



Comprehensive Review on the Formulation and Evaluation of Herbal Antibacterial Mouthwash

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Abstract

Antibacterial herbal mouthwashes are emerging as effective, natural alternatives to traditional chemical-based oral care products. With growing concerns about the adverse effects of long-term use of synthetic mouthwashes, such as altered taste, mucosal irritation, and oral dysbiosis, herbal mouthwashes offer a promising solution for maintaining oral hygiene. These mouthwashes are formulated from plant extracts known for their antimicrobial, anti-inflammatory, and antioxidant properties, which help manage oral pathogens and support gum health. Common herbs used in antibacterial mouthwashes include mint oil, neem, chamomile, clove oil, each possessing unique antibacterial properties that target harmful microorganisms like *Streptococcus mutans*, *Porphyromonas gingivalis*, and *Fusobacterium nucleatum*. These bioactive compounds work through mechanisms such as disrupting bacterial cell membranes, inhibiting bacterial enzyme activity, and boosting immune responses. Clinical studies have demonstrated that herbal mouthwashes can effectively reduce plaque accumulation, decrease gingival inflammation, and improve oral health, often with fewer side effects than their chemical counterparts. Despite their potential, challenges remain in terms of formulation consistency, standardization, and evidence from large-scale clinical trials. Future research should focus on optimizing these formulations, conducting rigorous clinical evaluations, and ensuring regulatory standards to make herbal mouthwashes a reliable and widely used alternative in oral care.

Keywords: Antibacterial Herbal Mouthwash; Mint Oil, Neem; Chamomile; Clove; Oral Hygiene; Plaque Control; Gingivitis; Natural Oral Care; Antimicrobial Agents

Introduction

Oral hygiene is a cornerstone of general health, and maintaining a healthy oral environment helps prevent several diseases, including caries, gingivitis, periodontitis, and halitosis. Mouthwashes have been used for centuries to enhance oral hygiene, providing antimicrobial effects, reducing plaque, and refreshing breath. Traditional chemical-based mouthwashes like chlorhexidine, hydrogen peroxide, and CPC are common in modern oral care. However, these products often come with side effects such as staining, altered taste, and mucosal irritation when used for extended periods.

With an increasing trend toward natural products, there is a growing demand for herbal alternatives in oral hygiene. These herbal mouthwashes, based on plants with antimicrobial, anti-inflammatory, and antioxidant properties, have gained attention due to their perceived safety and efficacy. This review provides an overview of the various herbal ingredients utilized in mouthwash formulations, their antibacterial mechanisms, clinical efficacy, and safety profiles.

Types of Herbal mouthwash

- **Fluoride mouthwash:** Fluoride in mouthwashes contains salt which helps protect the teeth from cavities and cavities. Since fluoride can also be found in toothpaste and water, it's advisable to require care when using this type of mouthwash since intake of an excessive amount of fluoride isn't good for your overall health.
- **Antiseptic mouthwash:** This is the foremost common mouthwash. This mouthwash usually contains alcohol and is typically utilized by people with mouth infections to stop bacterial growth. This is often also helpful for people who have halitosis or bad breath. This is often used alongside the proper brushing of teeth and flossing to help forbid bacteria that cause mouth infections and stinky breath.
- **Cosmetic mouthwash:** A mouthwash that doesn't do anything to your overall oral care but is just how to freshen your breath or mask bad breath.
- **Natural mouthwash:** Natural mouthwash could also be a mouthwash that does what other sorts of mouthwash do except the ingredients are natural. It is also a popular option as an alcohol-free mouthwash. Their ingredients are safer to use as compared to other sorts of mouthwash.

Advantages

- **Reduces Harmful Bacteria:** Targets and kills bacteria that cause plaque, bad breath, and gum disease (e.g., gingivitis and periodontitis).
- **Improves Gum Health:** Helps reduce inflammation, swelling, and bleeding associated with gingivitis by eliminating bacteria that irritate the gums.
- **Prevents Plaque Build up:** Minimizes the accumulation of plaque, which can harden into tartar and lead to more severe oral health issues if left untreated.
- **Combats Bad Breath:** Effectively neutralizes odor-causing bacteria, promoting fresher breath.
- **Enhances Post-Surgical Healing:** Often recommended after dental surgeries or procedures to reduce the risk of infection and support healing.

Disadvantages

- **Disruption of Oral Microbiome:** Overuse can kill both harmful and beneficial bacteria, potentially disrupting the natural balance of the oral microbiome.

- **Risk of Dry Mouth:** Some formulations (especially those containing alcohol) may cause dry mouth, which can exacerbate bad breath and increase the risk of cavities.
- **Staining of Teeth:** Certain mouthwashes, such as those containing chlorhexidine, may cause staining of teeth or dental restorations with prolonged use.
- **Temporary Altered Taste:** Antibacterial agents can sometimes lead to a temporary metallic or bitter taste in the mouth.

