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Niosome Is A Promising Tool For The Targated Drug Delivey System

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Abstract:

Niosomes composed of non-ionic surfactant vesicles they are prepared by hydrating mixture of cholesterol and non-ionic surfactant. The basic component of drug delivery systems is an appropriate carrier that protects the drug from rapid degradation or clearance and thereby enhances drug concentration in target tissues. Niosomes exhibit various properties that is they are biodegradable, biocompatible non-immunogenic and has flexibility in their structure. Target-specific drug-delivery systems for the administration of pharmaceutical compounds enable the localization of medicine to diseased sites. Based on their biodegradable, biocompatible, and nonimmunogenic structure, niosomes are promising drug carriers that are helps in drug permeation , their use in permeation enhancer, their application how we can use niosomes to treat different type of disease and their toxicity and how we can treat their toxicity by the help of surfactants. Niosomes also are useful for diagnostic testing and as a lively ingredient to the vaccine. Such areas, therefore, need additional study and development to products available within the market niosomal preparations. Niosomes attempted the issue of insolubility, instability, low bioavailability and fast debasement of medications. This paper overviews the method of preparation of Niosomes along with applications in pharmaceutical use.

Keywords: Niosomes, Encapsulation, Controlled drug release, Drug entrapment, Hydration technique.

Introduction

In the year 1909 the researcher name Paul Ehrlich started the work of establishment of targeted delivery when he thought that a Drug Delivery mechanism that would target directly to infective cells. We will now study what is drug targeting.[1] The drug targeting can be elobrated as the ability to direct a therapeutic agent to a desired specific site to show the action on targeted tissue. In niosomes as a novel drug delivery the medication is

encapsulated in a polymer matrix as a vesicles[2] these vesicles basically contain a double layer of non-ionic surfactant hence the name given to them as niosomes.[3] The vesicles that are amphiphilic in nature are non-surfactant such as span-60 which is usually stabilized by addition of cholesterol and ample amount of anionic surfactant such as dicetyl phosphate Due to the presence of ester bond, phospholipids are easily hydrolysed.[4] Unreliable reproducibility arising from the use of lecithin in liposomes leads to additional problems and has led scientist to search for vesicles prepared from other material, such as nonionic surfactants.[5] Niosomes are promising vehicle for drug delivery and being nonionic; it is less toxic and improves the therapeutic index of drug by restricting its action to target cells. Niosomes or non-ionic surfactant vesicles are microscopic lamellar structures formed on admixture of non-ionic surfactant of the alkyl or dialkyl polyglycerol ether class and cholesterol with subsequent hydration in aqueous media.[6] In niosomes, 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 dicetyl phosphate.[7] Niosomes are one of the promising drug carriers that have a bilayer structure and are formed by self-association of nonionic surfactants and cholesterol in an aqueous phase. Niosomes are biodegradable, biocompatible, and nonimmunogenic.[8] They have long shelf life, exhibit high stability, and enable the delivery of drug at target site in a controlled and/or sustained manner[10]. In recent years, the potential of niosomes as a drug carrier has been extensively studied[11]. Various types of nonionic surfactants have been reported to form niosomes and enable the entrapment of a large number of drugs with a wide range of solubility[12]. The composition, size, number of lamellae, and surface charge of niosomes can be varied and optimized to enhance the performance of niosomes for drug delivery.[13]

