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Research Article

Niosomes-a Vesicular Drug Delivery System for Drug Targeting

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Abstract

Niosomes are aqueous core enclosed in bilayer consisting of cholesterol and one or more non-ionic surfactants. Niosomes are having high penetration through the skin compared to liposome and ethosomes. In a vesicular system, the drug- delivery effectively increases the bioavailability of drug through controlled release of the drug. It provides number of advantages in the drug efficacy, enhancing patient compliance and comfort. Enhanced delivery of drug through the skin and cellular membranes by means of an niosomes carrier opens numerous challenges and opportunities for research and future development of novel improved therapies. This articles deals with the preparation, characteristic / evaluation, applications of niosomes.

Keywords: Surfactant; Cholesterol; Niosomes

Introduction

Controlled drug delivery system has been designed to obtain an optimal drug action and targeting the drug to the particular sites in order to reduce the side effect and improve therapeutic efficacy by preventing undesired drug localization in healthy tissue site and decreasing rapid degradation or elimination of drugs. Transdermal drug delivery system is used as an alternative delivery of drug into the systemic circulation. It is advantageous in avoiding problems of poorly absorbable drugs and enzymatic degradation. In order to increase the number of drugs administered via transdermal route, novel drug delivery systems have to be designed. They include physico-chemical method such as penetration enhancers and biochemical means using liposomes, transferosomes and ethosomes. It also has been reported to enhance permeability in stratum corneum. Niosomes are novel vesicles with enhance penetration compared to the conventional liposomes [1,2].

Advantages of Niosomes [3,4]

a) Targeted drug delivery can be achieved by delivering drug directly to the body part .

b) Enhanced permeation of drug through the skin for transdermal drug delivery.

c) Delivery of hydrophilic and lipophilic drug is possible.

d) Contains non-toxic raw material in formulation.

Disadvantage Of Niosomes

a) Time consuming.

b) It's high production cost.

c) Leakage and fusion of encapsulated drug/molecule.

d) Short half-life.

Methods of preparation

Ether injection method: In this method niosomes are slowly introducing a solution of surfactant dissolved in diethyl ether into warm water maintained at 60 °C. The mixture of ether is injected through 14-gauge needle into an aqueous solution. So, vaporization of ether leads to the formation of single layered vesicles. The vesicle range from 50 to 1000nm5.

Preparation steps

Surfactant is dissolved in solvent. Then injected in warm water which is maintained at 60 °C through a 14 gauze needle. Vaporization form single layered niosomes.

Hand shaking method (thin film hydration technique):

The mixture of surfactant and cholesterol are dissolved in a volatile organic solvent (diethyl either, chloroform or methanol) in a round bottom flask. The solvent is evaporated at the room temperature (20 °C) by using rotary evaporator leaving a thin layer of solid mixture which is deposited on the wall of the flask. The dried film could be again rehydrated with the aqueous phase at 0-60 °C with gentle agitation. This process forms typical multilamellar niosomes 6.

Preparation steps

Surfactant + cholesterol + solvent.

Remove organic solvent at Room temperature.

Thin layer formed on the Walls of flask.

Film can be rehydrated to form multilamellar Niosomes.

Characterization of Niosomes

Entrapment efficiency

The determination of the entrapped drug is identifying by using a complete vesicle disruption using 50% n-propanol or 0.1% Triton X-100 and analyzing the resultant solution by appropriate assay method for the drug.

Measurement of vesicle size

Vesicle size was measured on a particle size analyzer (Laser diffraction particle size analyzer).

Drug content

Niosomes which are prepared was taken into a standard volumetric flask. Then they were analyzed with solvent. Then 1ml of this was subsequently diluted with phosphate buffer (pH 7.4). The absorbance was measured, and the drug content was calculated from the calibration curve [5,6].

Stability studies

To determine the stability, the niosomes are optimized under batch, and it was stored in airtight sealed vials at different temperatures. The samples are checked at regular intervals of time like (0, 1, 2, and 3months), observed for color change, surface characteristics and tested for the percentage drug retained after being hydrated to form niosomes. Then they are analyzed by using the suitable analytical methods such as (UV spectroscopy, HPLC methods etc).

Drug content

The drug content of the niosomes are determined by using the ultraviolet spectrophotometer. This can be quantified by a modified high-performance liquid chromatographic method [7,8].

In-Vitro Methods for Niosomes

In vitro drug release can be done by Dialysis Tubing Franz Diffusion Cell

Dialysis tubing

It could be achieved by using dialysis tubing. The niosomes which are placed in the prewashed dialysis tubing they are hermetically sealed. The niosomes which are sealed in the dialysis sac is dialyzed by using a suitable dissolution medium at room temperature and then the samples are withdrawn from the medium at suitable intervals, centrifuged and analyzed by using suitable method (U.V. spectroscopy, HPLC etc).

