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A REVIEW ON NIOSOMAL DRUG DELIVERY SYSTEM

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ABSTRACT
Niosomes are non-ionic surfactant vesicles obtained on hydration of synthetic nonionic surfactants, with or without incorporation of cholesterol or their lipids. They are vesicles systems similar to liposomes that can be used as carriers of amphiphilic and lipophilic drugs. Niosomes are promising vehicle for drug delivery and being non-ionic and niosomes are biodegradable, biocompatible non-immunogenic and exhibit flexibility in their structural characterization. Niosomes have been widely evaluated for controlled release and targeted delivery for the treatment of cancer, viral infections and other microbial disease. Niosomes can entrap hydrophilic and lipophilic drugs and can prolong the circulation of the entrapped drug in body. Encapsulation of drug in vesicular system can be predicted to prolong the existence of drug in the systemic circulation and enhance penetration into target tissue, perhaps reduce toxicity if selective uptake can be achieved. This review article focuses on the advantages, Disadvantages, preparation methods, factor affecting, characterizations, invitro methods, drug release kinetics, and applications of niosome.

KEYWORDS: Niosomes, conventional therapy, polymer.

INTRODUCTION

Paul Ehrlich, in 1909, initiated the development for targeted delivery when he envisaged a drug delivery mechanism that would target directly to diseased cell. Drug targeting can be defined as the ability to direct a therapeutic agent specifically to desired site of action with little or no interaction with non target tissue. In noisome, the vesicles forming amphiphile is a non-ionic surfactant such as Span-60 which is usually stabilized by addition of cholesterol and small amount of anionic surfactant such as diacetyl phosphate. The concept of incorporating the drug into noisome for a better targeting of the drug at appropriate tissue destination is widely accepted by researchers and academicians. Various types of drug deliveries can be possible using niosomes like targeting, ophthalmic, topical, parental, etc.[1]

Introduction of Novel Drug Delivery System[2]

Definition

- NDDS refers to the approaches, formulations, technologies & system for transporting a pharmaceutical compound in the body as needed to safely achieve its desire therapeutic effects.
- NDDS should ideally fulfill two prerequisites such as,
  - It should deliver the drug at a rate directed by the needs of the body, over the period of treatment.
  - It should channel the active entity to the site of action.

Merits of NDDS

- Reduces the total amount of drug administered over the period of drug treatment, so it reduces the systemic and local side effects.
- Targeting of the drug molecule towards the tissue (or) organ reduces the toxicity to the normal tissues.
- Improved patient compliance resulting from the reduction in the frequency of doses required to maintain the desired therapeutic response.

Drug delivery carrier[3]

Carriers are used to achieve targeted drug delivery. Carrier is one of the special molecule or system essentially required for effective transportation of loaded drug up to the preselected sites.

Vesicular system carrier for drug delivery[4]

- Vesicles act as the vehicle of choice in drug delivery. Vesicles can play a major role in modelling biological membranes, and in the transport and targeting of active agents. Some important vesicular drug delivery systems are,

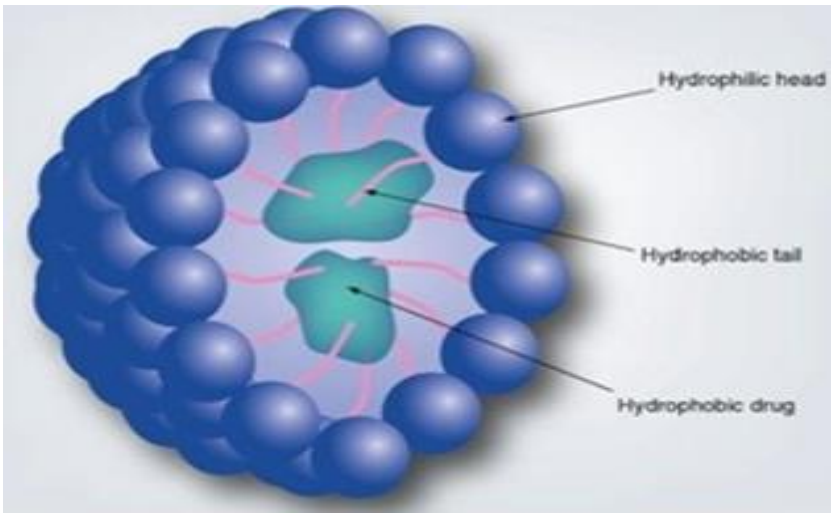
- Liposomes
- Niosomes

Niosomes

- Niosomes or non-ionic surfactant vesicles are microscopic lamellar structures formed on ad mixture of non-ionic surfactant of the alkyl or dialkyl poly glycerol ether class and cholesterol with subsequent hydration in aqueous media.
- Niosomes are unilamellar or multilamellar vesicles formed from synthetic non-ionic surfactants. They are very similar to the liposomes. Niosomal drug delivery is potentially applicable to many pharmacological agents for their action against various diseases.

Structure of niosomes

A typical niosome vesicle would consist of a vesicle forming amphiphile i.e. a non-ionic surfactant such as Span-60, which is usually stabilized by the addition of cholesterol and a small amount of anionic surfactant such as diacetyl phosphate, which also helps in stabilizing the vesicle.



