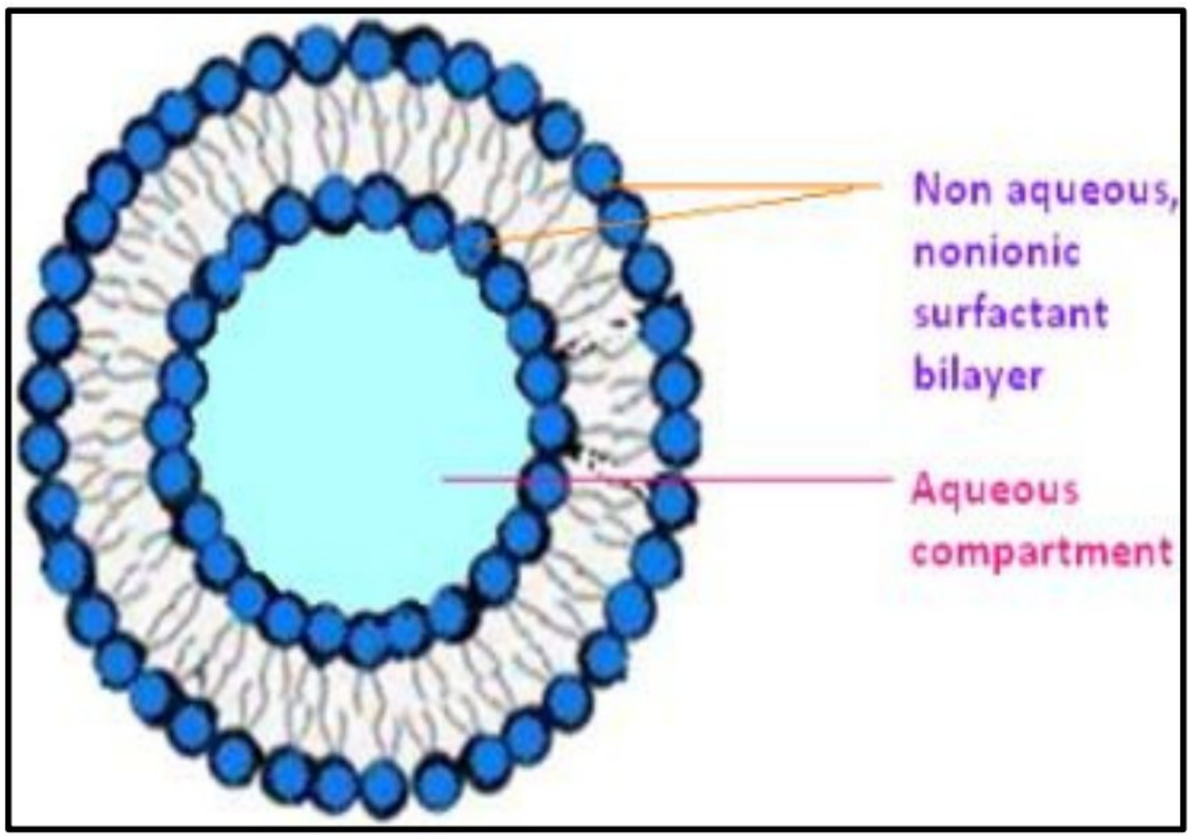
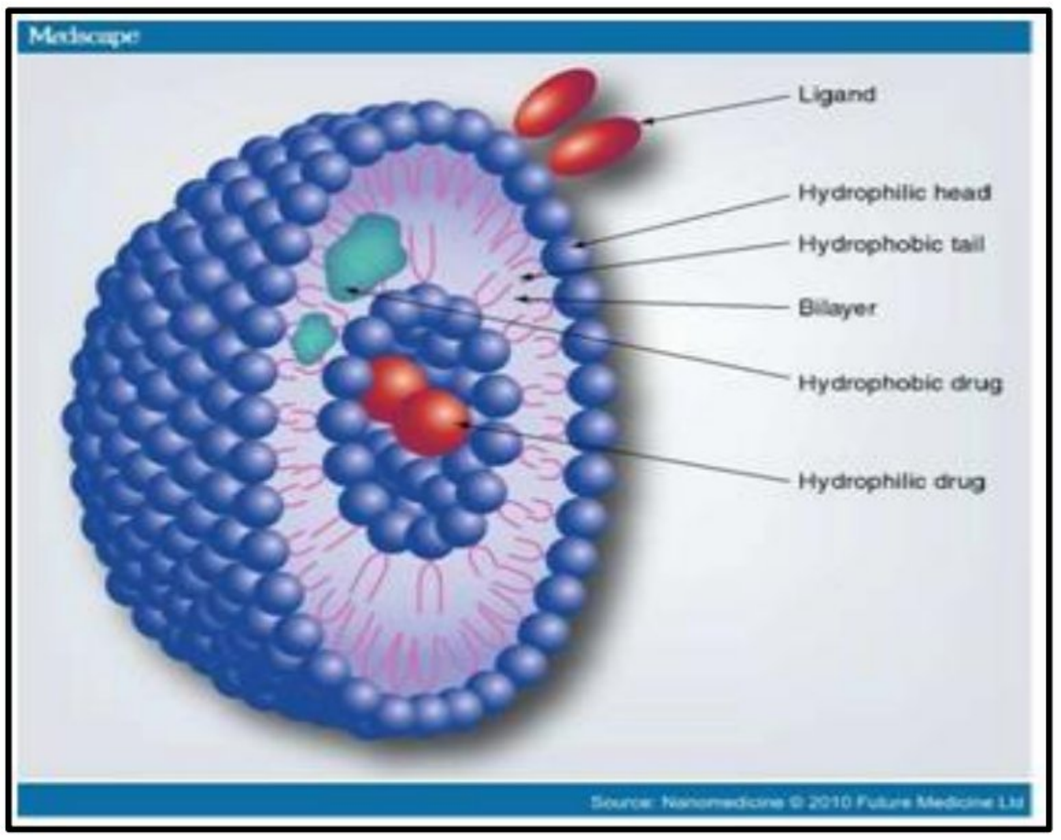