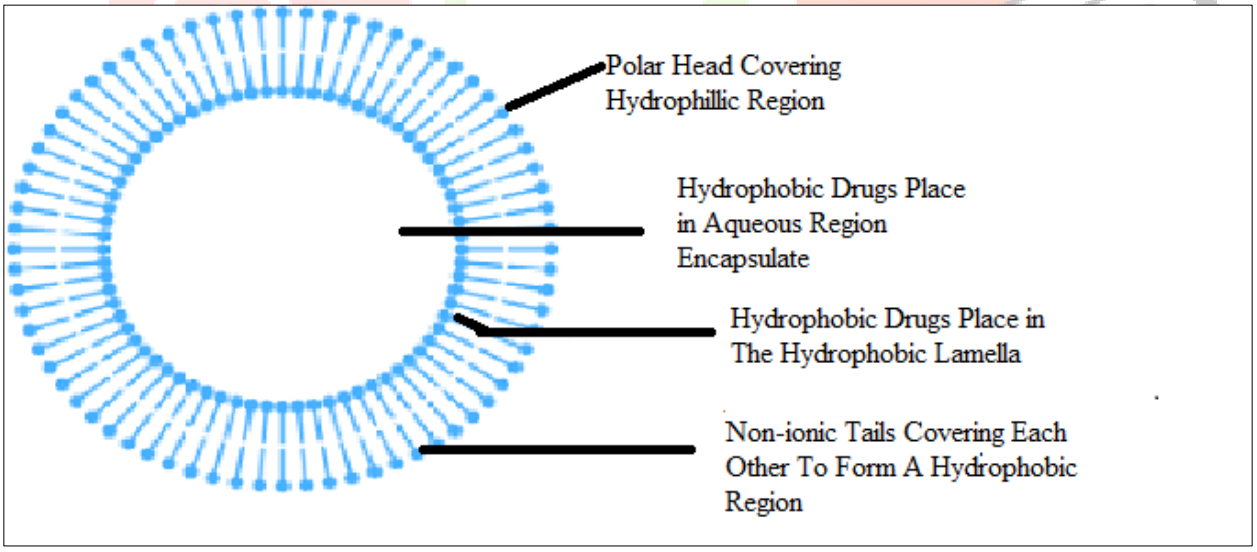

Fig.No.1: Structure of Niosomes

COMPONENTS OF NIOSOMES

There are various components used for the preparation of niosomes they are as follows.

1. Cholesterol
2. Non-ionic surface acting agent

1. CHOLESTEROL:

These are the derivative of steroids which is used to provide the flexibility , rigidity and to give appropriate shape.[14]

2. NON-IONIC SURFACE ACTING AGENT

The examples of certain non-ionic surfactant that are incorporated for the preparation of niosomes Eg. Spans (Span20,40,60,80,85) Tweens (tween 20,40,60,80) Brijs (brij 30,35,52,58,72,76) The nonionic surfactant consist of a hydrophilic head and hydrophobic tail. [15]Based on the vesicle size, niosomes can be divided into three groups. These are small unilamellar vesicles (SUV, size=0.025-0.05 μm), multilamellar vesicles (MLV, size=>0.05 μm), and large unilamellar vesicles (LUV, size=>0.10 μm).

Advantages of Niosomes

1. It require small amount to give the proper effective effect
2. Niosomes are stable as we use hydrophilic system because of hydrophilic in nature they are osmotically active.[16]
3. It entrapped easily and tend to increase their stability due to hydrophilic in nature. Can enhance the skin penetration of drugs[17]
4. Vesicles act as depot to release the drug slowly[18]
5. They're osmotically active and stable.[19]
6. They increase the steadiness of the entrapped drug[20]
7. It can enhance the skin penetration of medicine[21]
8. It can enhance the skin penetration of medicine

Disadvantages of niosomes

1. Hydrolysis of encapsulated drugs which limiting the time period of the dispersion
2. Leaking of entrapped drug[22]
3. Aggregation[23]
4. Inefficient drug loading[24]
5. May require specialized equipment[25]
6. High production cost[26]

Type of Niosomes

1. MLV (Multilamellar vesicles)

It consists of the many bilayers, which correspond to the aqueous lipid compartment separately. Such vesicles are approximately 0.5-10 μm in size. Multilamellar vesicles were the foremost commonly used niosomes. All such vesicles are suitable for lipophilic substances as a drug transporter.[27]

2. LUV (Unilamellar Vesicles)

The sort of niosomes features a high percentage of the aqueous / lipid container, and perhaps during a somewhat economical got to have membrane lipids, larger quantities of bioactive substances could be obtained.[28]

3. SUV (Small Unilamellar Vesicles)

Such Small Unilamellar Vesicles are often formed by sonication approach through multilamellar vesicles. At an equivalent time, the electrostatic stabilisation of French press deformation is that the inclusion of dicetyl phosphate in 5(6)-carboxyfluorescein (CF) charged niosomes supported Span 60

PREPARATION METHOD OF NIASOMES

1. Handshaking method

(Thin film hydration technique) Another round bottom flask dissolves during a volatile organic solvent the mixture of vesicles that shape ingredients including surfactant and cholesterol. At room temp (20 ◦C), the organic solvent is collected and use a rotary evaporator that leaves a surface layer of solid mixture accumulated on the flask rim. To gentle agitation, its dried surfactant film might be rehydrated at 0-60 ◦C to the aqueous phase. Standard multilamellar niosomes form this technique.[29]

