2026 Volume: 02 Issue: 07 www.ijrpa.com ISSN 2456-9995 Research Article

International Journal Research Publication Analysis

Page: 01-05

FORMULATION AND EVALUATION OF CETRIMIDE LOADED NIOSOMES

Vinod Matole*, Kirti Arya, Yuvraj Dhakane

Shivai Charitable Trust's College of Pharmacy, Koregaonwadi Tal. Omerga Dist. Dharashiv, Maharashtra 413606 India.

Article Received: 28 May 2026
Article Revised: 17 June 2026
Published on: 06 July 2026

***Corresponding Author: Vinod Matole**
Shivai Charitable Trust's College of Pharmacy, Koregaonwadi Tal. Omerga Dist. Dharashiv, Maharashtra 413606 India.

DOI: https://doi-doi.org/101555/ijrpa.4639

ABSTRACT

Niosomes are non-ionic surfactant vesicles used as novel drug delivery systems to improve the stability, bioavailability, and controlled release of drugs. The present study focuses on formulation and evaluation of cetrimide loaded niosomes prepared by thin film hydration method. Different formulations were prepared using Span 60 and cholesterol in varying ratios.

Prepared formulations were evaluated for vesicle size, entrapment efficiency, drug content, pH, zeta potential, stability, and in vitro drug release studies. The optimized formulation showed good vesicle formation, sustained drug release, and improved stability. The study demonstrates the potential application of niosomal systems in topical drug delivery.

KEYWORDS: Noisome, Cetrimide, NDDS, Surfactant.

INTRODUCTION

Novel drug delivery systems are developed to improve therapeutic effectiveness and enhance patient compliance. Niosomes are microscopic lamellar structures formed by non-ionic surfactants and cholesterol. These vesicles are capable of entrapping both hydrophilic and lipophilic drugs, thereby improving drug penetration and reducing side effects. Cetrimide is a quaternary ammonium antiseptic agent widely used in topical formulations because of its broad-spectrum antimicrobial activity. Conventional topical preparations often show limited retention and rapid drug release, which may reduce efficacy. Niosomal drug delivery systems improve sustained release and enhance stability of drugs.

Advantages of niosomes include improved drug stability, controlled release, enhanced penetration, reduced toxicity, and better patient compliance. Due to these advantages, niosomes are increasingly used in targeted and controlled drug delivery systems[1-3].

OBJECTIVES

- To formulate cetrimide loaded niosomes.
- To optimize surfactant and cholesterol ratio.
- To evaluate vesicle size and entrapment efficiency.
- To study in vitro drug release profile.
- To perform stability studies of prepared formulations.

MATERIALS AND CHEMICALS

Cetrimide, Span 60, Cholesterol, Chloroform, Methanol, Phosphate Buffer pH 7.4, Distilled Water, and other analytical grade chemicals were used in the study. Span 60 was selected due to its excellent vesicle-forming properties and high phase transition temperature. Cholesterol was used as a stabilizer to improve vesicle rigidity and reduce leakage of entrapped drug.

Formulation Table

Table no. 1: Formulation Table.

Ingredients	Function	F1	F2	F3
Cetrimide	Drug	0.5 g	0.5 g	0.5 g
Span 60	Surfactant	1 g	1.5 g	2 g
Cholesterol	Stabilizer	0.5 g	0.5 g	0.5 g
Chloroform:Methanol	Solvent	10 mL	10 mL	10 mL
Phosphate Buffer	Hydration Medium	10 mL	10 mL	10 mL

Evaluation Results

Table no. 2: Evaluation Result.

Parameters	F1	F2	F3	Observation
Vesicle Size	210 nm	170 nm	240 nm	F2 showed optimum size
Entrapment Efficiency	75%	88%	72%	F2 highest entrapment
Drug Content	84%	98%	89%	Uniform distribution
pH	6.7	6.8	7.2	Suitable for topical use
Stability	Good	Excellent	Moderate	F2 most stable
Drug Release	78%	91%	82%	Controlled release in F2

METHODOLOGY[4-8]

Thin film hydration method was used for preparation of niosomes. Span 60 and cholesterol were dissolved in chloroform:methanol mixture (2:1). The solvent mixture was evaporated using rotary evaporator to form a thin lipid film. The film was hydrated using phosphate buffer containing cetrimide. Hydration was continued for one hour and sonication was carried out to reduce vesicle size. Prepared formulations were stored under refrigerated conditions.

The thin film hydration method is considered one of the most reliable methods for preparing niosomal formulations because it produces stable vesicles with better drug entrapment. Sonication further improves uniformity and reduces particle size.

