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NIOSOME AS NOVEL DRUG DELIVERY SYSTEM

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Abstract: Niosome are non-ionic surfactant vesicles that are obtained by hydrating mixture of cholesterol and nonionic surfactant and it can be used as carries of amphiphilic and liophilic drug. Noisome are biodegradable, biocompatible non-immunogenic and exhibit flexibility in structural characterization. The main object of this review the application of noisome have good opportunity in research and beneficial for researcher and pharma industries. Noisome appears to be a well preferred drug delivery system over liposome because of being stable and economic. Also noisome have great drug delivery potential for targeted delivery of anticancer, anti-infective agents. Drug delivery potential of noisome can enhance by using novel drug delivery concepts like pronisomes, discomes and aspasome. Noisome also serve in diagnostic imaging and as a vaccine adjuvant. Thus these areas need further research so as to bring out or to make for commercially available noisome preparation.

Keywords: Niosomes, Novel drug delivery, non-ionic surfactant, Vesicle,apasome,discomes.

INTRODUCTION

Drug delivery is the method of administering a pharmaceutical compound to produce a therapeutic impact in humans or animals. For the treatment of human diseases, nasal and respiratory organ routes of drug delivery square measure increasing importance. These routes offer promising alternatives to drugs delivery of parenterals significantly for amide and macromolecule medicine. For this purpose, many drug delivery system are developed and square measure being investigated for nasal and respiratory organ delivery. These contain liposomes, proliposome, microsphere, gels , prodrugs, cyclodextrins, among others. Nanoparticles composed of perishable polymers show assurance in fulfilling the demanding needs placed on these delivery systems, like ability to be transferred into associate aerosol, stability against forces generated throughout aerosolization, biocompatibility targeting of specific sites or cell population within the respiratory organ, unleash of the drug in a very preset manner, and degradation at intervals a suitable amount of time.

Novel drug delivery system measure designed to produce an non-stop delivery of medication at predictable associate in Nursing duplicatable mechanics over an extended amount of time within the circulation. The potential benefits of this idea contain minimization of drug associate facet effect because of controlled therapeutic blood levels rather than oscillatory blood levels, improved patient compliance because of reduced frequency of dosing and so the reduction of the entire does of drug administered. Hence, the mix of each sustained unharness and control unharness properties in an exceedingly delivery system would additional enhance therapeutic effectuality.

The Benefits of Novel Drug Delivery System are Follows:

1. Protection from physical and chemical degradation.
2. Sustained delivery
3. Improved tissue macrophages distribution.
4. Improvement of stability.
5. Improvement of medical specialty activity.
6. Protection from toxicity.
7. Enlarged bioavailability.

Plant Drug Delivery System

In the past few decades, considerable attention has been centered on the evolution of a very distinctive drug delivery system (NDDS) for natural flavoring drugs.Conservative amount forms, further as prolonged-release amount forms, they're unable to satisfy every holding the drug component at an explicit rate as per directed by the wants of the body, at some purpose of the number of treatment, in addition as guiding the phytoconstituents to their desired target web site to urge AN utmosyt therapeutic response.

Paul Paul Ehrlich, in 1909, initiated the age of development for targeted delivery once he envisaged a drug delivery mechanism thatwould target on to unhealthy cell. Since then, numbers of carries were used to hold drug at the target organ/tissue, that embrace immunoglobulins, bodily fluid proteins, artificial polymers, liposome, microshperes, erythrocytes, noisome electroshock therapy. In noisome, the vesicles forming amphiphile may be a non-ionic surface-active agent like span – sixty that is sometimes stable by addition of sterol and tiny quantity of anionic surface-active agent like dicetyl phosphate.

