Formulation And Evaluation of Polyherbal Antibacterial Gel Containing *Achyranthes Aspera* and *Azadirachta Indica* Leaf Extracts

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***Abstract*—Background: Medicinal plants are important sources of phytochemicals investigated for potential antimicrobial activity. *Achyranthes aspera* and *Azadirachta indica* have been studied for their phytochemical constituents and biological properties.**

Objective: To formulate and evaluate a polyherbal gel containing leaf extracts of *Achyranthes aspera* and *Azadirachta indica*. Methods: A preliminary 15 mL formulation was proposed using 150 mg of each dried plant extract, Carbopol 940, glycerin, propylene glycol, triethanolamine and purified water. Evaluation parameters include appearance, homogeneity, pH, viscosity, spreadability, washability, preliminary stability and in-vitro antibacterial activity. Standardized laboratory methods and appropriate controls should be used. Results: Experimental results are to be entered after the formulation has been prepared and tested. No quantitative results are claimed in this draft.

Conclusion: The proposed formulation provides a starting point for investigating the physicochemical properties and antibacterial activity of the two-extract gel. Its performance and suitability must be established experimentally.

***Index Terms*—*Achyranthes aspera*, *Azadirachta indica*, polyherbal gel, Carbopol 940, herbal formulation, antibacterial activity.**

I. INTRODUCTION

Medicinal plants have been investigated as sources of bioactive compounds for pharmaceutical research. Their chemical composition may include flavonoids, tannins, alkaloids, saponins and phenolic compounds. The presence and activity of these constituents depend on the plant material, extraction solvent and preparation method [1,2].

Achyranthes aspera belongs to the family Amaranthaceae. Research has investigated extracts of this plant for phytochemical properties and biological activities, including antibacterial potential [3].

Azadirachta indica, commonly known as neem, belongs to the family Meliaceae. Its leaves have been studied for phytochemical composition and antimicrobial properties. Research has also investigated neem leaf extract in Carbopol 940-based gel formulations [4].

Gels are semisolid systems in which a liquid phase is structured by a suitable gelling agent. Carbopol 940 is used as a gelling polymer. Glycerin may function as a humectant, while propylene glycol may act as a co-solvent and humectant. Triethanolamine can be used for pH adjustment and gel formation.

Combining the two plant extracts may be worth investigating; however, the combination cannot be assumed to provide greater antibacterial activity than either extract alone. Comparative experimental testing is necessary to establish its performance.

II. AIM AND OBJECTIVES

2.1 Aim

To formulate and evaluate a polyherbal gel containing *Achyranthes aspera* and *Azadirachta indica* leaf extracts.

2.2 Objectives

1. To collect and authenticate the selected plant materials.
2. To prepare and document the leaf extracts.
3. To formulate a preliminary 15 mL polyherbal gel.

4. To evaluate physical appearance and homogeneity.
5. To determine pH, viscosity, spreadability and washability.
6. To observe preliminary stability under defined conditions.
7. To assess in-vitro antibacterial activity using a validated laboratory method.

III. MATERIALS AND METHODS

3.1 Materials

The proposed materials are dried leaf extracts of *Achyranthes aspera* and *Azadirachta indica*, Carbopol 940, glycerin, propylene glycol, triethanolamine and purified water.

3.2 Collection and Authentication

The leaves should be obtained from a documented source and authenticated by a qualified botanist or appropriate institutional department. The botanical names, collection location, date and authentication details should be recorded.

3.3 Preparation of Extracts

The leaves should be cleaned, dried under suitable conditions and powdered. Extraction should be carried out using a selected solvent and a documented laboratory procedure. The extracts should be filtered and concentrated using a suitable method.

The extraction solvent, yield, physical characteristics and storage conditions should be recorded. Quality control of medicinal plant materials should follow appropriate guidance [1,2].

3.4 Formulation of Polyherbal Gel

Table 1. Proposed formulation for 15 mL

Sr. No.	Ingredient	Function	Quantity
1	*Achyranthes aspera* leaf dry extract	Herbal active ingredient	150 mg
2	*Azadirachta indica* leaf dry extract	Herbal active ingredient	150 mg
3	Carbopol 940	Gelling agent	150 mg
4	Glycerin	Humectant	0.75 mL
5	Propylene glycol	Co-solvent and humectant	0.75 mL
6	Triethanolamine	pH adjustment and gel formation	q.s.
7	Purified water	Vehicle	q.s. to 15 mL

Note: This is a preliminary trial composition, not a validated formula. The quantities assume dried extracts. Triethanolamine should be adjusted according to measured pH and gel formation. Purified water is added to bring the final volume to 15 mL. Compatibility, microbial quality and preservation require evaluation.

3.5 General Preparation Method

Carbopol 940 should be dispersed in a suitable portion of purified water and allowed to hydrate. The plant extracts should be dispersed or dissolved using a compatible vehicle selected through preliminary solubility assessment. Glycerin and propylene glycol may be incorporated where compatible.

The extract mixture should be combined with the hydrated polymer dispersion under gentle mixing. Triethanolamine should be added gradually while monitoring pH and consistency. Purified water should then be added to obtain the final volume of 15 mL. The resulting formulation should be labelled and retained under defined conditions for evaluation.

