anti-diabetic

HOLY BASIL:-



Fig. 3 Tulsi

4. TURMERIC

Common name: Turmeric

Scientific name: Curcuma Longa

Genus: Curcuma

Species: Longa

Family: Zingiberaceae

Source: Obtained from dried roots of Curcuma longa

Active constituents: curcumin, demethoxycurcumin, bisdemethoxycurcumin



Fig. 4 Turmeric

Pharmacological action: Antioxidant, Anti-inflammatory, Blood thinning, Antimicrobial

5. HONEY

Common name: Madhu

Scientific name: Apis mellifera (honey bee), Apis indica

Genus: Apis

Family: Apidae

Source: Honey is a sugary substance deposited in



Fig. 5 Honey

honey comb by the hive

Active constituents: Gallic acid, Pinocembrin, Galangin, Isorhamnetin, Caffeic acid

Extraction Methods:

Aqueous Extraction Method:

Preparation: Fresh leaves or roots are washed thoroughly, shade-dried, and pulverized into a coarse powder.

Solvent Addition: A measured quantity of plant powder is mixed with distilled water in a fixed ratio.

Decoction: Heated on a water bath for 15–45 minutes

Maceration: Soaked at room temperature for 24–48 hours

Filtration: The extract is filtered through a muslin cloth followed by Whatman No. 1 filter paper.

• EVALUATION PARAMETERS

Sr. No	Evaluation Test	Result
1.	Color, odor, appearance	Smooth, uniform gel with natural herbal color and pleasant odor
2.	pH	pH between 5.5 to 7.0, suitable for oral mucosa
3.	Viscosity	Moderate viscosity (approx. 10000 to 30000cP) indicating good consistency
4.	Spreadability	Good spreadability
5.	Extrudability	Easily extrudable from tube with smooth flow

6.	Homogeneity	Uniform appearance without lumps
7.	Grittiness	No gritty or coarse particles detected
8.	Stability study	No significant change in pH, color, viscosity; stable at different storage condition
9.	Mucoadhesive strength	Good adhesion to mucosa for adequate retention time

Table no. 1.3 Evaluation parameters**RESULT:**

Analysis of published literature indicates that herbal-based gel delivery systems show promising potential in the management of Recurrent Aphthous Stomatitis (RAS). Reported studies highlight the therapeutic relevance of herbal agents such as *Withaniasomnifera*, *Ocimum sanctum*, *Piper betel*, *Curcuma longa*, and honey due to their anti-inflammatory, antimicrobial, antioxidant, analgesic, and wound-healing properties.

The reviewed literature consistently suggests that gel formulations enhance local drug retention on the oral mucosa, leading to improved symptom control, reduced inflammation, and faster ulcer healing. Overall, evidence supports the suitability of herbal gels as an effective topical approach for RAS management.

DISCUSSION:

Recurrent Aphthous Stomatitis is a multifactorial condition involving immune dysregulation, inflammation, oxidative stress, and microbial involvement. Conventional therapies primarily provide symptomatic relief and are often associated with adverse effects during long-term use. The reviewed literature highlights the growing interest in herbal-based gel systems as an alternative strategy to address these limitations.

The herbal ingredients discussed in this review exhibit complementary and synergistic mechanisms of action. *Ashwagandha* contributes immunomodulatory and anti-inflammatory effects, while *Tulsi* and *Betel* leaves provide antimicrobial and antioxidant activity that helps prevent secondary infections. *Turmeric* plays a key role in reducing inflammatory mediators and enhancing tissue repair, whereas *honey* supports wound healing by maintaining a moist environment and exerting antibacterial action.

The gel dosage form is repeatedly emphasized in the literature as a suitable vehicle for oral ulcer treatment due to its mucoadhesive nature, ease of application, and ability to deliver actives directly to the affected site. Importantly, herbal gels are reported to be better tolerated than synthetic formulations, making them particularly suitable for recurrent or chronic conditions such as RAS.

Despite promising evidence, the review also identifies gaps, including variability in extraction methods, lack of standardization, and limited large-scale clinical trials. Addressing these challenges is essential for translating literature findings into validated therapeutic products.

CONCLUSION:

This review highlights the potential role of herbal-based gel delivery systems in the management of Recurrent Aphthous Stomatitis. Existing literature supports the therapeutic benefits of herbal ingredients such as Ashwagandha, Tulsi, Betel leaves, Turmeric, and honey.

Herbal gels offer advantages including localized action, improved patient compliance, and a favourable safety profile. Although no experimental formulation was carried out in this review, the compiled evidence supports further research focused on formulation development, standardization, and clinical validation to establish herbal gels as effective treatments for RAS.

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