

Design And Evaluation Of Mimosa Pudica Based Hydrogel For Wound Healing Applications

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ABSTRACT

The objective of the present research was to design and evaluate a novel herbal hydrogel containing Mimosa pudica extract for potential wound healing applications. Hydrogels are preferred topical drug delivery systems due to their ability to maintain hydration, promote healing, and enhance patient compliance. Mimosa pudica is a medicinal plant traditionally used for treating wounds, inflammation, and skin disorders. In this study, a hydrogel was formulated using a suitable polymeric base incorporated with a hydroalcoholic extract of Mimosa pudica. The prepared formulation was evaluated for physicochemical parameters including appearance, pH, viscosity, spreadability, swelling index, and drug content uniformity. In vitro diffusion studies were conducted to assess the release pattern of the extract, along with short-term stability studies. The results indicated that the developed hydrogel possessed acceptable physicochemical properties, uniform drug distribution, and sustained release behaviour. The study concludes that Mimosa pudica based hydrogel can serve as a promising herbal formulation for topical wound healing applications.

Keywords: Mimosa pudica, herbal hydrogel, wound healing, topical formulation, evaluation.

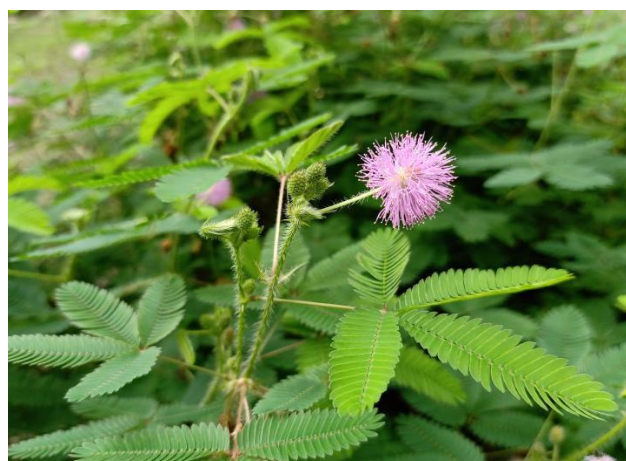
INTRODUCTION

Wound healing is a complex biological process involving inflammation, proliferation, and remodelling of damaged tissues. Despite the availability of several synthetic wound care products, issues such as delayed healing, irritation, and high cost remain major concerns. This has increased interest in herbal-based formulations that are biocompatible, economical, and culturally acceptable.

Mimosa pudica (family: Fabaceae), commonly known as the sensitive plant, has been extensively used in traditional medicine for the treatment of wounds, burns, ulcers, and skin infections. The plant is reported to contain bioactive constituents such as flavonoids, tannins, alkaloids, and phenolic compounds that contribute to its therapeutic potential.

Hydrogels are three-dimensional, hydrophilic polymeric networks capable of absorbing large amounts of water or biological fluids. Their softness, elasticity, and ability to provide sustained drug release make them ideal for topical and wound healing

applications. The present study aims to design and evaluate a novel hydrogel formulation containing Mimosa pudica extract and to assess its suitability for topical wound healing use.



Materials and Methods:

Plant Material Collection and Authentication:

The 2kg of Mimosa pudica was collected from a local region and authenticated by a qualified botanist. The authenticated plant material was shade dried, coarsely

Relevant conflicts of interest/financial disclosures: The authors declare that the research was conducted in the absence of any commercial or financial relationships that could be construed as a potential conflict of interest.

powdered, and stored in an airtight container until further use.

Preparation of Plant Extract:

The 50g powdered plant material was subjected to maceration using a hydroalcoholic solvent (70% ethanol) system for a specified duration with intermittent stirring. The 500ml extract was filtered and concentrated under reduced pressure to obtain a semi-solid mass, which was stored in a desiccator for further formulation.

Formulation of Mimosa pudica Hydrogel:

The hydrogel was prepared using a suitable gelling agent dispersed in purified water with continuous stirring. After complete hydration of the polymer, the Mimosa pudica extract was incorporated uniformly

into the gel base. Additional excipients such as humectants and preservatives were added as required, and the final volume was adjusted with purified water. The pH of the formulation was adjusted to match skin pH.



