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DELONIX REGIA BASED NATURAL GARGLE: A POTENTIAL TREATMENT FOR UPPER RESPIRATORY TRACT AILMENTS

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ABSTARCT

Background: Upper respiratory tract infections are becoming increasingly prevalent due to environmental pollution. During the COVID-19 pandemic, herbal remedies have gained prominence for managing throat infections and other microbial conditions. *Delonix regia* is a medicinal plant known for its antifungal, antiviral, antimicrobial, and anti-inflammatory properties.

Objective: This study aimed to develop and evaluate a newer natural gargle formulation incorporating *Delonix regia* and other medicinal ingredients to manage oral and throat ailments, including pharyngitis, gingivitis, candidiasis, tonsillitis, dental caries, and postoperative sore throat.

Methodology: An herbal gargle formulation was developed using *Delonix regia* in combination with rock salt, cinnamon, liquorice, Aloe vera gel, clove oil, and peppermint oil. The formulation underwent thin layer chromatography and physicochemical evaluation, encompassing pH measurement, antimicrobial efficacy testing, physical stability assessment, clarity, and viscosity analysis. **Results:** The developed gargle exhibited favourable physicochemical properties, Thin layer chromatography (R_f value: 0.8), stable, clarity (clear), viscosity (1.074

cP), and significant antimicrobial activity (Zone of inhibition: 17 mm). These findings suggest potential therapeutic benefits for patients with oral and throat conditions. **Conclusion:** The formulated herbal gargle, enriched with *Delonix regia* and other natural ingredients, demonstrated promising antimicrobial and anti-inflammatory properties, indicating its potential as an alternative for managing throat and oral infections. Further studies are necessary for clinical validation.

KEYWORDS: *Delonix regia*, Rock salt, Throat infections, Gargles.

INTRODUCTION

A Gargle, which is an aqueous solution, is swished and held in the mouth using the perioral muscles to flush out infections primarily caused by plaque buildup. Gargling serves multiple purposes, including treating and alleviating existing bacterial and viral infections, as well as providing protection against future illnesses. This medical practice also acts as a preventive measure, inhibiting the development of unpleasant odours in the oral and pharyngeal regions by suppressing microbial growth. Herbal gargles have gained significant attention as potential alternatives to conventional oral hygiene products due to their perceived natural composition and reported therapeutic effects. This aims to provide a comprehensive review of the advantages of utilizing herbal gargles for oral health maintenance[1] and improvement.[2]

The herbal ingredient *Delonix Regia* have an antimicrobial,[3][4] antifungal,[5] antiviral, anti-inflammatory benefits to prevent a condition like tonsillitis, post-operative sore throat, sore throat, gingivitis,[6] dental caries.[7] Rock salt is used to treat sore throat condition.[8][9] Liquorice serves as a component in natural sweeteners[10] used for gargling. Peppermint oil is frequently utilized as a flavouring agent.[11] The clove oil functions as a self-preservative in numerous herbal formulations.[12] Cinnamon act as an antibacterial.[13] Aloe vera gel was employed to modify viscosity and act as a soothing agent in cases of inflammation.[14] This research examines various gargling solutions that have demonstrated efficacy in reducing respiratory infections caused by bacteria, viruses, or a combination of both. However, it is noted that using herbal remedies for gargling may lead to certain unexpected effects. The text lists several medicinal herbs traditionally used for gargling, including *zingiber officinale, Azadirachta indica, curcuma longa, Ocimum sanctum, eugenia caryophyllus, piper betle, Psidium guajava, Commiphora myrrh, and salvia officinalis*.[15]

MATERIAL AND METHOD

Collection of leaves: Leaves from a mature *Delonix regia* (Gulmohar) plant were randomly collected. The Department of Pharmacognosy at Anand Pharmacy College confirmed the plant's authenticity, assigning it the identification number APC/2024/09.