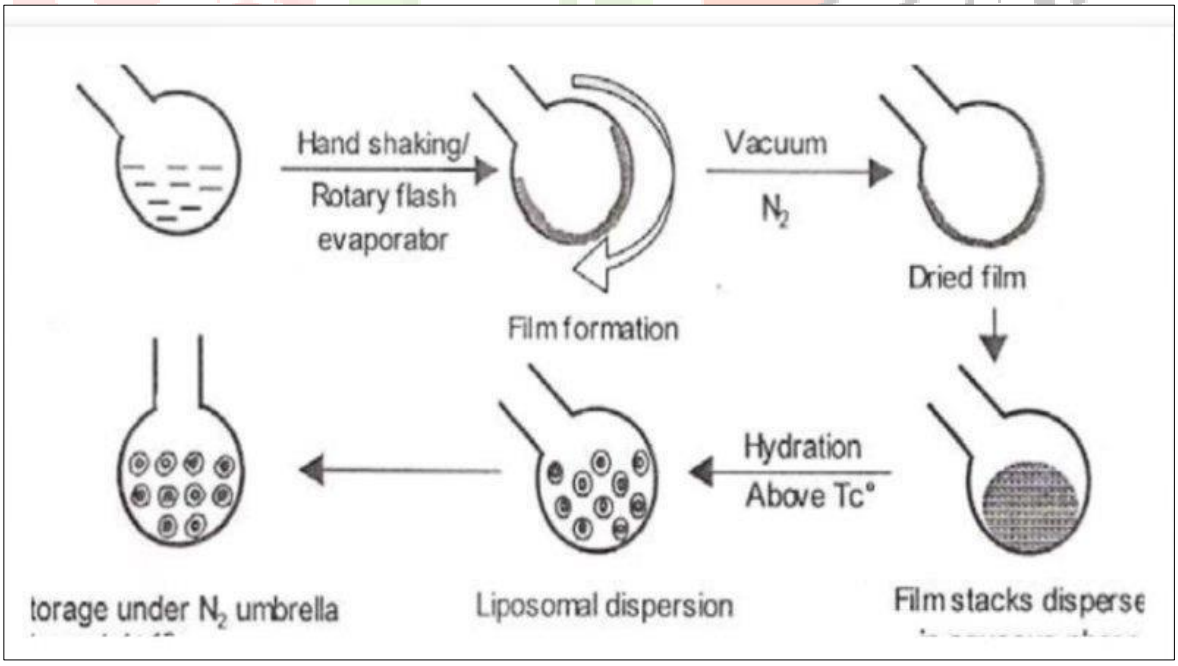

Fig. No. 2. Handshaking method

2. Micro fluidisation:-

Micro fluidisation may be a current strategy used only to form specified size production unilamellar vesicles. This approach is predicated on the concept of the submerged jet where two fluidised streams communicate at ultra-high velocities inside the interaction chamber in discrete micro channels. The impingement on a well-liked full view thin liquid layer is configured during a very way that perhaps the energy delivered to the device persists inside the niosome formulation region.[30]

3. Reverse Phase Evaporation Technique (REV)

during a combination of ether and chloroform, cholesterol and surfactant (1:1) are diluted. additionally thereto , an aqueous phase comprising a drug is sonicated at 4-5◦C. The aqueous phase forms into two phases. With the introduction of a coffee amount of phosphate-buffered saline (PBS), the clear gel produced will further be sonicated. The organic phase is extracted at 40 ◦ C at lower pressure. The resulting vicious niosome suspension is mixed with PBS and raised for 10 minutes during a water bath to develop niosomes at 60 ◦C. the assembly of Diclofenac Sodiumniosomes using Tween 85 was recorded by using this process.[31]