Ingredients

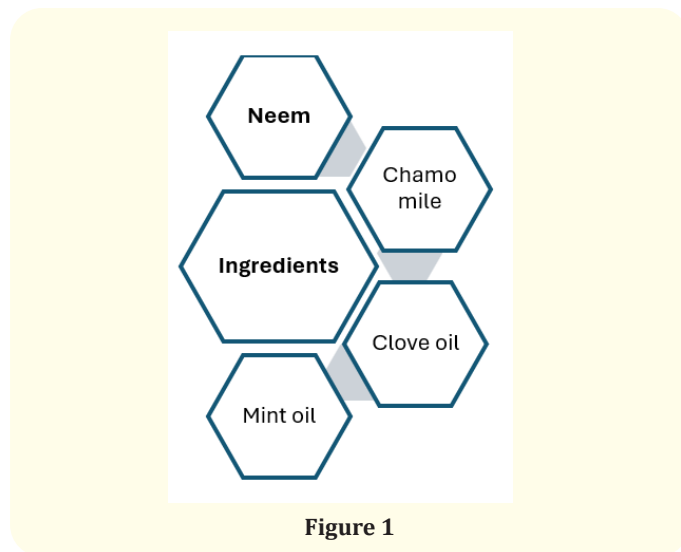


Figure 1

Neem

There are several ways to treat fungal diseases with neem (*Azadirachta indica*), which has antifungal qualities. Neem contains compounds called nimbidin and nimbolide, which have antifungal qualities. They function by lysing bacterial and fungal cell membranes.

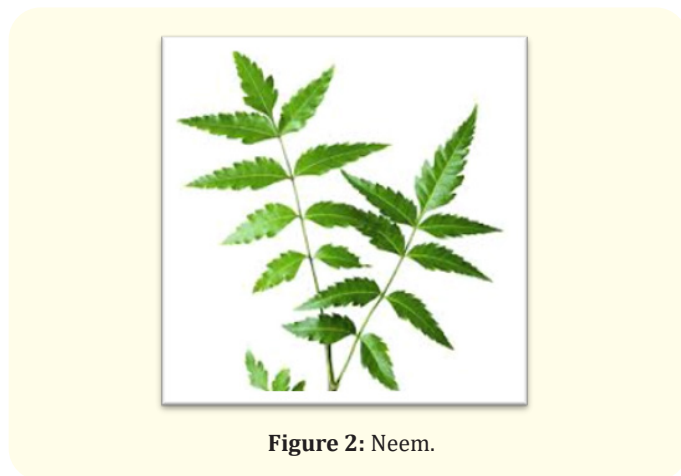


Figure 2: Neem.

Chamomile

Chamomile is a well-known herb recognized for its health benefits and soothing properties, often referred to as a natural remedy for various physical and emotional ailments. It has been used for centuries in traditional medicine across cultures, particularly for its calming effects and its role in promoting overall well-being.



Figure 3: Chamomile.

Clove oil

Clove oil, derived from the flower buds of the clove tree (*Syzygium aromaticum*), is a potent essential oil renowned for its health benefits and therapeutic properties. Native to Indonesia and other tropical regions, clove oil has been used in traditional medicine for centuries due to its antimicrobial, analgesic, and antioxidant effects. Its main active compound, eugenol, is responsible for its distinctive aroma and medicinal qualities.



Figure 4: Clove Oil.

Rose oil

Mint oil, often referred to as peppermint oil (*Mentha × piperita*), is an essential oil derived from the leaves of the peppermint plant. Known for its refreshing, cooling sensation and distinct aroma, mint oil has been used for centuries in both culinary and medicinal applications. The oil contains compounds such as menthol and menthone, which contribute to its therapeutic properties, making it a popular choice for natural remedies.



Figure 5: Mint Oil.

Evaluation of cream

Physical properties

The cream's colour, smell, and look were assessed.

Appearance

- **Color:** Herbal mouthwashes should have a consistent color, typically clear to slightly tinted depending on the herbs used (e.g., greenish from mint or tea tree oil). Any significant variation in color may indicate a problem with the formulation or preservation.
- **Clarity:** The mouthwash should be clear, without cloudiness or sediment. If there are particles or an opaque appearance, this may suggest improper mixing or contamination.
- **Consistency:** Herbal mouthwash should have a uniform consistency, not too thick or too watery. If the product is too thick, it might be uncomfortable to use; if too watery, it may be less effective at coating the mouth and teeth.