Delonix regia leaves undergo a drying process before being ground into a fine powder using a mortar and pestle.[16] The powders of *Delonix regia* (Gul mohar), *Glycyrrhiza glabra* (Liquorice), and *Cinnamomum verum* (Cinnamon) are subjected to defatting. This process involves using petroleum ether as a solvent,[17] with a ratio of 10g of powder to 100ml of solvent, for a duration of 48 hours.

Extraction process

The defatted powder underwent a drying process prior to extraction. Utilizing sterilized water as the solvent (10g/100 ml),[18] the extraction was performed through a percolation method.[19][20] The resulting liquid was then filtered using Whatman paper, and the extract was collected for further use.

Preparation of gargle

The collected extract was ground in a mortar and pestle to ensure uniform powder particle size. A solution of rock salt (10 g/100 ml)[8] was combined with aloe vera gel. Clove oil and peppermint oil were then added while stirring continuously to prevent phase separation. The final volume was adjusted using sterile water.

Table 1: Formulation composition.

Sr. no.	Ingredients	Purpose	Formula 1 (F1) (100 ML)	Formula 2 (F2) (100 ML)	Formula 3 (F3) (100 ML)
1.	*Delonix regia*	Antimicrobial & Anti-inflammatory	500 mg	1000mg	2000mg
2.	Cinnamon	Antibacterial	50 mg	100 mg	200 mg
3.	Liquorice	Sweetener	50 mg	100 mg	150 mg
4.	Clove oil	Preservative, Dental analgesic	0.1 ml	0.15 ml	0.20 ml
5.	Peppermint oil	Flavouring agent	0.5 ml	0.5 ml	0.5 ml
6.	Aloe vera gel	Soothing agent	1 gm	1 gm	1 gm
7.	Rock salt solution	Treat sore throat	10 ml	15 ml	20 ml
8.	Sterilized Water	q.s.	q.s.	q.s.	q.s.

Evaluation parameter

Organoleptic analysis

Colour: Visual inspection[21] was conducted to evaluate the extract's physical attributes, specifically its visual appearance.[16]

Odour: characteristic

Figure 1: Gargle batches.

pH

In this experiment, we utilized a pH meter to determine the pH value. The pH meter was calibrated using standard buffer solution, we diluted 1 ml of gargle solution in 100 ml of water and measured the pH using the pH meter. The device indicated a pH range between 6 and 7, which was verified by comparing it with a standard pH scale. The observed pH values fell within the 6-7 range.[22]

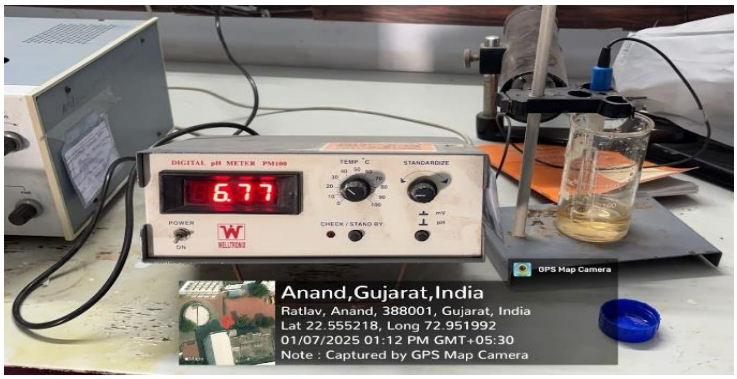

Figure 2: pH of Formula 3.

Clarity test

The sample is placed in a beaker and examined against contrasting white and black backgrounds. During the examination, no visible particles are detected in the sample. Consequently, the gargle solution is determined to be transparent.

