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Development And Evaluation Of Niosomal Formulation Containing Hydroalcoholic Extracts Of Blumea Lacera (Burm.F.) DC. Leaves

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Blumea lacera (Burm.f.) DC., a medicinal plant from the Asteraceae family, is traditionally used for its anti-inflammatory, antimicrobial, and wound-healing properties. Despite its diverse phytochemical profile, poor solubility and stability of its bioactive compounds limit its therapeutic applications. The current study aimed to develop and evaluate a niosomal drug delivery system containing hydroalcoholic extract of B. lacera leaves to enhance its bioavailability and therapeutic efficacy. Niosomes were prepared using the thin-film hydration method employing non-ionic surfactants (Span 60 and Tween 60) and cholesterol. The formulation was optimized based on entrapment efficiency, vesicle size, zeta potential, and drug content. The results suggest that the niosomal encapsulation of B. lacera extract enhances its physicochemical stability and provides a promising approach for effective herbal drug delivery.

Key-words: Niosomes, Plant Extract, Evaluation.

Introduction

Drug delivery system ensures the reach of adequate amount of drug to the targeted part of the body. It also ensures therapeutic response, while minimizing the adverse effects of the drug. Topical drug delivery system is a localized drug delivery system that involves introduction of drug on any surface of the body, from where, the drug can be absorbed and produce action. Skin, vaginal, rectal and ophthalmic are some of the routes for the topical delivery of the drugs. [1] Traditional and conventional medicinal approaches have certain limitations, such as, drug degradation and loss, harmful adverse reactions, lesser bioavailability and, accumulation of adequate amount of drug at the required target area. These limitations can be addressed by novel drug delivery systems (NDDS). [2] NDDS is presently used widely in allopathic and other medicinal systems. Integrating the knowledge of traditional herbal medicines and NDDS concepts can provide safer and more effective formulations for the disease. Topical drug administration is a localized drug delivery system anywhere in the body through ophthalmic, rectal, vaginal and skin as topical routes. Skin is one of the most readily accessible organs on

human body for topical administration and is main route of topical drug delivery system. Herbal medicines, although widely accepted for their efficacy and minimal side effects, often face limitations such as low bioavailability, rapid metabolism, and degradation in the gastrointestinal tract. Blumea lacera (Burm.f.) DC. is an aromatic, annual herb known in traditional systems of medicine for its antioxidant, antimicrobial, hepatoprotective, and anti-inflammatory effects. Phytochemical investigations have revealed the presence of alkaloids, flavonoids, terpenoids, phenolics, and essential oils. Niosomes, non-ionic surfactant-based vesicles, offer an effective strategy for enhancing the bioavailability of plant extracts by protecting bioactives from degradation, allowing controlled release, and improving penetration. [3] This study focuses on the development and physicochemical evaluation of a niosomal formulation loaded with hydroalcoholic extract of B. lacera leaves.

Materials and Methods

Selection and Procurement of Plant Material

The anti-fungal medicinal plants viz., leaves of Blumea lacera (Burm.f.) DC.was selected based on their traditional uses and were procured from Indore region of Madhya Pradesh and was authenticated from Botanist Dr. Smruti Sohani.

Extraction of plant material

The shade dried coarsely powdered plant material (500 gm) i.e., leaves of Blumea lacera (Burm.f.) DC. was extracted using ethanol:water (70:30) in soxhlet apparatus for about 72 hours. After extraction the filtrate was dried in rotator evaporator and was stored for further use.
spectrophotometrically. [4]

Development of Novel Carrier Systems containing Drugs (Niosomes)

Selection of surfactants for niosomes formation

The different nonionic surfactants viz., span 20, span 60, tween 40 & tween 60 grades was selected for present study. [5]

Preparation of Drug Loaded Niosome

Extract loaded niosomes were formulated by using thin film hydration technique and the different nonionic surfactants (span 20, span 60, tween 40 & tween 60) grades in different extract:surfactant:Cholesterol ratios as 1:1:1, 1:2:1, 1:1:2. Accurately weighted quantities of surfactant and Cholesterol were dissolved in 5 ml chloroform using a 100 ml round bottom flask. The lipid solution was evaporated by rotary shaker. The flask was rotated at 135 rpm until a smooth and dry lipid film was obtained. The film was hydrated with 5 ml phosphate buffer saline (PBS) of pH 7.4 containing drug for 3 hours with gentle shaking. The niosomal suspension was further stabilized by keeping at 2-8ºC for 24 hours. [5-6]

Table 1: Composition of Niosomal of Plant Extract containing leave extract of Blumea lacera (Burm.f.) DC.

