

Ophthalmic Drug Delivery o From ocular dosage form like ophthalmic solution, suspension and ointment it is difficult to achieve excellent bioavailability of drug due to the tear production, impermeability of corneal epithelium, non-productive absorption and transient residence time. Niosomes are nonionic

surfactant based multi lamellar or unilamellar vesicles in which an aqueous solution of solute(s) is entirely enclosed by a membrane resulted from the organization of surfactant macromolecules as

bilayers 3/15/2024 Dr. Doaa Hussien Hassen 16 ?Excellent unique features and abilities make these

surfactants a potential candidate for a wide range of applications in various bio-medicinal fields such as dermatology, drug delivery, anticancer treatment, surfactant therapy, vaccine formulation, personal

hygiene care products and many more. They are surface-active compounds having the ability to

decrease surface and interfacial tension at the interfaces between gases, liquids, and solids, thus

enabling them to blend or diffuse voluntarily like emulsions in water or other liquids. The vesicles forming amphiphile is a non- ionic surfactant stabilized by addition of cholesterol and small amount of anionic

surfactant such as dicetyl phosphate NIOSOMES Figure 3: Vesicle of niosome (Aitha S, 2013) Figure 4:

Structure of Niosomes STRUCTURE OF NIOSOMES ?Addition of cholesterol molecule to Niosomal

system oMakes the membrane rigid oReduces leakage of drug from the Niosome oIncreases the chain

order of bilayer oStrengthen the non-polar tail of the non-ionic surfactant oIncrease in the entrapment

efficiency MEMBRANE ADDITIVES Cholesterol ?Over the decades many researchers have reported the antimicrobial, anti- adhesive, antibiofilm, anti-inflammatory, antioxidant activities of surfactants regarding

its utility in medicinal purposes. Niosomes 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 Figure

5: Structure of niosome (Makeshwar KB, 2013) ?oNiosomes prepared by the span 60 has high

resistance against proteolytic enzyme and exhibit good stability in storage temperature and in presence

of sodium deoxycholate 3/15/2024 Dr. Doaa Hussien Hassen 33 Improve Drugs Stability and Physical

Properties ?The surfactants play an active part in the designing and manufacturing of industrial and

customer products, comprising cosmetics, detergents, paints, paper products, and

pharmaceuticals. Surfactants after reaching their CMC (Critical Micellar Concentration) produce

micelles/reverse micelles which indeed work as nano-sized supra- molecules in solubilization,

emulsification of drugs. Examples: Dicetyl phosphate (DCP) and Stearyl amine (SA) MEMBRANE

ADDITIVES NIOSOME DELIVERY APPLICATIONS ?37 Other Application i. Sustained release

Sustained release action of niosomes can be applied to drugs which have low therapeutic index and

have low solubility with water since those could be maintained in the circulation via niosomal

encapsulation. The formation of bilayer vesicles rather than micelles depends on the hydrophilic-lipophilic

balance (HLB) of the surfactant, and the chemical structure of the components Composition of

Spanlastics ?The kind of fatty acid connected to the polyoxyethylene sorbitan component of the

molecule determines the shape of Spans: Span80 (monooleate), Span60 (monostearate), Span40

(monopalmitate), and Span 20. o The cationic, anionic, zwitterionic and neutral surfactants have their

specific applications in bio-medicinal and pharmaceutical fields. The drug interacts with surfactant head

groups and develops the charge that creates mutual repulsion between surfactant bilayers, and hence