STRUCTURE AND COMPONENTS OF NIOSOME

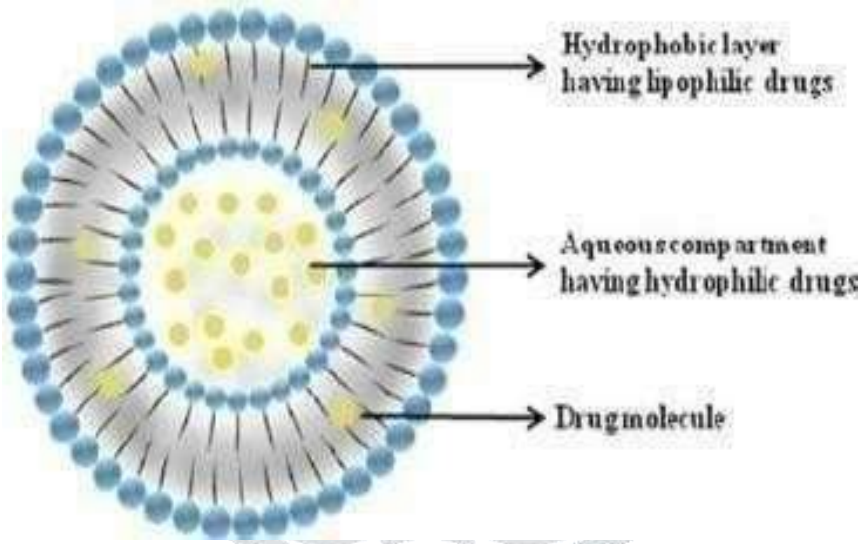


Fig 1: Structure of Niosome

The major elements of niosomes area unit nonionic surfactants, association medium and lipids like sterol. The self-assembly of nonionic surface-active agent inaqueous media lead to closed bilayer structures A high interfacial surface tension between water and therefore the hydrophobictails of the amphiphile casuses them to associate. The steric and deliquescent repulsion between the pinnacle teams of nonionic surface-active agent make sure that deliquescent termini purpose outwardsand area unit up-to-date with water. The assembly into closed bilayers typically needs some input of energy like mechanical or heat. Niosome may be categorised in 3 teams per their sixes and bilayers. little unilamellar vesicles (SUV) (10-100 nm), giant unilamellar vesicles (LUV)(100-3000 nm), and multi lamellar vesicles (MLV) wherever over one bilayer is gift.

Niosome area unit lamellar structures that area unit microscopic in size. They represent of non-ionic surface-active agent of the group or dialkyl polyglycerol ether category and sterol with sequent association in binary compound media. The surface-active agent molecules tend to orient themselves in such how that the deliquescent ends of the non-ionic surface-active agent purpose outward, whereas the hydrophobic ends face one another to forms the bilayer.

Components of Niosomes

The main components of niosomes are nonionic surfactant, hydration medium and lipids such ascholesterol.

NON-INONIC Surfactants

The non-ionic surfactants situate themselves in bilayer lattices wherever the polar or hydrophilic heads change themselves, effort a watery mass (media) whereas the hydrophobic head or organic compound protions align in such the way that the interaction with the

liquid media would be restricted. To achive physical science stability, every bilayer creases over itself as consistent film i.e. shapes vesicles in order that hydrocarbon/water interface remains no a lot of exposed [3]. the subsequent varieties of nonionic chemical agent square measure used for the formation of niosomes: Ex:- polyglycerol souse ethers,glucosyl dialkyl ethers **Alkyl Ethers:**

L'Oreal describe some surface-active agent for the preparation of noisome containing drugsasC16 mono alkyl radical glycerin ether with average of 3 glycerin units, with molecular weights of 473. Diglycerol ether (MW972) is another surfaceactive agent with a mean of the seven glycerin units. Associate in Nursing organic compound joined surfactant(MW393) is another example [3]. aside from alkyl radical glycerin ,alkyl glycosides and alkyl radical ethers bearing polyhydroxly head teams are used in formulation of niosomes. Ex:- ether

Alkyl Esters:

Sorbitan esters ar surface-active agent favored for utilization within the preparation of niosomes. sac ready by the polyoxyethylene sorbitan monolaurate ar genrally soluble than different surface-active agent vesicles. as an example polyoxyethylene (polysorbate sixty) has been used for encapsulation of NSAID. a mix of polyoxyethylene-10-stearyl ether: group laurate: cholesterin (27:15:57) has been used as a locality of percutaneous delivery of cyclosporine-A. Ex:- ethyl group propionate, methyl group formate

Alkyl Amides:

Alkyl amide have been used to deliver niosomes vesicles. Ex:- Galactosides and glucosides

Fatty Acid and Amino Acid Compounds:

Long chain fatty acids and amino acid moieties have also been used in some niosomes preparation.

