Niosomal Drug Delivery

Researchers from the University of Auckland have developed a novel topical drug delivery system that could overcome the limitations of current treatments.

Niosomes are closed bilayer structures formed from self-assembly of a non-ionic surfactant in an aqueous media. Major advantages to niosomes include:

- they are biodegradable, biocompatible, non-toxic and non-immunogenic
- encapsulation of large amounts of materials in a small vesicle volume
- better patient adherence and satisfaction and also better effectiveness than conventional oily formulations
- carrying a wide range of chemicals (lipophilic, hydrophilic and amphiphilic drugs) due to the unique structure
- the shape, fluidity and size can be easily controlled by changing the structural composition and method of production
- can be given in different administration routes
- storage is simple due to the chemical stability of the structural composition.

The new drug delivery system consists of niosomes that encapsulate active agents such as antioxidants, including catechin, catechin derivatives and resveratrol.

Prevent degradation of the active component

Drugs are often unstable and easy to degrade, have low solubility in water based systems, and have low bio-availability due to the first-pass effect. Prevention of drug degradation before absorption and enhancement of permeation are critical to topical drug delivery. These problems can be overcome, or reduced, by encapsulating the drug in niosomes, which can be used for ingredients with different solubilities and can improve the physical and chemical stability of antioxidants, preventing degradation of the active component before arrival at the targeted site.
Penetration-enhancing effect across skin

Drugs frequently have difficulty penetrating into deep layers of the skin, by encapsulating drugs in a niosome we can enhance penetration and increase active absorption into the epidermis and dermis. Drug-loaded niosomes are uniformly spherical with a particle size that is perfect for skin permeation. Additionally, the vesicle bilayer structure is highly similar to biological membranes, resulting in a penetration-enhancing effect across skin stratum corneum (the outer layer of skin). Niosomal carriers also have prolonged drug release profiles that aid topical delivery of drugs, assisting in cellular uptake of the entrapped drug and contributing to enhanced antioxidant effects. The rate of drug release can be modified by changing composition of the vesicle.

Prolonged drug release profiles

Niosomes are becoming popular in the field of topical drug delivery and this invention provides compositions of active agents (an antioxidant, catechin and derivatives, or resveratrol) encapsulated in niosomes and methods for preparing and delivering such compositions.

The inventors have successfully prepared and optimised the formulation of catechin-loaded, epigallocatechin gallate (EGCG) - loaded and resveratrol-loaded niosomes, and determined the physical and chemical properties of the drug-loaded niosomes. It was found that the niosomes are uniformly spherical and a suitable particle size for skin permeation, and they showed prolonged drug release profiles. The niosomes also improved cellular uptake of the entrapped drug which may contribute to the enhanced antioxidative effects.

The diffusion of drug from niosomal formulation showed an initial fast phase (20% over three hours) followed by a sustained release phase (70-90% over 24 hours). This is of interest for dermal application as initial fast release improves penetration, while further sustained release provides the drug over a prolonged period, maintaining therapeutic concentration in the skin.

The University of Auckland

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