Evaluation of Hydrogel Formulation: Qualitative test for mimosa pudica:-

Name of the test	Procedure	Observation	Report
1. Test for Alkaloids	1. Mayer test: 1 ml of plant extract in test tube + few drops of reagent. Shake gently.	Formation of a yellow-white precipitate	Present
2. Test for Flavonoids	2. Alkaline reagent test: 1 ml of plant extract in test tube + few drops of NaOH solution	Development of intense yellow color which disappears upon adding dilute acid	Present
3. Test for Tannins	3. Ferric chloride test: Add 2–3 drops of 5% or 10% neutral ferric chloride solution to a small amount of aqueous extract	A dark blue color indicates presence of tannins	Positive / Present
4. Test for Carbohydrates	4. Molisch's test: To 2 ml of sample, 2–3 drops of Molisch reagent added. Then 2 ml of conc. H ₂ SO ₄ added	No formation of purple or violet ring at the junction of the two liquids	Absent
5. Test for Glycosides	5. Keller–Killiani test: Dissolve the plant extract in glacial acetic acid. Add a drop of FeCl ₃ and add conc. H ₂ SO ₄	A reddish-brown ring formed at the interface	Present
6. Test for Proteins	6. Biuret test: Add 2 ml of NaOH to sample	Violet or purple color indication	Present
7. Test for Terpenoids / Steroids	7. Salkowski test: Mix 5 ml of the plant extract with 2 ml of chloroform and add 3 ml of conc. H ₂ SO ₄	A reddish-brown coloration at the interface	Present

Quantitative test for mimosa pudica:-

Name of Test	Procedure	Observation	Calculation	Report
Thin Layer Chromatography (TLC) of <i>Mimosa pudica</i> extract	1. Prepare ethanolic plant extract. 2. Use silica gel TLC plate as stationary phase. 3. Mobile phase: n-Butanol : Acetic acid : Water (4 : 1 : 5 v/v/v). 4. Spot the sample on TLC plate. 5. Develop the plate in a chromatographic chamber. 6. Dry the plate and observe under visible / UV light. 7. Spray detecting reagent (ninhydrin reagent).	Two spots were observed on the TLC plate. One spot appeared green in colour and another spot appeared purple/brown after spraying.	Distance travelled by solute = 3.0 cm Distance travelled by solvent front = 6.0 cm Rf value = Distance travelled by solute / Distance travelled by solvent front $Rf = 3.0 / 6.0 = 0.5$	The Rf value of <i>Mimosa pudica</i> extract was found to be 0.5. This indicates the presence of phytochemical constituents in the extract.

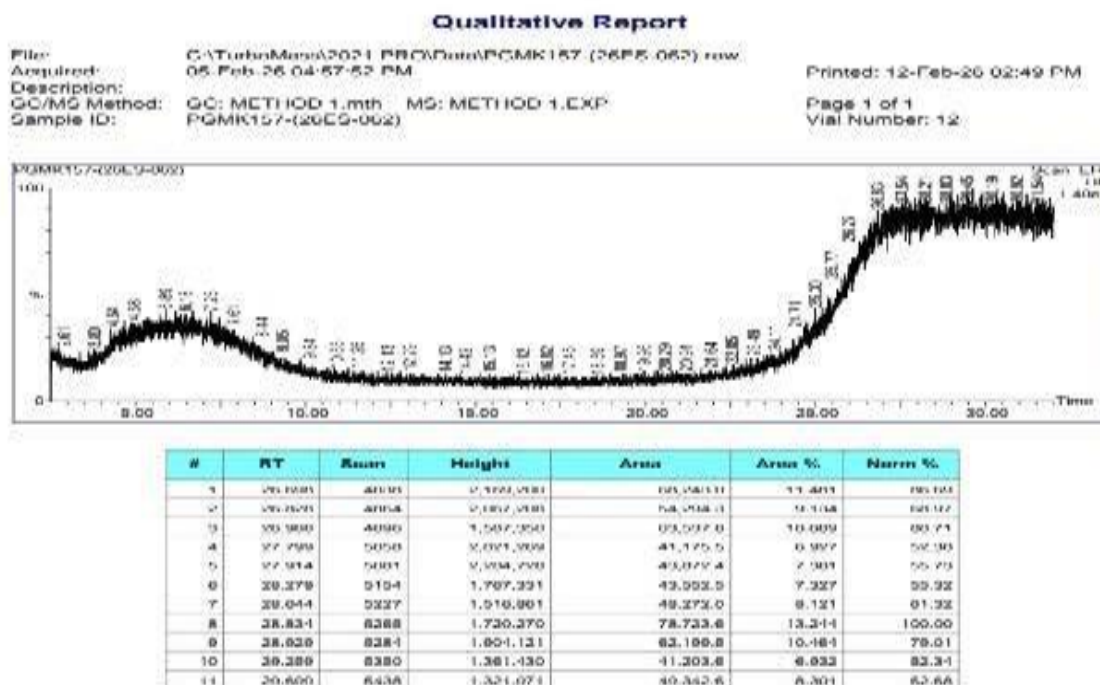
Evaluation test of mimosa pudica hydrogel :-