Cholesterol:

Steroids ar vital elements of the cell film and their presence influence the bilayer thinness and permeability. cholesterin could be a steroid spinoff, that is especially used for the formulation of niosomes. Despite the actual fact that it's going to not demonstrate any half in theformation of bilayer, its significance in formation of niosomes and of layer attributes can't be disposed of. Inclusion of cholesterol influences properties of niosomes like membrane porosity, inflexibility, encapsulation potency, simplicity of rehydration of freeze dried noisomes and their harmfulness. It keeps the sac accumulation by the thought of atoms that balance the system against the formation of aggregates by repulsive steric or electricity forces that prompts the modification from the gel to the liquid introduce noisome systems. Thus, the noisome seems to be less leaky in nature.

Charged Molecule:

Some charged molecules ar supplementary to niosomes to extend stability of niosomes by electricity repulsion to avoid jointure. The charged molecules used ar diacetyl phosphate (DCP) and phoshotidic acid. Similarly, stearyl alkane (STR) and stearylpyridinium chloride ar wll acknowledged charged molecules is tolerable as a result of higher concentration will hinder the noisome formation

Advantages of Niosomes

1) Niosomes are osmotically active, chemically stable and have long strong time compared toliposomes
2) Their surface formation and modification is very easy because of the functional groups on their hydrophilic heads 3) They have high compatibility with biological system and low toxicity because of their non-ionic nature
4) They are biodegradable and non-immunogenic
5) They can entrap liophilic drugs into vesicular bilayer membranes and hydrophilic drug in aqueous compartments
6) They can improve the therapeutic performance of the drug molecules by protecting the drug from biological environment, resulting in better availability and controlled drug delivery by restricting the drug effect to to target cells in targeted carriers and delaying clearance from thecirculation in sustained drug delivery 7) Access to row materials is convenient.

Disadvantages of Niosomes

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

APPLICATION OF NIOSOMES

Niosomes as drug carriers

Niosome have been used as a carriers for iobitridol, a diagnostic agent for X-ray imaging .topical niosome might be serve as a solubilization matrix, as local depot for sustained release of topically active compounds, penetration enhancers, as a rate limiting membrane barrier for the modulation of systemic absorption of drugs.

Drug targeting

One of the foremost helpful aspects of niosomes is its ability to focus on medication. Niosomes are often used as a target medication to the system. The system preferentially takes up Niosome vesicles. A carrier system (like antibodies) are often hooked up to niosomes (as immunoglobulin's bind promptly to the macromolecule surface of the niosome) to focus on them to specific organ.

LEISHMANIASIS

Leishmaniasis could be a malady during which a parasite of the Leishmania seize the cells of the liver and spleen. the employment of niosome in tests conducted showed that it had been attainable to administer higher levels of the drug while not the activate of the aspect effects, and so allowed larger effectivity in treatment.

NIOSOMES AS CARRIERS FOR HEMOGLOBIN

Niosomes area unit used as a carrier for haemoprotein. Niosomal suspension seem an evident spectrum that is superimposable onto that of free haemoprotein.Vesicles area unit pervious to atomic number 8 and also the haemoprotein dissociation curve are often altered comparably to the nonencapsulated haemoprotein.

- **TYPES OF NIOSOMES**

The niosomes area unit classified as a perform of the quantity of bilayers or as a perform of size or as a perform of the strategy of preparation. the assorted styles of niosomes area unit represented below..

1) MULTI LAMELLAR VESICLE (MLV)

It consists of several bilayers surrounding the aqueous liquid compartment saperately. The estimated size of this vesicles is 0.5 µm diameter. Multi lamellar vesicles are the most widely used niosomes.

2)LARGE UNILAMELLAR VESICLES(LUV)

