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A REVIEW OF LIPOSOMES AS A DRUG DELIVERY SYSTEM

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ABSTRACT

Liposomes have been considered promising and versatile drug vesicles. Compared with traditional drug delivery systems, liposomes exhibit better properties, including site-targeting, sustained or controlled release, protection of drugs from degradation and clearance, superior therapeutic effects, and lower toxic side effects.

This novel drug delivery system aims to target the drug directly to the site of action. Liposomes are biocompatible and stable they have the unique property to entrap both hydrophilic drug and lipophilic drug (amphipathic nature) to its compartment and lead to a controlled-release effect.

Keywords: liposomes, drug delivery, lipid excipient, drug loading,

INTRODUCTION

Liposomes are self-assembled (phospho)lipid-based drug vesicles that form a bilayer (uni-lamellar) and/or a concentric series of multiple bilayers (multilamellar) enclosing a central aqueous compartment .

Liposomes is useful because act as a carrier for a variety of drugs, having a potential therapeutic action or other properties. Liposome is colloidal carriers, having a size range of 0.01–5.0μm in diameter.

Liposomes have been targeted to specific tissues by attaching specific ligands to their surface. Long-circulating liposomes have also been prepared by grafting the liposome surface with certain chemically and biologically inert synthetic polymers. Current liposomal preparation can combine longevity and targetability.

Liposomes very useful because act as a carrier for a variety of drugs, having a potential therapeutic action or other properties. Liposomes are colloidal carriers, having a size range of 0.01–5.0μm in diameter. Indeed these are bilayer vesicles that are formed when phospholipids are hydrated in excess of aqueous medium or aqueous solution.

STRUCTURE OF LIPOSOMES

Liposomes can be classified as unilamellar vesicles (ULVs), oligolamellar vesicles (OLVs), multilamellarvesicles (MLVs), and multivesicular liposomes (MVLs) depending on the compartment structure and lamellarity. Liposome most often composed of phospholipid and cholesterol.

1) Phospholipids

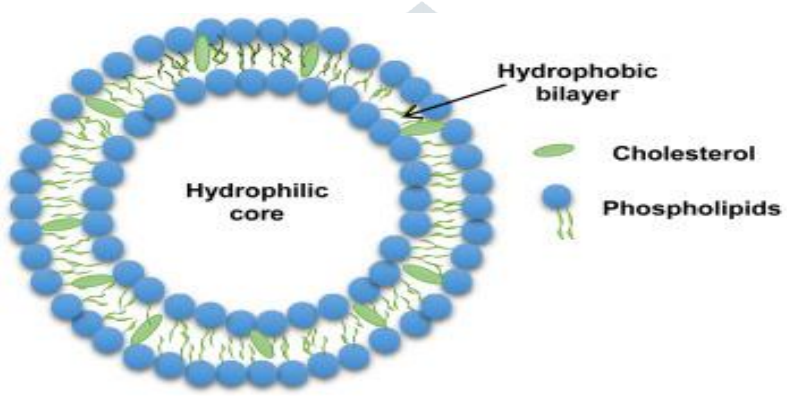
Phospholipids are the major structural components of liposome. The most common phospholipids used in liposomal preparation are

Phosphatidylcholine. Phosphatidyl-choline is an amphiphatic molecule consist of-

- A hydrophilic polar head group, phosphocholine
- A glycerol bridge
- A pair of hydrophobic acyl hydrocarbon chains The chemical structure of naturally occurring Phosphatidylcholine has a glycerol moiety attached to two acyl chains which may be saturated or unsaturated.

2) Cholesterol

Cholesterol is another important structural component of liposome. It is a commonly used sterol. The addition of sterols modulates the function of stability and rigidity. It does not by itself form a bilayer structure. It gets incorporated into phospholipids in a very high concentration up to 1:1 or 2:1 molar ratio of cholesterol to phosphatidyl choline. The presence of cholesterol in the lipid bilayer enhances the stability and form highly ordered and rigid membrane structure.Cholesterol reduces the permeability of water soluble molecules and improves the fluidity and stability of biological membrane. The interaction and destabilization of liposomes was prevented by cholesterol.



LIPOSOMES PREPRATION

Film-Hydration Method

The thin-film hydration method is a traditional technique and is beneficial for loading the lipophilic drug. A thin film is created by evaporating the lipid–solvent solution during flask rotation under vacuum. MLVs suspension can be obtained by adding the aqueous solution to hydrate the lipid film. The particle size can be further reduced to obtain SUVs, and the drug substance can be passively or actively loaded during or after the liposome formation, respectively. The commercial products of AmBisome, Visudyne, and Shingrix (Adjuvant system$AS01_B$) adopt this method for manufacturing.

Ether injection method

This method involves dissolution of lipids in diethyl ether or ether/methanol. This lipid mixture is then injected into an aqueous solution containing material to be encapsulated. This is performed at a temperature of 55-65º C or under reduced pressure. Evaporation of organic solvent is bought about by vacuum application. Finally, liposomes are obtained.

Detergent removal method (removal of non-encapsulated material)

Dialysis the detergents at their critical micelle concentrations (CMC) have been used to solubilize lipids. As the detergent is detached, the micelles become increasingly better-off in phospholipid and lastly combine to form LUVs. The detergents were removed by dialysis. A commercial device called LipoPrep (Diachema AG, Switzerland), which is a version of dialysis system, is obtainable for the elimination of detergents. The dialysis can be performed in dialysis bags engrossed in large detergent free buffers (equilibrium dialysis).

Detergent (cholate, alkyl glycoside, Triton X-100) removal of mixed micelles (absorption) Detergent absorption is attained by shaking mixed micelle solution with beaded organic polystyrene adsorbers such as XAD-2 beads (SERVA Electrophoresis GmbH, Heidelberg, Germany) and Bio-beads SM2 (Bio-Rad Laboratories, Inc., Hercules, USA). The great benefit of using detergent adsorbers is that they can eliminate detergents with a very low CMC, which are not entirely depleted.

ADVANTAGE AND DISADVANTAGE

ADVANTAGE	DISADVANTAGE
Stability increased if liposome prepared via encapsulation	Short half-life
Liposomes offer several advantages in delivering genes to cells.	Production cost is high.
Liposomes can be targeted to specific cells or tissues.	Low solubility.
Site avoidance effect	Fewer stables
Flexibility to couple with site-specific ligands to achieve active targeting	Leakage and fusion of encapsulated drug/molecules

APPLICATIONS OF LIPOSOMES

1) Enhanced solubility of amphiphilic and lipophilic drugs
2) Inactive objective to the cells of the immune system
3) Maintained free system of systemically or locally administered liposomes
4) Precise targeting of Location
5) Improved transfer of hydrophilic, electric molecules such as antibiotics, chelators, plasmids and genes, into cells.
6) Improved penetration into tissues, particularly in the case of dermally functional liposomal dosage forms
7) Vaccination, gene therapy and diagnostics

CONCULSION

Liposomes were successfully utilized as an efficient drug delivery system for various diseases ranging from cancer treatment to pain managing. The biocompatible, biodegradable, and low immunogenicity liposomes

formulation enhanced the pharmacokinetics and pharmacodynamics properties of water insoluble, poor bioavailable and highly toxic drug. Liposomes undergone numerous evolutions in terms of their constituents and manufacturing process to overcome their early limitations. Several liposomes formulation is currently approved in the market to treat various diseases and more than five hundred liposomal formulations are now in different phases of clinical investigation. Nevertheless, liposomes critical challenges are their physical and chemical stability.

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