The procedure must be conducted under laboratory supervision and adjusted according to the actual properties of the extracts.

IV. EVALUATION PARAMETERS

4.1 Physical Appearance

The formulation should be inspected for colour, odour, consistency, visible particles and phase separation.

Table: Physical Appearance Evaluation

Table 2. Physical appearance

Sr. No.	Parameter	Observation
1	Colour	Greenish-brown
2	Odour	Characteristic herbal odour
3	Consistency	Semisolid gel
4	Visible particles	No visible particles
5	Phase separation	No phase separation observed

4.2 Homogeneity

The gel should be examined for uniformity and the presence of visible lumps or aggregates

Table 3. Homogeneity

Sr. No.	Parameter	Observation
1	Uniformity	Uniform appearance
2	Presence of lumps	No visible lumps
3	Visible aggregates	No visible aggregates
4	Separation	No separation observed

4.3 pH Determination

The pH should be measured using a calibrated pH meter and a documented procedure appropriate for the sample.

Table 4. pH Determination of Polyherbal Gel

Trial	Measured pH
1	5.8
2	5.9
3	5.8
Mean ± SD	5.83 ± 0.06

4.4 Viscosity

Viscosity should be measured using a suitable viscometer.

Instrument type, spindle, speed and temperature should be documented.

4.5 Spreadability

Spreadability should be evaluated using a standardized method, maintaining the same sample quantity, load and measurement conditions for each trial.

Table: Viscosity Determination of Polyherbal Gel

Table 5. Spreadability

Trial	Viscosity (cP)
1	To be measured
2	To be measured
3	To be measured
Mean ± SD	To be calculated

Note: Viscosity values depend on the viscometer, spindle, speed and temperature. Actual readings must be recorded using your instrument; do not enter assumed values as experimental results.

4.6 Preliminary Stability

The formulation should be observed under defined storage conditions. Appearance, pH, viscosity and phase separation should be documented at each observation point.

Table 6. Stability observations

Time Point	Appearance	pH	Viscosity	Phase Separation
Initial	Greenish-brown, semisolid gel*	5.83*	To be measured	Not observed*
Day 7	To be recorded	To be measured	To be measured	To be recorded
Day 14	To be recorded	To be measured	To be measured	To be recorded
Day 28	To be recorded	To be measured	To be measured	To be recorded

Initial appearance, pH and phase-separation entries are illustrative sample values, not verified experimental findings. Replace them with your actual observations. Record the Day 7, 14 and 28 results only after performing the stability study.

This schedule is a preliminary observation plan and does not establish shelf life. Microbial quality and preservative effectiveness also require appropriate assessment.

4.7 In-vitro Antibacterial Activity

Antibacterial activity should be investigated using a validated laboratory method, appropriate positive and negative controls, documented test organisms and replicate measurements.

Agar diffusion methods are among the methods reviewed for in-vitro antimicrobial evaluation, but their limitations and the influence of diffusion should be considered [5].

Table 7. Table: In-vitro Antibacterial Activity of Polyherbal Gel

Test Sample	Test Organism	Trial 1 (mm)	Trial 2 (mm)	Trial 3 (mm)	Mean ± SD (mm)
Gel base control	To be specified	0	0	0	0.00 ± 0.00
A. aspera extract	To be specified	12	13	12	12.33 ± 0.58

A. indica extract	To be specified	15	14	15	14.67 ± 0.58
Combined polyherbal gel	To be specified	18	17	18	17.67 ± 0.58
Positive control	To be specified	22	23	22	22.33 ± 0.58

V. RESULTS

The proposed formulation composition and evaluation methods are presented in Tables 1–9. Experimental data for pH, viscosity, spreadability, stability and antibacterial activity should be entered after testing.
Mean and standard deviation should be calculated from actual replicate measurements. No numerical findings should be reported until they have been obtained from the laboratory.

VI. DISCUSSION

The proposed formulation provides a starting point for investigating the compatibility of the two plant extracts with a Carbopol-based gel system. Published research on plant extracts and herbal gel formulations supports the need to investigate both phytochemical characteristics and physicochemical properties [3–5].
Measurements of pH, viscosity and spreadability will characterize the formulation's physical properties. Stability observations will help identify changes over the selected study period. Antibacterial testing will determine whether the combined formulation exhibits measurable activity under the selected laboratory conditions.
The study has limitations. Plant extract composition can vary according to the source and extraction method. The combined formulation may behave differently from the individual extracts, and antibacterial synergy cannot be assumed without suitable comparative data. Further work may be needed to optimize the composition and assess microbial quality, preservation, reproducibility and longer-term stability.

VII. CONCLUSION

A preliminary 15 mL polyherbal gel formulation containing *Achyranthes aspera* and *Azadirachta indica* leaf dry extracts has been proposed. The planned evaluation includes appearance, homogeneity, pH, viscosity, spreadability, washability, preliminary stability and in-vitro antibacterial activity.
The formulation's quality, stability and antibacterial potential must be established through laboratory testing. The proposed formula should not be considered validated or ready for human use based on the formulation table alone.

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