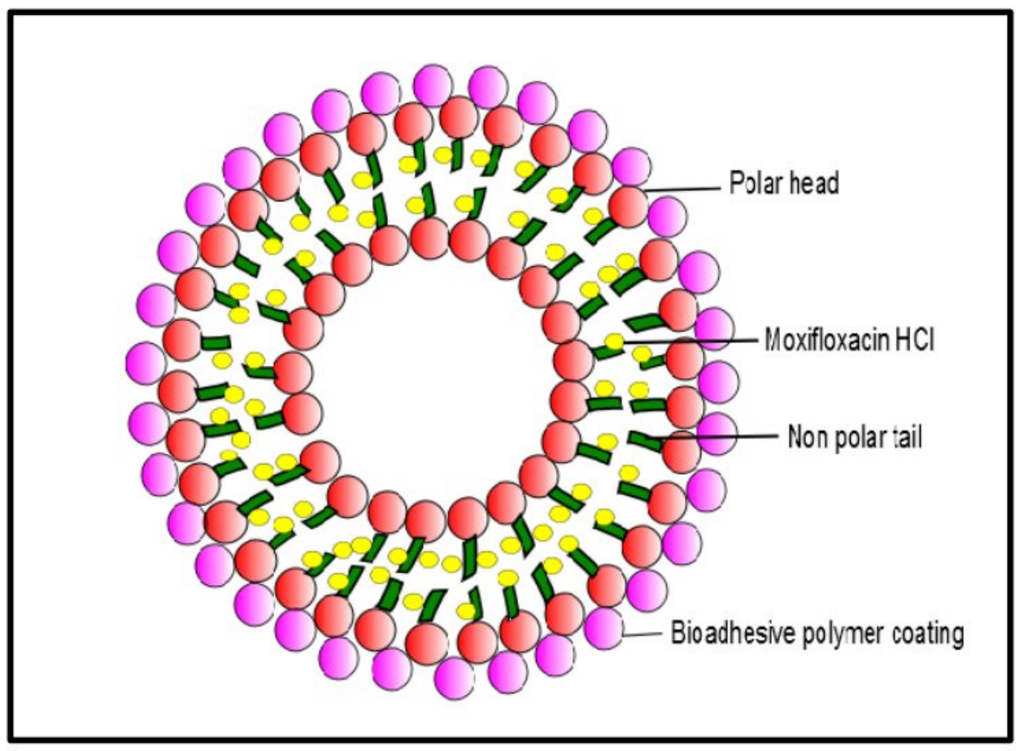
•NIOSOMES