Viscosity

- **Flowability:** Viscosity refers to the thickness or resistance to flow. For a mouthwash, this property should be light and fluid enough to easily rinse the mouth. A too-thick mouthwash may be difficult to swish around, while a very thin one might not provide lasting coverage in the mouth.
- **Measured via:** This can be assessed using a viscometer or simple flow tests, where the mouthwash is observed for its ability to spread and coat the oral cavity effectively.

Odor and Fragrance

- **Pleasant Fragrance:** Herbal mouthwashes often contain essential oils like peppermint, eucalyptus, or tea tree oil, which should impart a refreshing and clean scent. The fragrance should be subtle but noticeable.

- **No Off-putting Odors:** The product should not have any rancid, overly strong, or artificial odors. Strong chemical odors might indicate the presence of undesirable preservatives or a breakdown in product quality.

Taste

- **Refreshing and Mild:** The taste should be pleasant, as mouthwash is intended to stay in the mouth for a short period. Common herbal flavors like mint, eucalyptus, and cinnamon are often used to provide a refreshing aftertaste.
- **Aftertaste:** An herbal mouthwash should not leave a bitter, overly strong, or lingering aftertaste. A harsh aftertaste may indicate excessive amounts of active ingredients or the presence of certain herbs in high concentrations.
- **Sensory Evaluation:** Taste can be evaluated by consumer testing, where individuals provide feedback on how the product feels and tastes during and after use.

pH Level

- **pH Balance:** The pH of a mouthwash should be close to neutral (around 7) or slightly acidic (between 4.5 and 6) to be safe for oral tissues and teeth. A mouthwash that is too acidic or too alkaline can cause irritation to the gums, mouth lining, or teeth.
- **Effect on Oral Tissues:** An improper pH can contribute to mouth dryness, irritation, or a burning sensation. It's essential to measure the pH of the formulation to ensure it is gentle yet effective.

Foaming Ability

- **Foam Formation:** Herbal mouthwashes generally do not foam as much as those with chemical surfactants like sodium lauryl sulfate. However, if the mouthwash contains gentle foaming agents from natural sources (like soapnut or other herbal extracts), it should produce a mild foam.
- **Effectiveness of Foaming:** While foaming isn't necessary for effectiveness, some consumers prefer it as it gives a sensation of thorough cleaning. The foam should be minimal yet present enough to help the mouthwash cover the entire mouth.

Solubility

- **Homogeneity:** The active ingredients (herbal extracts, essential oils, and any added preservatives) should remain dissolved and evenly distributed throughout the mouthwash. If separation occurs, the product may need shaking before use, which can be inconvenient for consumers.
- **Stability:** Herbal oils and extracts are more likely to separate over time than synthetic chemicals. The formulation should be evaluated for stability to ensure that the ingredients remain evenly distributed throughout the shelf life.

Future Prospects

The future of herbal mouthwashes appears promising, driven by growing consumer demand for natural and sustainable alternatives to synthetic oral care products. As awareness of the potential risks associated with long-term use of chemical mouthwashes, such as oral dysbiosis and mucosal irritation, increases, herbal mouthwashes may become a central component of daily oral hygiene regimens. With ongoing advancements in plant-based biotechnology, the identification of new bioactive compounds from lesser-known herbs could further enhance the antimicrobial and therapeutic properties of these formulations.

Future developments will likely focus on improving the consistency and potency of herbal mouthwashes through standardized extraction methods, ensuring optimal concentrations of active ingredients for reliable results. Research will also continue to explore the synergistic effects of combining different herbal extracts, optimizing formulations for enhanced antibacterial, anti-inflammatory, and antioxidant benefits. Additionally, advancements in delivery mechanisms, such as encapsulation technologies, could improve the stability and bioavailability of active compounds in herbal mouthwashes.

Moreover, as personalized oral care becomes more popular, custom-tailored herbal mouthwash formulations based on individual oral health needs, such as targeting specific pathogens or conditions, could gain traction. The growing interest in holistic and sustainable health practices, coupled with increasing consumer demand for eco-friendly products, positions herbal mouthwashes as a key player in the future of oral care [1-15].

Conclusion

In recent years, herbal mouthwashes have gained significant attention as effective, natural alternatives to chemical-based oral hygiene products. With a variety of plants demonstrating antimicrobial, anti-inflammatory, and antioxidant properties, herbal mouthwashes offer a promising solution for oral health management. Key ingredients such as tea tree oil, neem, sage, clove, and Echinacea have shown to possess potent antibacterial activity, effectively combating common oral pathogens and reducing the risk of conditions like gingivitis, periodontal disease, and dental caries. Herbal mouthwashes not only target harmful bacteria but also support gum health, reduce plaque accumulation, and alleviate inflammation, making them particularly beneficial for individuals seeking natural, side-effect-free alternatives. While clinical studies have confirmed the efficacy of herbal ingredients, challenges remain in terms of formulation standardization and long-term studies to fully assess their safety and effectiveness.

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