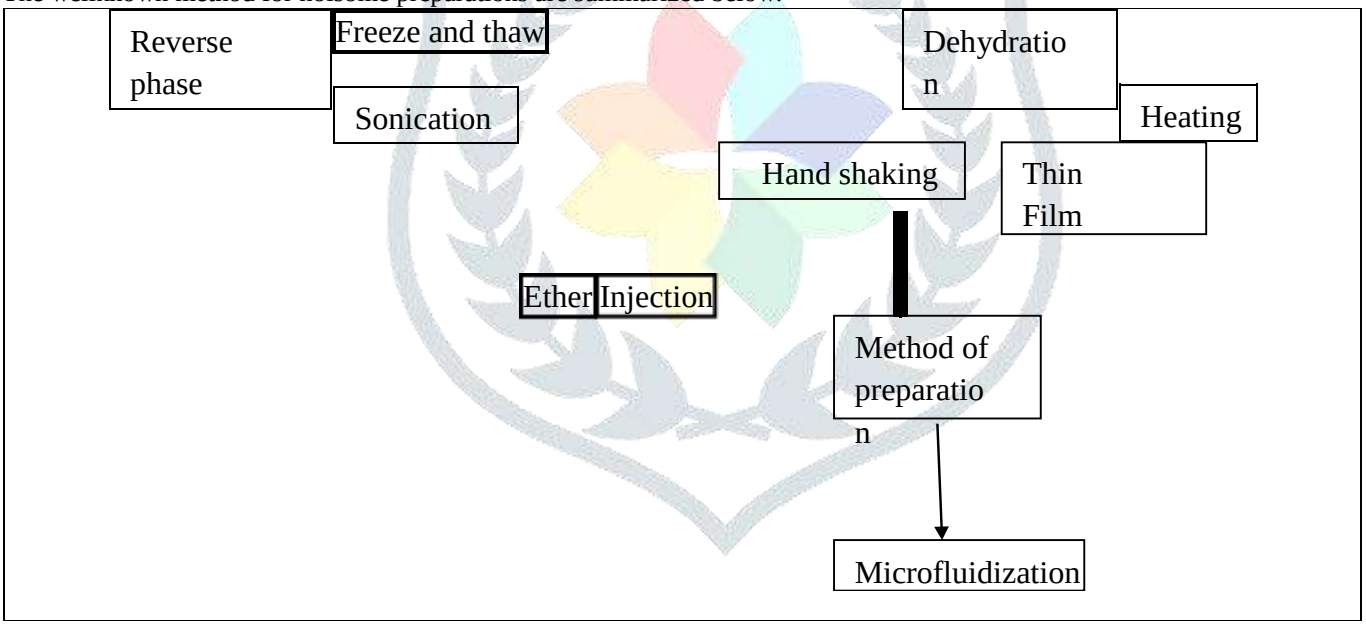
Niosomes of this type have a high aqueous or lipid compartment ratio,so that the larger volume of bio- active matrials can be entrapped with very economical use of membrane lipids.

3)SMALL UNILAMELLAR VESICLES(SUV)

The small Uni-lamellar vesicles are mostly prepared from multilamellar vesicles by sonication method, French press extrusion electrostatic stabilization is the inclusion of diacetyl phosphate in 5,6- carboxyfluorescein loaded span 60 based niosomes.

PREPARATION OF NEOSOMES

There are several methods to prepare noisome formulations. The methods of preparation influence the characteristics of the formulations. Therefore, characterization parameters should be taken into account when selecting the optimum preparation method. The wellknown method for noisome preparations are summarized below.



ETHER INJECTION METHOD

In this technique , a mix of active substance, surfactant, Associate in Nursingd sterol in inhalation general anesthetic resolution is injected slowly into an binary compound medium at heat employing a 14-gauge needle syringe. The mixture is heated on top of the boiling purpose of the organic solvent. Niosomes particles within the styles of LUV square measure fashioned (Vyas and Khar,2002) by this method, and square measure any subjected to size reduction.

