Research Article

Formulation and Evaluation of Phytosome-Loaded Suspension *from Ipomoea mauritiana* Tuber

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ABSTRACT

The present study is on the extraction, development, and assessment of a phytosome-formulated suspension from the Ipomoea *mauritiana* Jacq. tuber, a medicinal plant of common use in Ayurvedic medicine. The plant was extracted using Soxhlet extraction with 80% ethanol and then developed into phytosomes using the anti-solvent precipitation method with soya lecithin and dichloromethane. The optimized phytosomes were analyzed for particle size, zeta potential, and surface morphology by particle size analysis, zetasizer, and scanning electron microscopy (SEM). A suspension was formulated using sodium CMC, sorbitol, sodium benzoate, lemon oil, and Tween 80 as the excipients. The resulting suspension was assessed for organoleptic attributes, pH, viscosity, redispersibility, flow rate, and sedimentation volume. The phytosomes showed a particle size of around 153.67 nm and zeta potential of -25 mV, showing medium stability. SEM established a spherical vesicular structure suitable for augmented bioavailability. The suspension showed yellowish light brown color, nice odor, pH 5.60 ± 0.14, viscosity 126.34 cp, good redispersibility, and low sedimentation rate, showing good stability. This research proves that phytosome technology is a good way to enhance the delivery and therapeutic effectiveness of herbal drugs.

Keywords: *Ipomoea mauritiana*, Phytosome, Herbal drug delivery, Nanoformulation, Soxhlet extraction, Zeta potential, Particle size analysis, Scanning Electron Microscopy (SEM).

INTRODUCTION

A medicinal plant, according to the World Health Organization (WHO, 2001), is an herbal product that is derived by such processes as extraction, fractionation, purification, or concentration, to be used either for direct therapeutic use or as an ingredient for herbal preparations.[1] A medicinal plant, as defined by the World Health Organization (WHO, 2001), is a herbal product that is obtained by such methods as extraction, fractionation, purification, or concentration, to be employed either for immediate therapeutic purpose or as a raw material for herbal formulations.[2] The Indian Ayurvedic Pharmacopoeia refers to Ipomoea mauritiana as Kshiravidari. Vidari tubers are employed in more than 45 Ayurvedic formulations and are popularly consumed alone as medicine. Vidari also finds use in the very popular Ayurvedic medicine Chyavanaprasha. It's greatly prized for its various uses, including being an aphrodisiac, cardiotonic, demulcent, diuretic, refrigerant, galactagogue, and tonic.[3] Over the past few years, there has been an increasing demand for new drug delivery systems (NDDS) particularly for herbal drugs. With new advancements in phyto-formulation research, nano-sized dosage forms such as polymeric nanoparticles, nanocapsules, liposomes, solid lipid nanoparticles, phytosomes, and nanoemulsions have several advantages for enhancing the delivery and efficacy of herbal drugs.[4] Phytosome is a sophisticated technology from a world leader in the pharmaceutical and nutraceuticals business. It entails the association of standardized plant extracts or water-soluble phytoconstituents with phospholipids to create lipid-compatible molecular complexes called phytosomes. This technology greatly enhances the bioavailability and absorption of the active ingredients. Phytosomes show improved pharmacokinetic and pharmacological characteristics and are utilized in the management of acute and chronic liver diseases due to toxic, metabolic, infectious, or degenerative etiology.[5]

MATERIALS AND METHODS

Extraction

To perform the extraction of the constituents of 25 grams of dried, powdered Ipomoea mauritiana tuber, a Soxhlet apparatus was utilized with 500 mL of 80% ethanol as the solvent. Upon finishing the extraction process, the mixture was filtered through filter paper. The resulting filtrate was concentrated by evaporating the solvent, resulting in a crude extract. This extract was sealed in an airtight container, and the percentage yield was determined.[6]

Preparation of Phytosomes

Anti-solvent precipitation method

In a 100 mL round-bottom flask, the accurate quantities of extract and soya lecithin were weighed. The reaction mixture was then refluxed using 20 mL of dichloromethane, keeping the temperature below 60°C for 2 hours. The reaction mixture was then concentrated to about 5–10 mL after refluxing. Then, 20 mL of hexane was gradually added with constant stirring to enhance the precipitation. Lastly,

the product obtained was transferred to an amber glass bottle and kept at room temperature.[7]

Evaluation of phytosomes [8]

a. Particle Size Measurement

The particle size of the phytosomes was determined by a particle size analyzer, which gives data regarding the distribution and average particle size.

b. Zeta Potential Measurement

Zeta potential is significant in determining the stability of phytosomes. The more electrostatic repulsion that occurs between particles, the more stable the formulation is. Zeta potential of the optimized phytosomes was determined by using a zetasizer.

c. Scanning Electron Microscopy (SEM)

SEM was employed to study the surface morphology and particle size of the phytosomes. It creates high-resolution images that provide information about the shape (usually spherical or vesicular), surface texture, and aggregation behavior of the particles, proving successful formation of phytosomal vesicles.