-**Niosomes** (**n**on-**io**nic, **surfactant-based vesicles**) are formed from the self-assembly of non-ionic amphiphiles (surfactant) in aqueous media, resulting in closed bilayer structures.
-The assembly into closed bilayers is rarely spontaneous and usually involves the input of energy such as physical agitation or heat.
-The result is an assembly in which the hydrophobic parts of the molecule are shielded from the aqueous solvent and the hydrophilic head groups have maximum contact with the same.
-This structures are analogous to phospholipid vesicles (liposomes) and can encapsulate aqueous solutes, thereby serving as drug carriers.
-The main advantages such as low cost of production, greater stability, and resultant ease of storage non-ionic surfactants have made this vesicles good alternatives to phospholipids.







Diagrams and images to understand Niosomes

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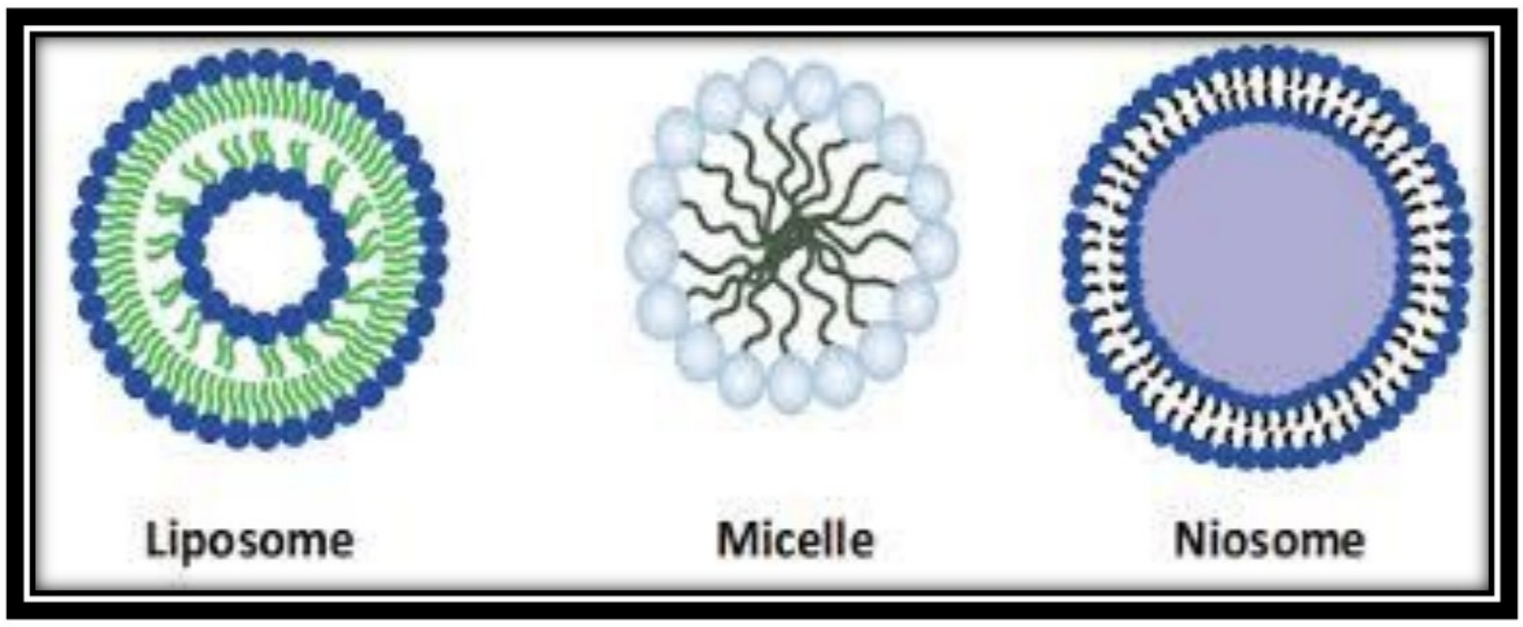

Difference between Liposome and Niosome

➢ Preparation of Niosomes-

-The various used to prepare niosomes are similar to those used to prepare liposomes.

