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Short Communication

The Prospect of Niosome Membrane in Drug-Delivery

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DESCRIPTION

The human body is an incredibly complex system, in which the action of drugs within the body is governed by a host of intrinsically complex biological, physiological and biochemical processes. To this end, the study of interaction of drug(s) with pertinent biological target forms an indispensable building block in this wide arena of research. A biological target is usually referred as an entity within a living organism to which an endogenous ligand/drug is directed and/or binds. The study of binding of drugs to biological receptors is central to the understanding of many complicated aspects of research in the field, such as, availability, efficacy and transport of drugs [1]. Although the topic has garnered enormous research attention over the years [2-4], a molecular level interpretation of the underlying mechanism of such interactions still leaves adequate scope for further exploration. This, in turn, makes explicit design and performance of experiments targeting specific research questions addressing interaction of drugs with biological receptors, and their delivery within the human body followed by excretion further more necessary than is usually anticipated. The distribution of drugs within the human body and deciphering its mechanism of action strongly depend on a host of complex processes which are commonly clubbed together to cite as Absorption, Distribution, Metabolism, Excretion, that is, the so-called ADME profile. The optimization of the ADME profile of a drug forms a key element in reference to evaluation of the therapeutic efficacy of the drug. However, given the multitude of complexities associated with true biological systems, the results of *in vitro* investigations often become important in view of furnishing a rational avenue before moving onto *in vivo* investigations. The prospect of using various supramolecular assemblies in targeted delivery of drugs has long been realized [5]. Furthermore, the application of supramolecular assemblies in liberating the bound drug molecules through host-guest complex formation without a chemical reaction has also received active research attention [6]. Niosomes are nanoscopic vesicular assemblies typically prepared of cholesterol and nonionic surfactants (amphiphiles) and are being potentially used as drug delivery agents [7,8]. The application of supramolecular assemblies in the transport and targeted delivery of drugs accompanies the great advantage of involvement of non-covalent interactions (that is, no chemical reactions) whereby ensuring that the active site(s) of the drugs is not chemically modified [7,8]. To this effect, the use of niosomes has received particular attention with a view to the stability, nontoxicity, and biodegradability of these assemblies [7,8]. However, it is imperative to note in this context that the microheterogeneous environment surrounding the drug binding sites within the niosomes may play a role in modifying the photophysical and dynamical aspects of the drug. For example, the interaction of the anti-cancer drug sanguinarine with niosomes (made of cholesterol and the neutral surfactant Triton X-100) is found to result in preferential stabilization of the neutral prototropic form (alkanolamine form) of the drug over the cationic (iminium) form. This is attributed to the enhanced hydrophobicity within the niosome environment in comparison to bulk aqueous buffer [7,8]. It is also important to note that addition of extrinsic additives and/or modification of the experimental conditions can also be potential candidates in influencing the photophysics of the encapsulated drug molecules. For example, with enhanced ionic strength of the medium (addition of salts) and enhanced temperature, the cationic (iminium) form of the drug is found to gain stabilization .The model of penetration of water molecules to the hydration layers of the niosome structure can be invoked to account for this observation [8]. The shift of the prototropic equilibrium in favor of the cationic form with increasing salt concentration and temperature can be quantified using the fluorescence spectral data under the assumption that concentrations of different prototropic forms is directly proportional to the fluorescence intensities of the respective forms [8]. The encapsulation of a given prototropic form of the drug within the niosome membrane is also accompanied with impartation of motional constraints on the drug molecules as manifested from enhanced rotational-relaxation time constants [8].

The optimization of the ADME profile of a drug encompasses the study of a vista of indigenously complicated interaction processes, and an important component of which is constituted by the study of release of the drug from the carrier vehicle. To this end, rupture of the carrier vehicle by use of an external agent can form a prospective strategy. However, such approaches must be addressed in view of the important issues like toxicity and biodegradability of the material, and its disruptive influence on

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cell membrane. The application of the naturally occurring cyclic oligosaccharides, cyclodextrins has been tested to this effect and it has been found that formation of inclusion complexes by β-cyclodextrins and γ-cyclodextrins of the components of niosome membrane can result in disruption of the compact niosome structure whereby aiding in the release of the encapsulated drug molecules [8]. However, the disruptive effects of cyclodextrins on niosome membranes can serve as a simplified model for the study of the effects of cyclodextrins on cell membranes before arriving at a conclusive statement on the prospect of cyclodextrins as drug delivery vehicles and/or extrinsic agents for release of bound drugs. These issues in turn form relevant research questions leaving room for further exploration of the field, particularly with regard to *in vivo* applications.

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