Franz diffusion cell

It can also be performed by using the Franz diffusion cell. The niosomes are kept under the donor chamber which is fitted with a cellophane membrane, then dialyzed against a suitable dissolution medium; the samples are withdrawn from the medium at suitable intervals, and the drug content is analyzed by using suitable method (U.V spectroscopy, HPLC, etc). the maintenance of sink condition is essential [9,10].

Niosomal gel preparation

The niosomal gel preparation involves preparation of gel base, carbopol 934 is commonly used gel and at low concentration it forms good consistency transparent gel. It will be prepared by dispersing Carbopol 934 in distilled water in which glycerol is previously added. To this accurately weighed quantity of methyl paraben and propyl paraben were added and the mixture was neutralize by adding triethanolamine. Then the niosomal formulation was slowly added to carbopol 934 gel base with stirring to get the niosomal gel [11].

Evaluation of Niosomal Gel

PH Measurement Gel

The pH of gel was measured by using pH meter.

Viscosity

Viscosity was determined by Brookfield viscometer, spindle s64.

Durg content of formulated gels

Drug content was estimated by dissolving 100mg of formulation in methanol and filtered. The volume was made up to 100ml and the absorbance was measured at 212nm11.

In Vitro diffusion study

In vitro diffusion study was carried out by using Franz diffusion cell with cellophane dialysis membrane of grade 110.

Applications of Niosomes [12-14]

The applications of niosomes, which is widely used to treat a enormous diseases:

a) It is used as Drug Targeting.

b) It is used as Anti-neoplastic Treatment i.e. Cancer Disease.

c) It is used as Leishmaniasis i.e. Dermal and Mucocutaneous infections e.g. Sodium stibogluconate.

d) It is used as a delivery of Peptide Drugs.

e) It is used in Studying Immune Response.

f) Niosomes as Carriers for Hemoglobin.

g) It is used in ophthalmic drug delivery.

Conclusion

As niosomes are made-up of nonionic surfactants so these are more stable, safe and convenient to handle when compared to the other ionic drug carriers such as (liposomes and ectosomes). Targeting of the drug at the specific tissue site by incorporating into it. Niosomes are well preferred in the targeted drug delivery system and when compared to liposomes, so it can be used as alternative drug delivery system and also having various advantages over liposomes such as cost, stability etc. They have ability to encapsulate different type of drugs within their structure like anti infective, anticancer drug. The various types of drug deliveries are possible by using niosomes in targeting, ophthalmic, topical, parenteral etc.

References

1. Gandhi A, Sen SO, Paul A (2012) Current trend in noisome as vesicular drug delivery system. Asian Asian Journal of Pharmacy and Life Science 2(2):339-353.
2. Kazi KM, Mandal AS, Biswas N, Guha A, Chatterjee SA, et al. (2010) Niosome: a future of targeted drug delivery systems. J Adv Pharm Tech Res 1(4):374-380.
3. Sahin NO (2007) Niosomes as nanocarrier systems. In: Mozafari MR (Edt.), Nanomaterials and nanosystems for biomedical applications. Dordrecht: Springer p: 67-82.
4. Bairwa NK, Choudhary Deepika (2011) Proniosome: A review. Asian Journal of Biochemical and Pharmaceutical Research 2(1): 690-694.
5. Suzuki K, Sokan K (1990) The Application of Liposome's to Cosmetics. Cosmetic and Toiletries 105: 65-78.
6. Satturwar PM, Fulzele SV, Nande VS, Khandare JN (2012) Formulation and evaluation of ketoconazole Niosomes. Indian J Pharm 64(2):155-158.
7. Vyas SP, Khar RK (2008) Niosomes Targeted and Controlled Drug delivery pp: 249-279.
8. Gibaldi M, Perrier D (1982) Pharmacokinetics. (2nd edn.), New York, Marcel Dekker, Inc, pp: 127-134.
9. Namdeo A, Jain NK (1999) Niosomal delivery of 5- fluorouracil. J Microencapsul 16(6): 731-740.
10. Bhaskaran S, Panigrahi L (2002) Formulation and Evaluation of Niosomes using Different Nonionic Surfactant. Ind J Pharm Sci 63:1-6.
11. Balasubramanian A (2002) Formulation and *In-Vivo* Evaluation of Niosome Encapsulated Daunorubicin Hydrochloride. Drug Dev Ind Pharm 28(10):1181-1184.
12. Sattuwar PM, Khandare JN, Nande VS (2001) Niosomal delivery of ketoconazole. Indian Drugs 38(12): 620-623.
13. Buckton GH (1995) Interfacial phenomena in Drug Delivery and Targeting. Academic Publishers Switzerland pp: 154-155.
14. Jain NK (2004) Controlled & Novel Drug Delivery, (1st edn.), published by CBS Publishers & Distributors, New Delhi.

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