Research & Reviews: Drug Delivery

Vesicular Systems: Novel Carriers to Enhance Dermal and Transdermal Drug Delivery

Venkatarajan Kuppusamy*

Department of Pharmaceutics, JSS University, Udhagamandalam, Tamil Nadu, India

Commentary

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***For Correspondence:** Venkatarajan Kuppusamy, Department of Pharmaceutics, JSS University, Udhagamandalam, Tamil Nadu, India

E-mail: venkup087@gmail.com

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ABOUT THE STUDY

The importance of dermal/transdermal medication delivery is continuing to rise as a way to improve therapeutic efficacy while lowering toxicity by preventing systemic drug absorption. It prompted the modification of a wide range of medication carriers. Vesicular systems are one of the methods utilized to enhance cutaneous medication delivery. The vesicular drug delivery system is a highly organized assembly made up of one or more concentric bilayers that are created when amphiphilic building blocks self-assemble in the presence of water. There are various categories of vesicular systems developed to enhance dermal drug delivery as follows.

Nanocapsules

Nanocapsules are colloidal particles that are smaller than 1 m. They are constructed with a liquid core encased in an extremely thin polymer shell. The cavity's medium is greasy. The active molecule is contained in this system as a liquid, a solid, or even a molecular dispersion. These can be produced using the layer-by-layer technique, producing polyelectrolyte nanocapsules. In this instance, the surface of a template that is eventually dissolved is coated with polyelectrolytes that have opposite charges.

Liposomes

It is composed of flat bilayers of phospholipids that spontaneously self-associate. Liposomes create vesicles with an aqueous core when they are dissolved in water. Phosphatidyl-cholines are the most often employed phospholipids among all those that are now available for the creation of liposomes. It is frequently supplemented with cholesterol. Although the cholesterol intercalates between the phospholipid molecules, a bilayer is not naturally formed. The membrane becomes more stiff as a result of the flaws it produces, which lowers the permeability to water-soluble molecules. Additionally, it makes items more stable when there are biological fluids present.

Ethosomes

Dermal transport has significantly improved when an alcohol up to 50% is added to the aqueous phase of liposomes. Compared to traditional liposomes, they are easier to prepare. A localised change of the extracellular matrix of the SC is caused by ethanol, which is first and foremost an intrinsic penetration enhancer. The physicochemical properties of ethosomes are impacted by ethanol, second. A study on the encapsulation of trihexyphenidyl HCl revealed that it causes a negative surface charge and a reduction in the size of vesicles. When compared to the equivalent liposomes, the average diameter of the ethosomes was 109 nm, while it was 324 nm.

Transfersomes

These are phospholipid vesicles to which an edge activator, a surfactant, or a single-chain lipid, up to a maximum of 25%, has been added. Although sodium cholate is the most popular edge activator, deoxycholate and various Spans and Tweens also exhibit some of the same characteristics. These molecules generate shapes with a large radius of curvature and only one fatty chain. Numerous studies have shown how well these flexible vesicles operate when it comes to the cutaneous and transdermal administration of medications. And because of its flexibility, it can flatten and fit through the small pores of stratum corneum.

Niosomes

While niosomes and liposomes are structurally similar, niosome membranes are composed of cholesterol and one or more nonionic surfactants. They have the benefit of being significantly less expensive and more stable than liposomes, and they can encapsulate a wide range of hydrophilic and lipophilic medicines. Niosomes act as a reservoir system, and altering their composition can alter the release kinetics. The surfactants selected for pharmaceutical applications must be biocompatible, biodegradable, non-immunogenic, and non-carcinogenic. The most widely employed are Spans and Brij. The main mechanism is a decrease in the barrier function of the epidermis caused by an increase in the fluidity of intercellular lipids. Additionally, they have the ability to separate or combine in the stratum corneum to create loosely bound aggregates that could pierce deeper.