increases vesicle size. Charge inducers are one of the membrane additives which are often included in Niosomes because ? Increase surface charge density ? Prevent vesicles flocculation, Aggregation and Fusion. Niosomes of doxorubicin prepared from C16 monoalkylglycerol ether with or without cholesterol, exhibited an increased level of doxorubicin in tumor cells, serum and lungs, but not in liver and spleen. o Transdermal drug delivery system of niosomes and proniosomes has led to increasing the penetration rate thereby enhancing therapeutic efficiency and bioavailability of the drug .ii. Localized drug action Drug delivery through niosomes is one of the approaches to achieve localized drug action, since their size and low penetrability through epithelium and connective tissue keeps the drug localized at the site of administration. However, the produced vesicles are more sustainable in Span 60 contains saturated alkyl chains Composition of Spanlastics ? The last few decades displayed an enormous curiosity in work related to the synthesis of surfactants from natural products such as sugar-based surfactants fatty acids and sterols. This wonderful quality of surfactants is most useful in the bio-medical and bio-chemical fields to improve production, purification and delivery of drugs Classification of surfactants o According to the charge of the head groups, surfactants are classified into four different categories. Niosomal dispersion in an aqueous phase can be emulsified in a nonaqueous phase to Regulate the delivery rate of drug Administer normal vesicle in external non-aqueous phase. Spanlastics are novel nanovesicular carriers composed of non-ionic surfactants or a blend of surfactants, along with an edge activator. Ethanol's capacity to condense on membranes results in a reduction in vesicular membrane thickness, which in turn leads to smaller vesicles. Structurally these two groups are contradictory in directions, but their ends are linked to the same molecule, developing an asymmetric and polar structure. Mean size of Niosomes increases proportionally with increase in the HLB of surfactants 3/15/2024 Dr. Doaa Hussien Hassen 25 ? Targeting and Retention of Drug in Blood Circulation Liver Targeting: Methotrexate was reported to be selectively taken up by liver cells after administration as a niosomal drug delivery system. Spanlastics have shown enhanced therapeutic efficacy, improved drug bioavailability, and reduced drug toxicity compared to other drug delivery systems. Non-ionic surfactants are the foremost ordinary type of surfactant employed in preparing vesicles, due to their superior advantages. They convey better stability, compatibility, and low toxicity related to their anionic, amphoteric ,or cationic surfactants. By adjusting the system's net charge towards a negative zeta potential, steric stability is achieved to some extent Composition of Spanlastics ? One portion is hydrophilic in nature and soluble in an aqueous medium, while the second portion is lipophilic, which is soluble in oil but insoluble in an aqueous medium. Composition of Surfactant o In surfactant molecules, the hydrophilicity and lipophilicity alter with molecular composition and arrangement. These surfactants are fascinating as they usually are effortlessly biodegraded Importance of Surfactants 3/15/2024 Dr. Doaa Hussien Hassen 8 ? Most of the pharmaceutical products show poor aqueous solubility and, in this regard, surfactants are inevitable to influence the solubility of the products. Surfactants used in preparation are biodegradable, biocompatible and non- immunogenic FEATURES OF NIOSOMES ? Improve the therapeutic performance of the drug molecules by Delayed clearance from the circulation Protecting the drug from biological environment Restricting effects to target cells ? Type of surfactant influences encapsulation efficiency, toxicity, and stability of Niosomes ? Improve Anti-inflammatory

Activity 3/15/2024 Dr. Doaa Hussien Hassen 30 NIOSOME DELIVERY APPLICATIONS ?Beside this, the percent entrapment efficiency of gentamicin sulphate was altered when administered as niosomes .With the formulation of niosomes, the oral bioavailability of the Acyclovir as well as Griseofulvin was increased as compared to the drug alone.Important tool for immunological selectivity, low toxicity and more stability of the incorporated active moiety.3/15/2024 Dr. Doaa Hussien Hassen 34 35 Carrier for hemoglobin Niosomes used as hemoglobin carriers.In general, the physical form of Niosomes did not influence their toxicity as evident in a study comparing the formulations prepared in the form of liquid crystals and gels.Vesicles based on Span 80 and Span 40 exhibit significant disruption, aggregation, and instability.The molecules of surfactant possess amphiphilic arrangement providing an allurements for both water and oil.o Both water-soluble and oil- soluble yields a significant physio-chemical consideration of surfactant use.Surfactants are amphoteric and solubilize both organic and inorganic substances.surfactants: are important in pharmaceutical dosage development 3/15/2024 Dr. Doaa Hussien Hassen 12 ?surfactants: are important in pharmaceutical dosage development 3/15/2024 Dr. Doaa Hussien Hassen 13 ?In medicinal drinks, surfactants are used to solubilize Vitamin E, D, other medicinal materials, and other necessary oil ingredients.Surfactants are useful in ointments formulations as well as in case of creams, lubricants and gels.Exhibits flexibility in their structural characteristics (composition, fluidity and size) ?Non-ionic surfactants