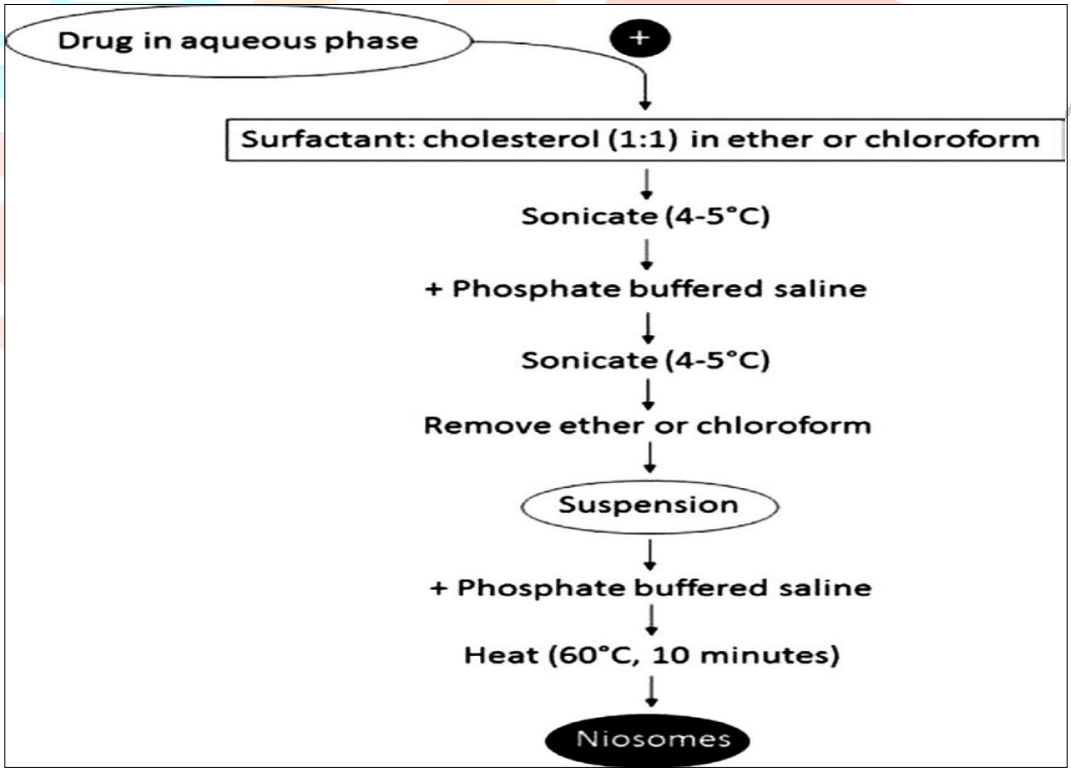

Fig. No. 3. Reverse Phase Evaporation Technique

4. Ether injection method

This approach offers the likelihood of manufacturing niosomes by progressively introducing a compound of the surfactant submerged in ether at 60 ◦ C in warm water. This surfactant mixture in ether is injected via a 14-gage needle into an aqueous substance solution. Ether vaporisation contributes to single-layered vesicles being formed. The vesicle's size ranges between 50 to 1000 nm, supported the circumstances utilized.[31]

Niosomes by slowly introduce in a solution of surfactant dissolve in diethyl ether into warm water maintain at 60

C

↓

Mixture in ether is injected through 14-gauge needle into an aqueous solution of material

↓

Vaporization of ether leads to the formation of the single layer vesicles

↓

Diameter of the vesicle range from 50 to 1000 nm depends upon the conditions use

5. Trans-membrane pH gradient Drug Uptake Process

Through chloroform, surfactant and cholesterol are consumed. Under lower pressure, the solvent will then dissolve and establish a skinny layer on the bottom of the round bottom Flask. an influence mixing acid (pH 4.0) moisturises the film. The MLV is frozen and reheated 3 times then sonicated. Aq. Sol. of 10 mg/ml of drugs is added to the present niosomal suspension and vortexed thereto . The sample pH would then be doubled to 7.0-7.2 including 1 M of disodium phosphate.[32]

Fig. No. 4. Trans-membrane pH gradient Drug Uptake Process

6. "Bubble" Method

This "Bubble" Method is an innovative strategy to organize liposomes and niosomes in one phase through the utilization of organic solvents. A bubbling machine comprises of a round-bottomed flask and a number of other necks to live temperature within the water bath. Water-cooled reflux and thermometer are inserted via the 3rd neck of the first and second neck and nitrogen supply. Throughout this buffer (pH 7.4) cholesterol and surfactant are spread at 70 ◦ C, the dispersion combined with a better shear homogeniser for 15 seconds then instantly "bubbled" with nitrogen gas at 70◦C.[33]