Formulation of suspension

Table 1: Formulation of Suspension

Sl. No	Ingredients	Functions	Quantity
1.	Phytosomes	Active ingredient	2g
2.	70% Sorbitol	Sweetener/ humectant	30ml
3.	Sodium benzoate	Preservatives	0.1g
4.	Tween 80	Surfactant/ emulsifier	1ml
5.	Sodium CMC	Suspending agent	0.75g
6.	Lemon oil	Flavoring agent	0.1g
7.	Purified water	Vehicle	100ml

Start by dissolving sodium CMC in 20 mL of hot water by stirring continuously and let it hydrate for about 30 minutes. Dissolve sodium benzoate in 10 mL of water in another container. Next, add 30 mL of sorbitol and stir the solution until it becomes transparent. Mix lemon oil separately with 1 mL of Tween 80 and add 5 mL of water dropwise slowly while stirring to create a fine emulsion. Use a small amount of sorbitol and mix it well with the phytosome to create a smooth paste. Add this paste slowly to the suspension base while mixing well for uniformity. In a beaker, blend the hydrated sodium CMC, sorbitol-preservative solution, lemon oil emulsion, and phytosome paste. Pour the mixed mixture into a measuring cylinder and top up the total volume to 100 mL using purified water. Lastly, place the prepared suspension in a 100 mL amber glass bottle. [9, 10]

Evaluation of suspension [9, 10]

a. Organoleptic Properties

The suspension was evaluated based on its color, odor, clarity, and consistency by sensory test.

b. Determination of pH

The pH of the suspension was determined by a calibrated pH meter to confirm that it is within the range required.

c. Determination of Viscosity

The viscosity of the suspension was determined by a Brookfield Viscometer to quantify its flow behavior.

d. Redispersibility

50 mL of the suspension was taken in calibrated tubes and kept at room temperature. Samples were drawn at varying time intervals (1, 5, 10, 15, 20, and 30 days). At every interval, a tube withdraws were shaken well and examined to see if the sediment was redispersible easily.

e. Flow Rate (F)

The flow rate was measured in terms of the time it took 10 mL of herbal suspension to flow through a 10 mL pipette. The flow rate was calculated by the following formula:

Flow rate (F) = Volume of sample (mL) / Time (seconds)

f. Sedimentation Volume

The suspension prepared was kept in graduated cylinders, and sedimentation was monitored over a given time by taking readings of heights of suspension and sediment to ascertain stability.

Sedimentation volume (F) was determined by the formula:

$$F = (Vu / V_o)$$

where:

F = Sedimentation volume (dimensionless)

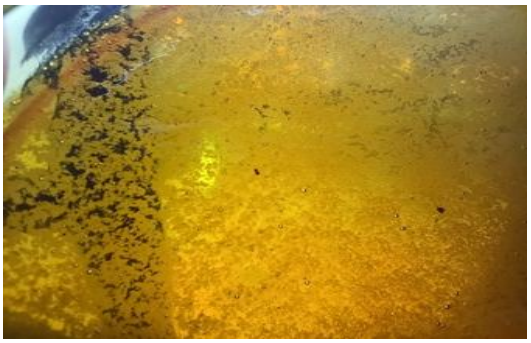
Vu = Final sediment volume after settling

V_o = Initial total volume of suspension

RESULTS AND DISCUSSION

Preparation of Phytosomes

The phytosomes were prepared by using Anti solvent precipitation method.



a)

b)