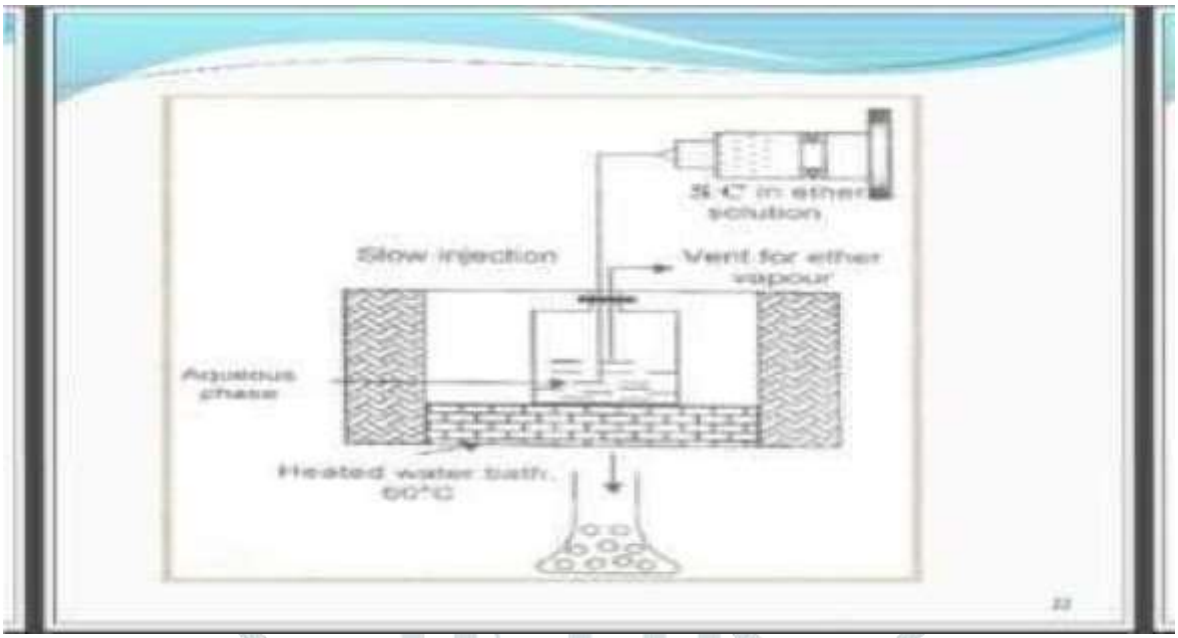


Fig no. 3

FILM METHOD

This method is based on dissolving the mixture of surfactant and cholesterol in organic solvent such as diethyl ether and chloroform. the organic solvent is removed by low pressure at RT using a rotary evaporator. A thin film is formed and the resultant dry film is hydrated with water, phosphate buffer, or active substance/phosphate buffer by agitation at 50-60°C. Process variables to be validated include the mass per batch, angel of evaporation, and rotation speed of the vacuum rotary evaporator. In this method MLV are formed with high entrapment efficiency.

SONICATION

The mixture of surfactant and cholesterol in a scintillation vial is added in the aqueous phase andhomogenized using a sonic probe to produced SUV-type noisome vesicle.