Advantages of Niosomes

1. Use of niosomes in cosmetics was first done by L'Oreal as they offered the following advantages
2. The vesicle suspension being water based offers greater patient compliance over oil-based systems
3. Since the structure of the niosome offers place to accommodate hydrophilic, lipophilic as well as amphiphilic drug moieties, they can be used for a variety of drugs.
4. The characteristics such as size, lamellarity etc. of the vesicle can be varied depending on the requirement.
5. The vesicles can act as a depot to release the drug slowly and offer a controlled release.

Disadvantages of Niosomes

1. Physical instability
2. Aggregation
3. Fusion
4. Leaking of entrapped drug
5. Hydrolysis of encapsulated drugs which limiting the shelf life of the dispersion.

Composition of Niosomes[5]

The two major components used for the preparation of niosomes are,

1. Cholesterol: Cholesterol is used to provide rigidity and proper shape, conformation to the niosomes preparations.
2. Non-ionic surfactants: The role surfactants play a major role in the formation of niosomes. The following non-ionic surfactants are generally used for the preparation of niosomes.

E.g. Spans (span 60, 40, 20, 85, 80)
Tweens (tween 20, 40, 60, 80)

Surfactant used in formulation of Niosomes[5]

- Niosomes are non-ionic surfactant unilamellar or multilamellar vesicles formed from synthetic non-ionic surfactants. The surfactants that are reported to form niosomes are as follows

❖ Ether linked surfactant
❖ Di-alkyl chain surfactant
❖ Ester linked surfactant
❖ Sorbitan Esters surfactant
❖ Poly- sorbates

⦿ **Characterization of niosomes[6]**

❖ Size
❖ Bilayer formation
❖ Number of lamellae
❖ Membrane rigidity
❖ Entrapment efficiency (EE)

Method of preparation of Niosomes[7]

- Ether Injection method
- Thin film hydration technique
- Sonication method

- Reverse phase evaporation technique (REV)
- Micro fluidization
- Multiple membrane extrusion method
- Trans membrane pH gradient (inside acidic) Drug Uptake Process (remote Loading)
- The "Bubble" Method
- Formation of niosomes from proniosomes

Method of separation[7]

- The removal of unentrapped solute from the vesicles can be done by various techniques
- Dialysis
- Gel Filtration
- Centrifugation

Factors Affecting Formation of Niosomes[8]

- Nature of surfactants
- Structure of surfactants
- Membrane composition
- Nature of encapsulated drug
- Temperature of hydration

Stability of Niosomes[9]

- Physical stability
- Chemical stability
- Stability in biological fluids

Application of Niosomes[10]

- Drug targeting
- Anti-neoplastic Treatment
- Leishmaniasis disease
- Delivery of Peptide Drugs
- Use in Studying Immune Response
- Niosomes as Carriers for Haemoglobin
- Transdermal Drug Delivery Systems Utilizing Niosomes

Disease overview

- Cancer known medically as a malignant neoplasm
- It is characterized by a loss in the normal control mechanisms that govern cell survival, proliferation and differentiation.
- It usually expresses cell surface antigens that may be of normal fetal type, may display other signs of apparent immaturity, and may exhibit qualitative or quantitative chromosomal abnormalities, including various translocations and the appearance of amplified gene sequences.
- Cells divide and grow uncontrollably. It may also spread to more distant parts of the body through the lymphatic system or bloodstream. Malignant neoplasm is cancerous while benign neoplasm is not cancerous.
- There are over 200 different known cancers that afflict humans.

Detection and treatment

- Cancer can be detected in a number of ways, once a possible cancer is detected it is diagnosed by microscopic examination of a tissue sample. Imaging techniques such as X-rays, CT scans, MRI scans, PET scans, endoscopy and ultrasound scans are used regularly to detect where a tumor is located and what organs may be affected by it.
- Biopsies and various bio marker tests were also used to detect specific cancers.

Treatment

- Cancer treatment depends on the type of cancer, the stage of cancer, age, health status and additional personal characteristics.
- Chemotherapy
- Radiation therapy
- Surgery Biological therapy
- Hormone therapy
- Gene therapy

Cancer chemotherapy

- Cancer chemotherapy strives to cause a lethal cytotoxic event or apoptosis in the cancer cell that can arrest a tumor's progression.
- The attack is generally directed toward DNA or against metabolic sites essential to cell replication.
- This means that chemotherapeutic drugs may be used to relieve symptoms caused by the cancer and improve the quality of life, even though the drugs may not lengthen life.

CONCLUSION

An effort was made to formulate the Capecitabine Niosomes. The prepared microspheres were able to pass all the evaluation parameters which are necessary for the ideal properties of Niosomes. The prolonged release of the drug from the niosomes suggests that the frequency of administration may be reduced. Further, as the particles are in nanometric size distribution range, the bioavailability may be increased and effective targeting may be achieved. Future investigations pharmacological and toxicological investigations in animals and human volunteers may help to exploit the niosomes as prosperous drug carriers for targeting drugs more efficiently. Hence, conclude that niosomes provide controlled release of drug and these systems are used as drug carriers for the delivery of cytotoxic drugs with fewer side effects.

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