Formulation Code	Surfactant used	Extract: Surfactant:Cholesterol Ratio	Solvent	Weight taken (mg)
NBL-1	Span 20	1:1:1	Chloroform	100:100:100
NBL-2		1:2:1	Chloroform	100:200:100
NBL-3		1:1:2	Chloroform	100:100:200
NBL-4	Span 60	1:1:1	Chloroform	100:100:100
NBL-5		1:2:1	Chloroform	100:200:100
NBL-6		1:1:2	Chloroform	100:100:200
NBL-7	Tween 40	1:1:1	Chloroform	100:100:100
NBL-8		1:2:1	Chloroform	100:200:100
NBL-9		1:1:2	Chloroform	100:100:200
NBL-10	Tween 60	1:1:1	Chloroform	100:100:100
NBL-11		1:2:1	Chloroform	100:200:100
NBL-12		1:1:2	Chloroform	100:100:200

Evaluation of Niosomes

Niosomes formulations were characterized with respect to shape, particle size distribution, entrapment efficiency anddrug content.. Shape and morphology of niosomal formulations were determined by optical microscopy and Scanning Electron Microscopy (SEM) **.** The particle size of the niosomal suspension was determined by optical microscopy. Entrapment efficiency of niosomal formulations was determined by centrifugation method. Drug content was determined by disrupting the niosomal formulation by propane-1-ol, diluted suitably using phosphate buffer pH 6.8 and analysed for the drug content spectrophotometrically at suitable wavelength. [5-6]

Results and Discussion

The evaluation parameters involving hydroalcoholic extracts of Blumea lacera (Burm.f.) DC. leaves encompass a comprehensive set of physicochemical and biological assessments. These include organoleptic evaluation**,** entrapment efficiency**,** particle size analysis**,** zeta potential**,** and morphological characterization using optical and electron microscopy to ensure optimal formulation characteristics. These parameters collectively validate the therapeutic potential, stability, and efficiency of the herbal extract-loaded niosomes as promising carriers for anti-fungal applications. Table 2 represents the results of the study.

Table 2:Particle size of Niosomal formulation containing hydroalcoholic extracts of Blumea lacera (Burm.f.) DC. leaves

Formulation Code	Particle size (µm)	% EE	Drug content (%)
NBL-1	5.52±0.50	62.39±0.18	94.29±0.22
NBL-2	6.86±0.80	70.18±0.21	95.15±0.18

NBL-3	6.60±0.70	73.82±0.22	96.21±0.10
NBL-4	2.22±0.20	71.29±0.34	94.31±0.11
NBL-5	4.06±0.27	76.26±0.42	96.28±0.15
NBL-6	6.09±0.05	78.19±0.11	95.11±0.17
NBL-7	1.68±0.02	81.12±0.17	97.29±0.43
NBL-8	2.80±0.77	86.23±0.43	98.89±0.27
NBL-9	3.26±0.56	77.16±0.22	97.91±0.14
NBL-10	2.76±0.68	70.21±0.16	96.22±0.17
NBL-11	2.28±0.69	69.46±0.31	97.14±0.31
NBL-12	3.18±0.27	78.48±0.29	96.28±0.43

All reading are expressed as mean ± S.D. (n = 3)

Conclusion

The present study successfully developed and optimized a niosomal formulation containing hydroalcoholic extract of Blumea lacera leaves. The formulation demonstrated high entrapment efficiency, desirable nanoscale size, good stability, and sustained release behavior. Niosomal encapsulation offers an effective approach to enhance the therapeutic potential and bioavailability of phytoconstituents. Further pharmacological studies and clinical evaluations are warranted to confirm its efficacy in vivo.

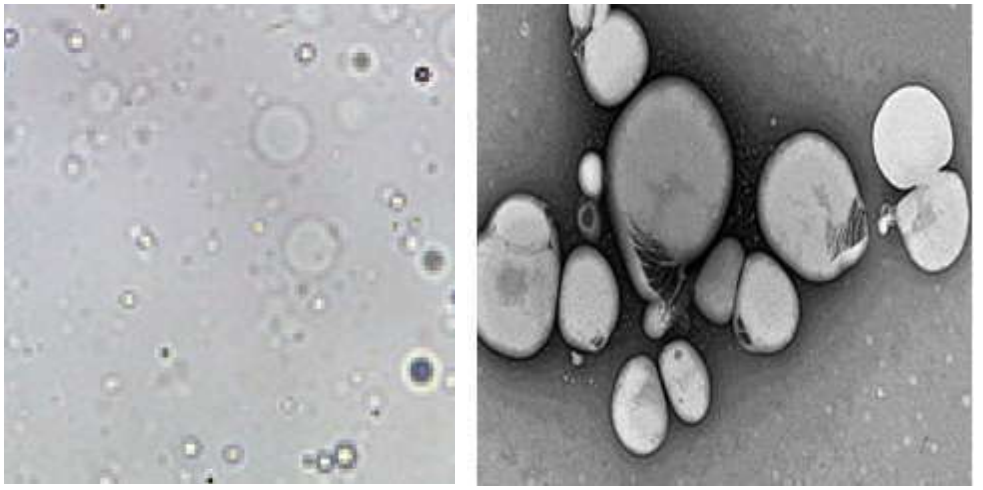

Fig. 1: Optical microscopy and SEM of niosomal formulation of NBL-8

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