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Review Article

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Niosomes and Its Application-A Review

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Abstract

Niosomes are a Novel Drug Delivery System (NDDS). A number of NDDS has been reported through various route of administration ,to achieve controlled and targeted drug delivery. Controlled release drug products are often formulated to permit the establishment and maintenance of any concentration at target site for longer intervals of time. One such technique of drug targeting is Niosomes. In the Niosomes medication is incapsulated in a vesicle. It is microscopic in structure and lies in nanometric scale. The focus of this review is to study the application of niosomes.

Key words: Niosomes, NDDS, Controlled Release, Targeted Drug Delivery, Vesicles

Contents

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1. Introduction

Niosomes are lamellar structures that are microscopic in size. They constitute of nonionic surfactant of the alkyl or dialkyl polyglycerol ether class and cholesterol with subsequent hydration in aqueous media. The surfactant molecules tend to orient themselves in such a way that the hydrophilic ends of the non-ionic surfactant point outwards, while the hydrophobic ends face each other to form the bilayer. Controlled release drug products are often formulated to permit the establishment and maintenance of any concentration at target site for longer intervals of time. One such technique of drug targeting is niosomes. Niosomes are microscopic lamellar structures formed on admixture of a nonionic surfactant, cholesterol and diethyl ether with subsequent hydration in aqueous media. They behave *in vivo* like liposomes prolonging the circulation of entrapped drug and altering its organ distribution. Niosomal drug delivery has been studied using various methods of administration including intramuscular, intravenous, peroral and transdermal. In addition, as drug delivery vesicles, niosomes have been shown to enhance

absorption of some drugs across cell membranes, to localize in targeted organs and tissues and to elude the reticuloendothelial system. Niosomes has been used to encapsulate colchicines, estradiol, tretinoin, dithranol, enoxacin and for application such as anticancer, antitubercular, anti-leishmanial, anti-inflammatory, hormonal drugs and oral vaccine.

2. Advantages of Niosomes [1]

a. Since the structure of the noisome offers place to accommodate hydrophilic, lipophilic as well as ampiphilic drug moieties, they can be used for a variety of drugs.
b. Niosomes exhibits flexibility in their structural characteristics (composition, fluidity and size) and can be designed according to the desired situation.
c. They improve the therapeutic performance of the drug by protecting it from the biological environment and restricting effects to target cells, thereby reducing the clearance of the drug.
d. Niosomes can act as a depot to release the drug slowly and offer a controlled release.
e. They can increase the oral bioavailability of drugs.
f. They are osmotically active and stable.
g. They increase the stability of the entrapped drug.
h. They can enhance the skin penetration of drugs.
i. They can be made to reach the site of action by oral, parenteral as well as topical routes.
j. The surfactants are biodegradable, biocompatible, and non immunogenic
k. The niosomal dispersions in an aqueous phase can be emulsified in a non-aqueous phase to control the release rate of the drug and administer normal vesicles in external non-aqueous phase.
l. Handling and storage of surfactants do not require any special conditions.
m. The vesicle suspension being water based offers greater patient compliance over oily dosage forms

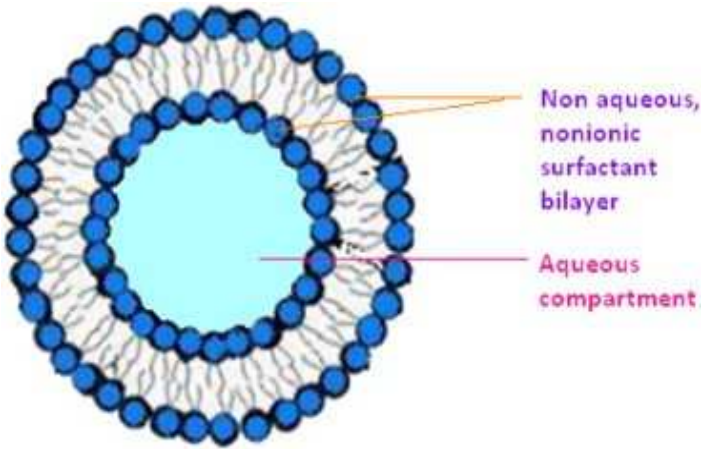

Figure 1. Structure of Niosome (Copied from technotes.alconox.com)

3. Applications of niosomes [2-6]

The application of niosomal technology is widely varied and can be used to treat a number of diseases.

Niosomes as Drug Carriers

Niosomes have also been used as carriers for iobitridol, a diagnostic agent used for X-ray imaging. Topical niosomes may serve as solubilization matrix, as a local depot for sustained release of dermally active compounds, as penetration enhancers, or as rate-limiting membrane barrier for the modulation of systemic absorption of drugs.

Drug Targetting

One of the most useful aspects of niosomes is their ability to target drugs. Niosomes can be used to target drugs to the reticuloendothelial system. The reticulo-endothelial system (RES) preferentially takes up niosome vesicles. The uptake of niosomes is controlled by circulating serum factors called opsonins. These opsonins mark the niosome for clearance. Such localization of drugs is utilized to treat tumors in animals known to metastasize to the liver and spleen. This localization of drugs can also be used for treating parasitic infections of the liver. Niosomes can also be utilized for targeting drugs to organs other than the RES. A carrier system (such as antibodies) can be attached to niosomes (as immunoglobulin's bind readily to the lipid surface of the niosome) to target them to specific organs.

Anti-neoplastic Treatment

Most antineoplastic drugs cause severe side effects. Niosomes can alter the metabolism; prolong circulation and half life of the drug, thus decreasing the side effects of the drugs. Niosomes are decreased rate of proliferation of tumor and higher plasma levels accompanied by slower elimination.

Leishmaniasis

Leishmaniasis is a disease in which a parasite of the genus Leishmania invades the cells of the liver and spleen. Use of niosomes in tests conducted showed that it was possible to administer higher levels of the drug without the triggering of the side effects, and thus allowed greater efficacy in treatment.

Delivery of Peptide Drugs

Oral peptide drug delivery has long been faced with a challenge of bypassing the enzymes which would breakdown the peptide. Use of niosomes to successfully protect the peptides from gastrointestinal peptide breakdown is being investigated. In an in vitro study conducted by oral delivery of a vasopressin derivative entrapped in niosomes showed that entrapment of the drug significantly increased the stability of the peptide.

Use in Studying Immune Response

Due to their immunological selectivity, low toxicity and greater stability; niosomes are being used to study the nature of the immune response provoked by antigens. Nonionic surfactant vesicles have clearly demonstrated their ability to function as adjuvant following parenteral administration with a number of different antigens and peptides.

Niosomes as Carriers for Haemoglobin

Niosomes can be used as carriers for haemoglobin within the blood. The niosomal vesicle is permeable to oxygen and hence can act as a carrier for haemoglobin in anaemic patients.

Other Applications [4-6]

a) Sustained Release

Sustained release action of niosomes can be applied to drugs with low therapeutic index and low water solubility since those could be maintained in the circulation via niosomal encapsulation.

b) Localized Drug Action

Drug delivery through niosomes is one of the approaches to achieve localized drug action, since their size and low penetrability through epithelium and connective tissue keeps the drug localized at the site of administration.

4. Conclusion

Niosomes are widely accepted by research scientist. Niosomes are used for better targeting of the drug at appropriate tissue destination. Niosomes are made up of uncharged single chain surfactant molecules. Toxic drugs which needed higher doses can possibly be delivered safely using niosomal application. Lancome is niosomal formulation. Few cosmetic products are also in research.

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