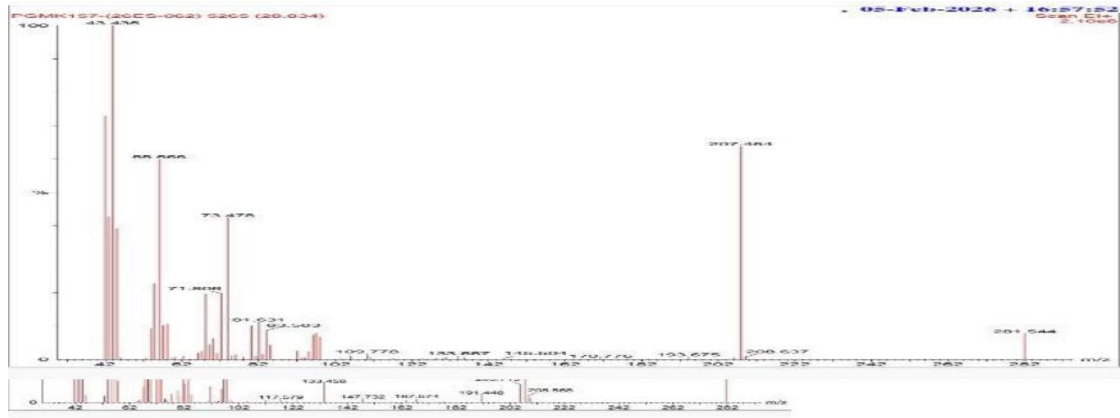
Name of test	Observation	Result
Physical appearance	Depending upon the hydrogel, clarity, grittiness and smoothness were observed.	The hydrogel was clear, smooth, homogeneous and free from lumps and air bubbles.
pH determination	pH of about 6.4 to 7.0 was observed.	The hydrogel was found to be suitable for skin application.
Viscosity and spreadability	Spread diameter was about 6.5 ± 0.3 cm and flow behaviour was consistent.	Viscosity of hydrogel was found to be about 41200 ± 120 cps.
Extrudability	The hydrogel was easily extruded from the tube by uniform application of force.	Uniform extrusion was achieved.
Swelling study	Maximum swelling index was observed with high water absorption capacity.	<i>Mimosa pudica</i> hydrogel showed high water absorption capacity.
Thermal analysis	No change in colour and the hydrogel remained stable.	Stable hydrogel.
Drug release study (in-vitro)	Using USP type-II apparatus, drug was dissolved within 2–3 minutes.	Uniform drug distribution was achieved.

Quality control test for mimosa pudica:-

Name of test	Observation	Result
Solubility test	The solubility of the sample was observed in ethanol and water.	Solubilisation of the extract took place.
Ash value	After ignition in a muffle furnace, ash was obtained and weighed.	Total ash value was found to be 2.37 % .

Loss on drying	The sample was kept in the oven at 105 °C for about 30 minutes and weighed.	Loss on drying at 105 °C was observed.
Acid-insoluble content	After adding acid to the sample, insoluble matter was observed.	Acid-insoluble content was present.





RESULT AND DISCUSSION:-

The formulated *Mimosa pudica* hydrogel showed satisfactory physicochemical characteristics and good patient-acceptable properties. The prepared hydrogel was clear, smooth, homogeneous and free from grittiness, indicating uniform dispersion of the extract within the polymeric base. The pH of the formulation (6.4–7.0) was found to be compatible with normal skin pH, suggesting suitability for topical application without causing irritation.

Viscosity and spreadability results indicated adequate consistency, good flow behaviour and easy applicability on the skin surface. The formulation exhibited good extrudability and high swelling capacity, which is desirable for maintaining a moist environment at the wound site. Qualitative phytochemical screening confirmed the presence of major bioactive constituents such as alkaloids, flavonoids, tannins, glycosides and proteins in the extract, which are known to contribute to wound healing activity. TLC analysis further supported the presence of phytoconstituents with a characteristic R_f value of 0.5.

In-vitro drug release studies demonstrated uniform drug distribution and satisfactory release behaviour, indicating effective incorporation of the extract into the hydrogel matrix. Short-term stability and thermal analysis showed no significant changes in colour or physical appearance, confirming the stability of the formulation. Overall, the results suggest that the developed *Mimosa pudica* hydrogel possesses suitable characteristics for topical wound healing applications.

CONCLUSION

The present study successfully developed a novel *Mimosa pudica* based hydrogel with satisfactory physicochemical and release characteristics. The formulation demonstrated good stability, uniformity, and suitability for topical application. Incorporation of *Mimosa pudica* extract into a hydrogel system represents a promising approach for developing effective herbal wound healing formulations. Further pharmacological and clinical studies are recommended to establish its therapeutic efficacy and safety.

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