Figure 1: Phytosomes of IMEE a) Formation Stage b) Dried Phytosome powder

Evaluation of Phytosomes

a. Particle size

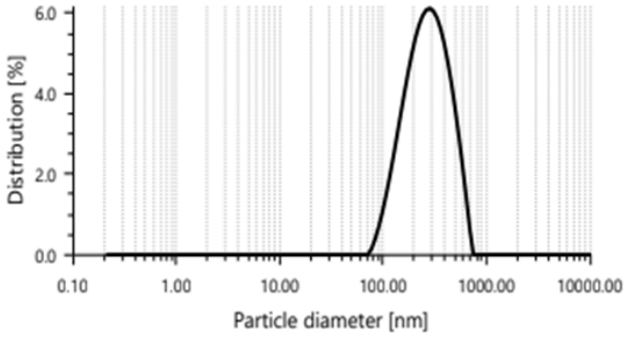


Figure 2: Particle size of Phytosomes

The particle size of phytosomes was found to be 153.67nm. This was in accordance with the particle size range of phytosomes.

b. Zeta potential

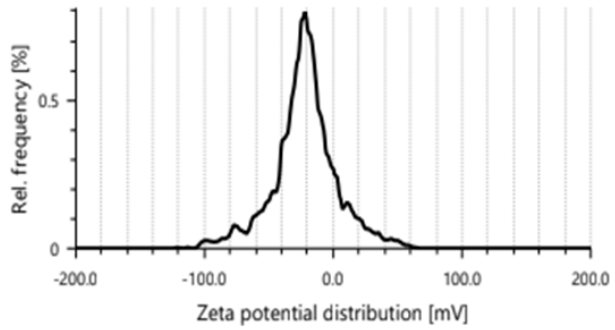


Figure 3: Zeta potential distribution of Phytosomes

The zeta potential of phytosomes were found to be -25Mv, which indicates phytosomes moderately stable.

c. Scanning Electron Microscopy

SEM analysis confirmed the successful synthesis of phytosomes from *Ipomoea mauritiana* ethanolic extract. The spherical shape and smooth surface reveal good vesicular structure, which is critical for stability and bioavailability improvement. Uniform distribution of phytosome particles also reveals the effectiveness of the preparation process used.

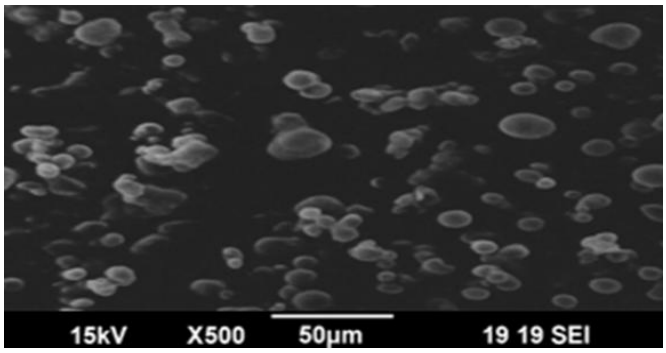


Figure 4: SEM image of Phytosomes

FORMULATION AND EVALUATION OF SUSPENSION

Formulation of suspension

The phytosome loaded anti-mycobacterial suspension was prepared.

a) b)

Figure 5: Formulated phytosome loaded anti-mycobacterial suspension a) in beaker and b) in amber storage bottle

Evaluation of Phytosomes

a. Organoleptic properties

Table 2: Organoleptic parameters of formulated suspension

Sl. No	Parameters	Observations
1.	Nature	Liquid
2.	Colour	Yellowish to light brown
3.	Odour	Pleasant
4.	Clarity	Opaque
5.	Texture	Suspension

b. Determination of pH

pH range of the formulation was found to be 5.60± 0.14.

c. Viscosity

Viscosity of prepared suspension was found to be 126.34 cp.

d. Sedimentation Volume

The experimentally determined sedimentation rate of the prepared suspension was measured. The suspension had a

sedimentation rate of 0.96 cm/h, which is the measure of particle settling over time. This value reflects the relative stability of the formulation with a lower sedimentation rate indicating better suspension stability.

e. Redispersibility

The redispersibility of the formulated suspension was found to be excellent, as the sediment was completely dispersed with only one inversion of the container.

CONCLUSION

Overall, this work successfully prepared a phytosome-based anti-mycobacterial suspension of *Ipomoea mauritiana* tuber extract through the anti-solvent precipitation technique. Phytosome characterization proved their suitable nanoscale particle size, moderate stability based on zeta potential, and good surface morphology facilitating increased bioavailability. The ultimate suspension showed desirable physicochemical characteristics, such as appropriate pH, viscosity, stability, and good redispersibility, and thus would be a good dosage form of herbal drug delivery. The results validate the potential application of phytosomal systems in enhancing therapeutic efficacy of herbal medicines, especially in treating mycobacterial infections. Additional in vivo research is suggested to confirm pharmacological performance and clinical efficacy.

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