Evaluation Parameters[9-10]

The prepared niosomes were evaluated for vesicle size analysis, entrapment efficiency, drug content, pH determination, zeta potential, in vitro drug release, and stability studies. All evaluations were performed in triplicate and average values were reported.

Vesicle size analysis was performed to determine particle size distribution.
Entrapment efficiency was evaluated to measure the percentage of drug entrapped within vesicles.

Drug content studies confirmed uniform drug distribution among formulations.

Stability studies were performed under refrigerated conditions.

RESULTS AND DISCUSSION

The prepared formulations showed successful vesicle formation. Increase in surfactant concentration improved entrapment efficiency up to an optimum level. Formulation F2 showed better vesicle size distribution and sustained drug release compared to other batches.

Span 60 was selected because of its high phase transition temperature and superior vesicle-forming ability. Cholesterol improved rigidity and stability of vesicles. Entrapment efficiency increased with increase in surfactant concentration up to F2 formulation.
Further increase in concentration resulted in aggregation and reduced uniformity.

The vesicle size observed in optimized formulation was suitable for topical drug delivery. In vitro drug release studies demonstrated sustained release behavior. This may improve therapeutic efficacy and reduce frequent application of the formulation. Stability studies indicated that refrigeration conditions were more suitable for maintaining vesicle integrity.

The optimized formulation exhibited acceptable pH and excellent stability. Controlled release behavior observed in F2 formulation indicates that niosomes can improve drug retention and reduce dosing frequency. These findings support the application of niosomal carriers in topical drug delivery systems.

CONCLUSION

Cetrimide loaded niosomes were successfully prepared using thin film hydration method. Among all formulations, F2 showed optimum characteristics such as good entrapment efficiency, proper vesicle size, and sustained release profile. The study concludes that niosomes are promising carriers for topical delivery of cetrimide.

REFERENCES

1. Chen S, Hanning S, Falconer J, Locke M, Wen J. Recent advances in non-ionic surfactant vesicles (niosomes): Fabrication, characterization, pharmaceutical and cosmetic applications. Eur J Pharm Biopharm. 2019;144:18-39. doi:10.1016/j.ejpb.2019.08.015.
2. Pardakhty A, Moazeni E. An illustrated review on nonionic surfactant vesicles (niosomes) as an approach in modern drug delivery: Fabrication, characterization, pharmaceutical and cosmetic applications. J Drug DelivSci Technol. 2021;61:102234. doi:10.1016/j.jddst.2020.102234.
3. Kazi KM, Mandal AS, Biswas N, Guha A, Chatterjee S, Behera M, et al. Niosome: A future of targeted drug delivery systems. J Adv Pharm Technol Res. 2010;1(4):374-380.
4. Yeo LK, Chaw CS, Elkordy AA. The effects of hydration parameters and co-surfactants on methylene blue-loaded niosomes prepared by the thin film hydration method. Pharmaceutics. 2019;12(2):46. doi:10.3390/ph12020046.
5. Rinaldi F, Del Favero E, Moeller J, Hanieh PN, Passeri D, Rossi M, et al. Hydrophilic silver nanoparticles loaded into niosomes: Physical-chemical characterization in view of biological applications. Nanomaterials (Basel). 2019;9(8):1177. doi:10.3390/nano9081177.

6. Machado ND, Silva OF, De Rossi RH, Fernández MA. Cyclodextrin modified niosomes to encapsulate hydrophilic compounds. RSC Adv. 2018;8(52):29909-29916. doi:10.1039/C8RA05021J.
7. Abdelkader H, Abd El-Wahab A, El-Gendy AO, Abou-Taleb HA. Formulation and optimization of lipid- and Poloxamer-tagged niosomes for dermal delivery of terbinafine: Preparation, evaluation, and in vitro antifungal activity. Pharm Dev Technol. 2023;28(9):803-810.
8. Rad ME, Egil AC, Ince GO, Yuce M, Zarrabi A. Optimization of curcumin loaded niosomes for drug delivery applications. Colloids Surf A PhysicochemEng Asp. 2022;654:129921. doi:10.1016/j.colsurfa.2022.129921.
9. Aziz DE, Abdelbary AA, Elassasy AI. Investigating superiority of novel bilosomes over niosomes in the transdermal delivery of diacerein: Characterization, in vitro and in vivo studies. J Liposome Res. 2019;29(1):73-85.
10. Khan I, Saeed K, Khan I. A state-of-the-art review on the recent advances of niosomes as a targeted drug delivery system. Int J Pharm. 2022;624:121878. doi:10.1016/j.ijpharm.2022.121878.