1) Ether Injection Method- The surfactant/cholesterol mixture is dissolved in diethyl ether and injected slowly through a needle into the aqueous phase at 60° C.
-Large unilamellar vesicles (LUVs) are formed during the evaporation of the ether.
-The main disadvantage of this method is that a small amount of ether is often present in the vesicle suspension and is very difficult to remove.

2) Hand Shaking (Film) Method- A surfactant/lipid film is formed by the evaporation of an organic solution of surfactant/lipids.
-This film is then hydrated with a solution of the drug.

3) Sonication- An aqueous pahse is added to the surfactant/cholesterol mixture in a glass vial.
-The mixture is then probe-sonicated for a certain time period.
-Small Unilamellar Veesicles (SUVs) are then formed.

4) Reverse phase evaporation- An oil-in-water (o/w) emulsion is formed from an aqueous solution of the drug.
-The organic solvent is then evaporated to leave niosomes dispersed in the aqueous pahse.
-In certain cases, the resulting gel has to thee further hydrated to yield niosomes.

➢ Evaluation of Niosomes-

-Size, Shape and Morphology
-Entrapment Efficiency
-Osmotic activity
-Vesicle surface charge
- and all other parameters similar to Liposomes.

Advantages of Niosomes-

-The suspension is water based vehicle. This offers high patient compliance in comparison with oily dosage forms.
-They possess an infrastructure consisting of hydrophilic, amphiphilic and lipophilic moieties together and as a result can accommodate drug molecules with a wide range of solubility.
-The characteristics of the vesicle formulation are variable and controllable. Altering vesicle composition, size, lamellarity, tapped volume, surface charge and concentration can control the vesicle characteristics.
-They are osmotically active and stable, as well as they increase the stability of entrapped drug.
- Handling and storage of surfactants requires no special conditions.
- They improve oral bioavailability of poorly absorbed drugs and enhance skin penetration of drugs.
- They can be made to reach the site of action by oral, parenteral as well as topical routes.
- The surfactants are biodegradable, biocompatible and non-immunogenic.
- They improve the therapeutic performance of the drug molecules by delayed clearance from the circulation, protecting the drug from biological environment and restricting effects to target cells.

Disdvantages of Niosomes-

-They have low solubility.
-They have short half-life.
-Production cost is high.
-Fusion.
-Leaking of the entrapped drug.
-Physical instability.

Applications of Niosomes-

1) Anticancer Niosomes- These niosomes, are expected to accumulate within tumours in a similar manner to that of liposomes.
-The niosomal encapsulation of methotrexate and doxorubicin increases drug delivery to the tumour and enables anticancer activity.

2) Niosomes as Vaccines- Niosomal antigens are potent stimulators of cellular and humoral immune response.
-The formulation of antigens as a noisome in a water-in-oil emulsion further increases the activity of antigens.
-The controlled release property of the emulsion formulation is responsible for enhancing immunological response.

3) Niosomes as Topical Delivery- Niosomes are also used for the topical delivery of drugs because of certain advantages such as higher chemical stability, intrinsic skin penetration enhancing properties and lower cost of production.

Difference between Liposomes and Niosomes :-

SR. No.	LIPOSOMES	NIOSOMES
1)	Vesicles are made up of concentric bilayers of Phospholipids.	Vesicles made up of non-ionic surfactants with or without incorporation of cholesterol.
2)	Size range:- 10 to 3000 nm	Size range:- 10 to 100 nm
3)	Comparatively Expensive	Inexpensive
4)	Special storage condition required.	No special requirements
5)	Phospholipids are usually unstable.	Non-ionic surfactants are stable.
6)	Comparatively more toxic.	Comparatively less toxic.
7)	Poor quality and purity.	Good quality and purity.
8)	Liposomes are made up of neutral or charged double-chained phospholipids.	Niosomes are made up of uncharged single-chain surfactant molecules.
9)	Phospholipid:- Phosphatidylcholine	Surfactant- Span- 20, 40, 60, 80 & Tween-20, 40, 60, 80.
10)	Uses- Gene delivery, MDR therapy etc.	Uses- Immunological, Oncology, Transdermal and diagnostics.