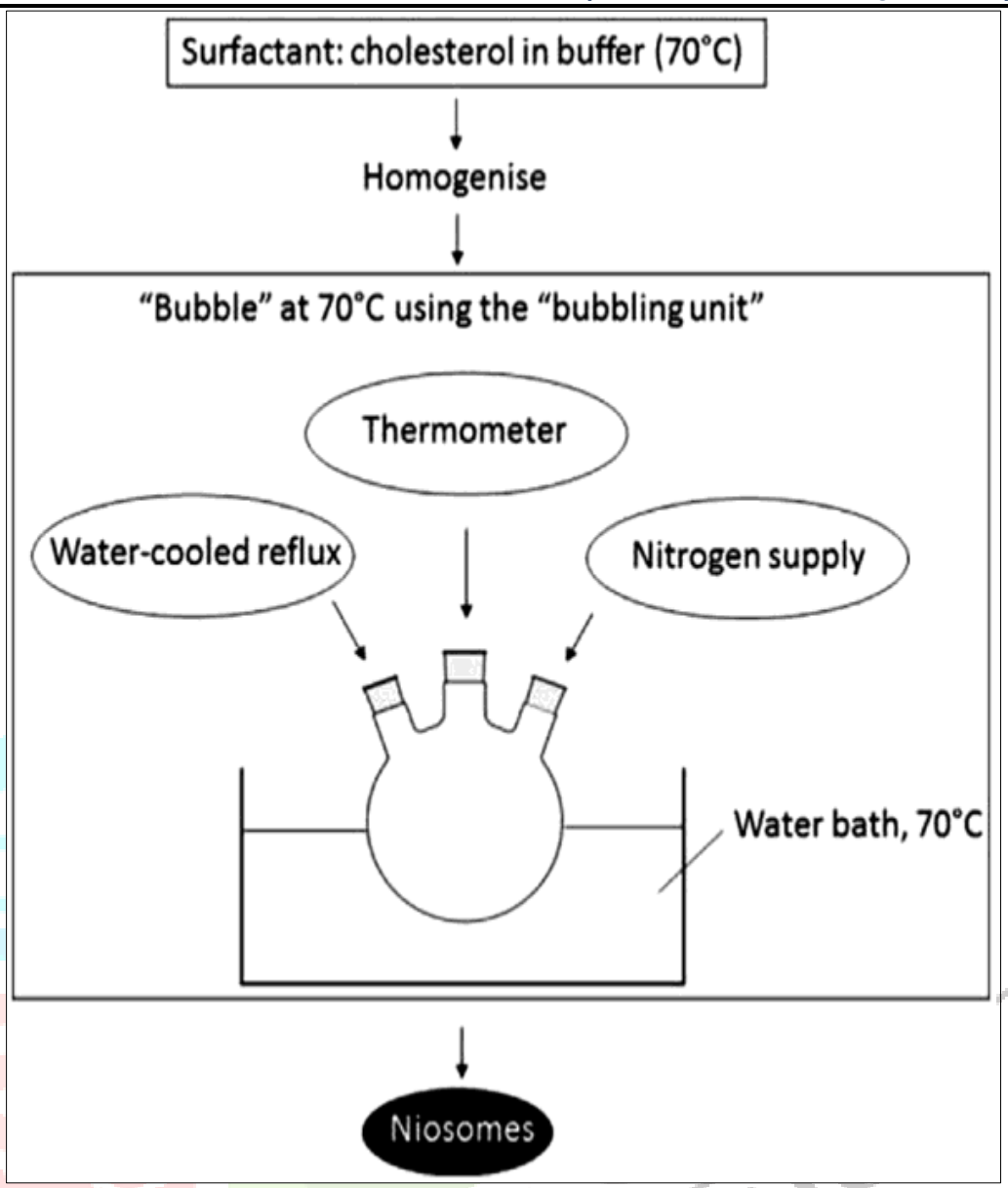

Fig. No. 5. "Bubble" Method

7. Sonication

A standard technique of vesicle development is by solution sonication as described in Cable. during this technique, a substance solution aliquot within the buffer is introduced during a 10-ml glass vial to the surfactant / choleste mixture. the answer is sonicised for 3 minutes at 600C, using just a sonicator with a titanium sample to get niosomes.[34]

8. Ethanol Injection Method

An ethanol solution of surfactant is injected rapidly through a fine needle

↓

Into excess of saline or other aqueous medium

↓

Vaporization of ethanol

↓

Formation of vesicles

9.Heating Method:

This method is in one-step, scalable and non-toxic and also based on the patent procedure. A suitable aqueous medium such as buffer distilled water, etc. in which mixtures of non-ionic surfactants, cholesterol and/or charge inducing molecules are added in the presence of the polyol like as glycerol. The mixture is heated with (at low shear forces) until the vesicles were form. [35]