Viscosity

In the evaluation, we have used 'Ostwald viscometer'. The herbal gargle preparation exhibited a viscosity of 1.074, suggesting it has a low resistance to flow and can be easily poured or administered.[23]

Antimicrobial assay[24][25]

By performing antimicrobial assay, it can be ensured that prepared gargle is safe for use. The prepared bacterial suspension was applied to agar media plates using the streak plate technique, alongside a control plate. These plates were then incubated at 37˚C for a 24-hour period. After that the small wells are prepared by using cork borer and the gargle solution was added and incubated for 24-hrs. Following incubation, the plates were removed and examined the zone of inhibition of each prepared batch.[26]

Formula	Zone of inhibition		
F1	10 mm	10 mm	10mm
F2	14 mm	18 mm	18 mm
F3	19 mm	17 mm	15 mm

Figure 3: Antimicrobial assay Formula 3.

Chromatographic analysis

Thin layer chromatography was conducted by using n-butanol: Glacial acetic acid: water in ratio of 4:1:2 as a solvent system. The R_f value was found to be 0.8 which is matched the standard one.[27]

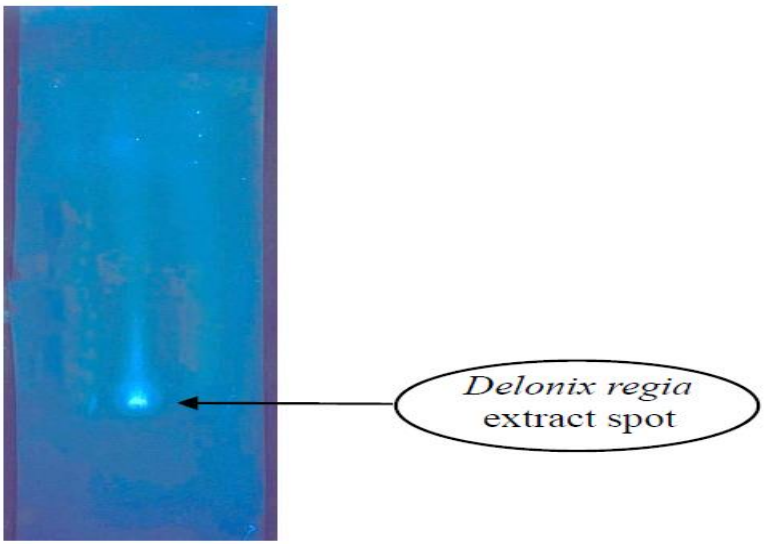

Figure 4: Thin layer chromatography.

RESULT

Sr. No.	Characteristics	Observation		
		(F1)	(F2)	(F3)
1	Colour	Light brown	Dark brown	Dark brown
2	Odour	characteristic	Characteristics	Characteristics
3	pH	6.93	6.88	6.77
4	Clarity	Clear	Clear	Clear
5	Viscosity	0.835 cP	0.992 cP	1.074 cP
6	Antimicrobial Assay (Zone of Inhibition)	10 mm	16.66 mm	17 mm

CONCLUSION

Delonix regia gargle demonstrates significant therapeutic potential in addressing various throat ailments. This natural remedy exhibits efficacy in alleviating throat infections of fungal, viral, and microbial origin, while also providing relief for conditions such as pharyngitis and tonsillitis. Furthermore, it offers a soothing effect for sore throats and helps reduce throat inflammation. In contrast to many commercially available products that contain potentially harmful chemicals, which may lead to oral irritation, adverse reactions, lesions, or even mouth ulcers, *Delonix regia gargle* presents a safer alternative for maintaining oral and throat health. This formulation boasts the absence of side effects, a crucial advantage over its synthetic counterparts. The gargle's composition includes several beneficial ingredients. Rock salt solution contributes to sore throat relief, while liquorice serves as a natural sweetener. Clove oil acts as a preservative within the formulation, and cinnamon aids in mitigating inflammatory conditions. When used with warm water, this gargle not only provides

enhanced relief from throat infections but also serves as a preventive measure against more severe infections.

Our comprehensive analysis of the *Delonix regia gargle* encompassed various parameters, including stability, clarity, viscosity, antimicrobial activity, and pH. The results of these evaluations indicate that the sample successfully met all specified criteria, further supporting its potential as an effective throat care solution.

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