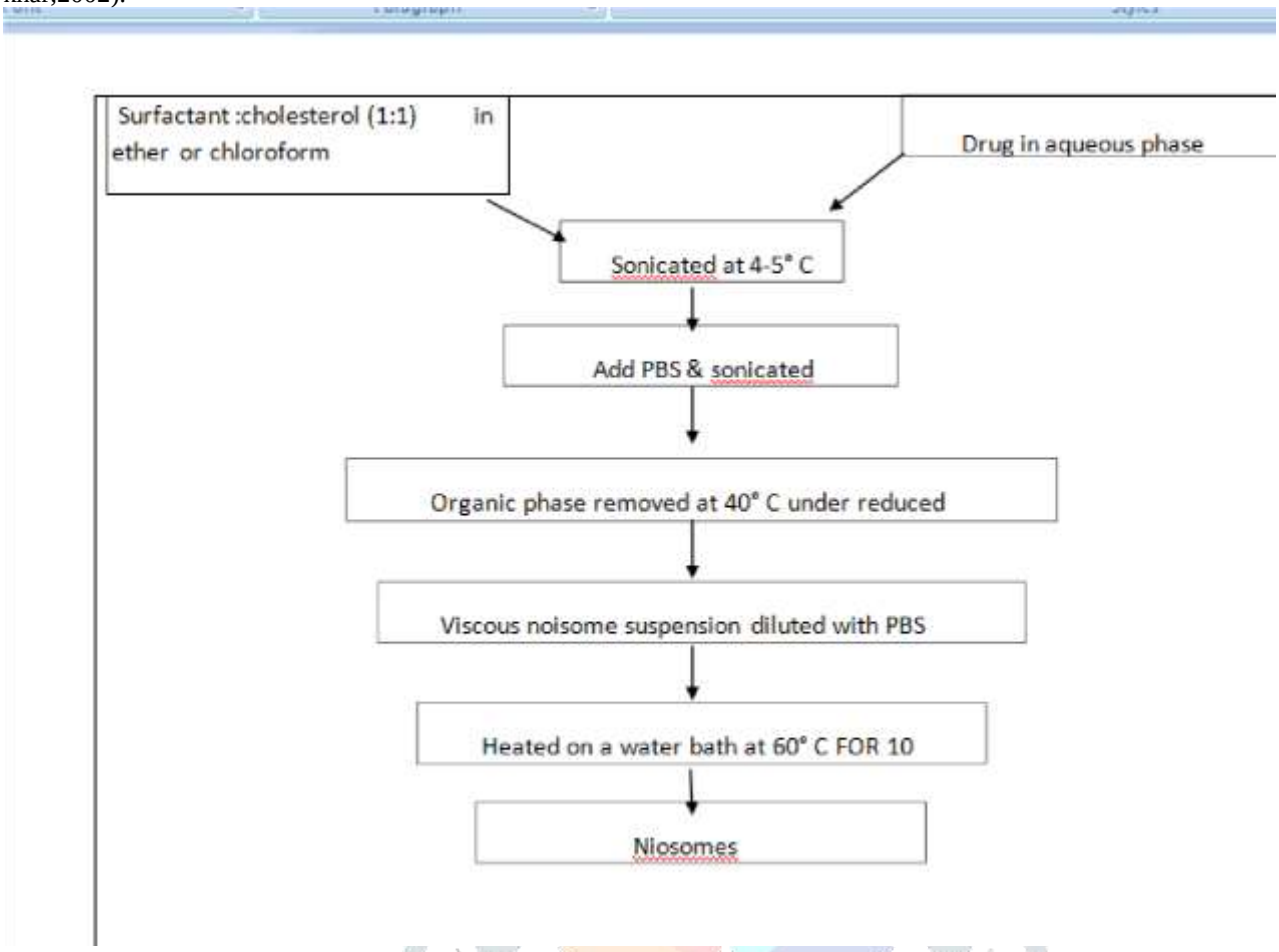
METHOD OF HANDJANI-VILA

Nonionic lipids ar mixed with associate solution containing constant quantity of active substance to be encapsulated and a homogenised lamellar section is made by shaking. Then the resultant mixture is homogenized by centrifugation and agitation at a controlled temperature (Handjani-Vila,1990).

REVERSE PHASE EVAPORATION

Surfactants ar dissolved during a mixture of ether and chloroform and phosphate-buffered saline- Containing active substance is blended to urge a water-in-oil (W/O) emulsion. The ensuing two-phase system is homogenized. The organic section is gaseous below reduced pressure. The wetter initial kind a gel so hydrate to make niosomal vesicles (Vyas and

khar,2002).



HEATING METHOD

The mixture of nonionic chemical agent, cholesterin, ANd charge-inducing molecules is further to an binary compound medium within the presence of polyol like glycerin. The mixture is heated till vesicles ar shaped whereas stirring by magnetic stirrer.

RESULT:

From various studies it was concluded that niosome technology proved to have more product stability, extend shelf life from weeks to sometimes years, prevent oxidation and emulsification, and also permits isolating antagonistic ingredient within the formulation until use. Some patented information shows its wide range of application in the field of pharmaceutical, foods, agrochemical, etc. many dermatological preparation have marked a new improvement in their efficacy by utilizing niosome technology

CONCLUSION

Niosomes drug delivery system is one of the best approach towards novel drug delivery. Niosomes are composed of nonionic surfactant and cholesterol. Niosomes are prepared by various method like ether injection method, hand shaking method, remote loading method, extrusion methodand microfluidization method. The properties of niosomes affected by additives, method of preparation, drug

prop-erties, amount, structure and type of surfactant used, choles-terol content and resistance to osmotic stress. In nutshell, as adrug delivery device, compared to liposomes, niosomes areosmotically active and are quite stable chemically by their own as well as improve the stability of the drug so entrappedand delivered. They do not require special conditions for the handiling, protection or storage and industrial manufacturing. Beside this, they offer flexibility in structural characteristics such as composition, fluidity, size,etc. and can be desired. Niosomes that offer many advantages over other drug delivery devices and have found applicability in pharmaceutical field. It was thus concluded that niosomes are very effective drug delivery tool for incorporation of various therapeutically active moieties and thus lies on future scientists to effectively harness its potential in divers application areas for the benefit of mankind.

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