10. Formation of Niosomes from Proniosomes:

Proniosome is a dry formulation in which each water-soluble particle are covered with a thin film of dry surfactant. The niosomes are recognizing by the adding aqueous phase at T > Tm with brief agitation. T is the Temperature and Tm is the mean phase transition temperature.[36]

Application of Niosomes

Niosomes as drug carriers

1. Niosomes have likewise been utilized as transporters for iobitridol, a symptomatic operator utilized for X-ray imaging. Topical niosomes may fill in as solubilization grid, as a neighborhood station for maintained arrival of dermally dynamic mixes, as entrance enhancers, or as rate-restricting layer obstruction for the tweak of foundational ingestion of medications[37]
2. Ophthalmic drug delivery It is difficult to achieve excellent bioavailability of drug from ocular dosage form like ophthalmic solution, suspension and ointment due to tear production, impermeability of corneal epithelium, nonproductive absorption and transient residence time. But to achieve good bioavailability of drug niosomal vesicular systems have been proposed that multiple dosing with sodium stibogluconate loaded niosomes was found to be effective against parasites in the liver, spleen and bone marrow as compared to simple solution of sodium stibogluconate.[38]
3. Use in studying immune response because of their immunological selectivity, low danger and more noteworthy solidness; niosomes are being utilized to ponder the idea of the insusceptible reaction incited

by antigens. Nonionic surfactant vesicles have plainly exhibited their capacity to work as adjuvant after parenteral organization with various distinctive antigens and peptides[39]

4. Leishmaniasis Niosomes can be utilized for focusing of medication in the treatment of maladies in which the contaminating life form lives in the organ of reticulo-endothelial framework. Leishmaniasis is such an infection in which parasite attacks cells of liver and spleen.[40]
5. Niosomes in gene delivery Novel niosome detailing in light of the 2,3-di (tetradecyloxy) propan-1-amine cationic lipid, joining with squalene and polysorbate 80 to assess the transfection productivity in rodent retinas. Lipoplexes at 15/1 proportion were 200 nm in measure, 25mV in zeta potential and displayed circular morphology. At this proportion, it was seen that niosomes consolidated and secured the DNA from enzymatic processing.[41]
6. Immunological Application of Niosomes Basically niosomes can be used for studying the nature of the immune response that is stimulted by antigens. Niosomes can also be used for targeting drugs for organs other than the Reticulo-endothelial system. A carrier system is attached to the niosomes to target the specific organs of the body.[42]
7.

MECHANISM OF ACTION OF NIOSOMES AS PERMEATION ENHANCERS:

There is no single component that can adequately clarify the capacity of niosomes to build drug move through the skin, and a few systems have been proposed, including: adjustment of the hindrance capacity of the layer corneum, because of reversible irritation of lipid organization. decrease of transepidermal water misfortune, which expands hydration of the layer corneum and releases its intently pressed cell structure.[43] And adsorption or potentially combination of niosomes on the outer layer of the skin, as uncovered by freeze crack electron microscopy and little point Xbeam dispersing, prompting a high thermodynamic action slope of medication at the connection point, which is the main thrust for saturation of a drug. Adsorption of niosomes onto the cell surface happens with practically zero disguise of either fluid or lipid parts; it might occur either because of drawing in actual powers or because of restricting by explicit receptors to ligands on the vesicle layer and move of medication straightforwardly from vesicles to the skin. Then again, niosomes may meld with the cell layer, bringing about complete blending of the niosomal substance with the cytoplasm.[44] At long last, niosomes might be overwhelmed by the cell (endocytosis), with lysozymes present in the cytoplasm corrupting or processing the membranous construction of the niosome, in this manner delivering the entangled material into the medium.

CONCLUSION:

Niosomal drug delivery system is one of the greatest exmaples in the field of pharmacy and a great evolution in drug delivery technologies and nanotechnology . it the most acceptable dosage form as compared to the other dosage form because the niosomes are economical and stable in nature. Scientists and academics widely understand the notion of integrating the drug into liposomes or niosomes to good target the drugs at the right tissue location. These display a liposome-like design and may , therefore, reflect alternate vesicular mechanisms

concerning liposomes combined with the power of the niosome to encompass various sorts of drugs throughout their non-environmental structure. Non-ionic surfactant vesicles alter the plasma clearance kinetics, tissue distribution, metabolism and cellular interaction of the drug. Niosomes are ideas for better drug delivery candidates, particularly as compared to liposomes thanks to different variables like price, stability, etc. Niosomes like focusing, ophthalmology, oral, parenteral are often wont to distribute differing types of medicine.

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