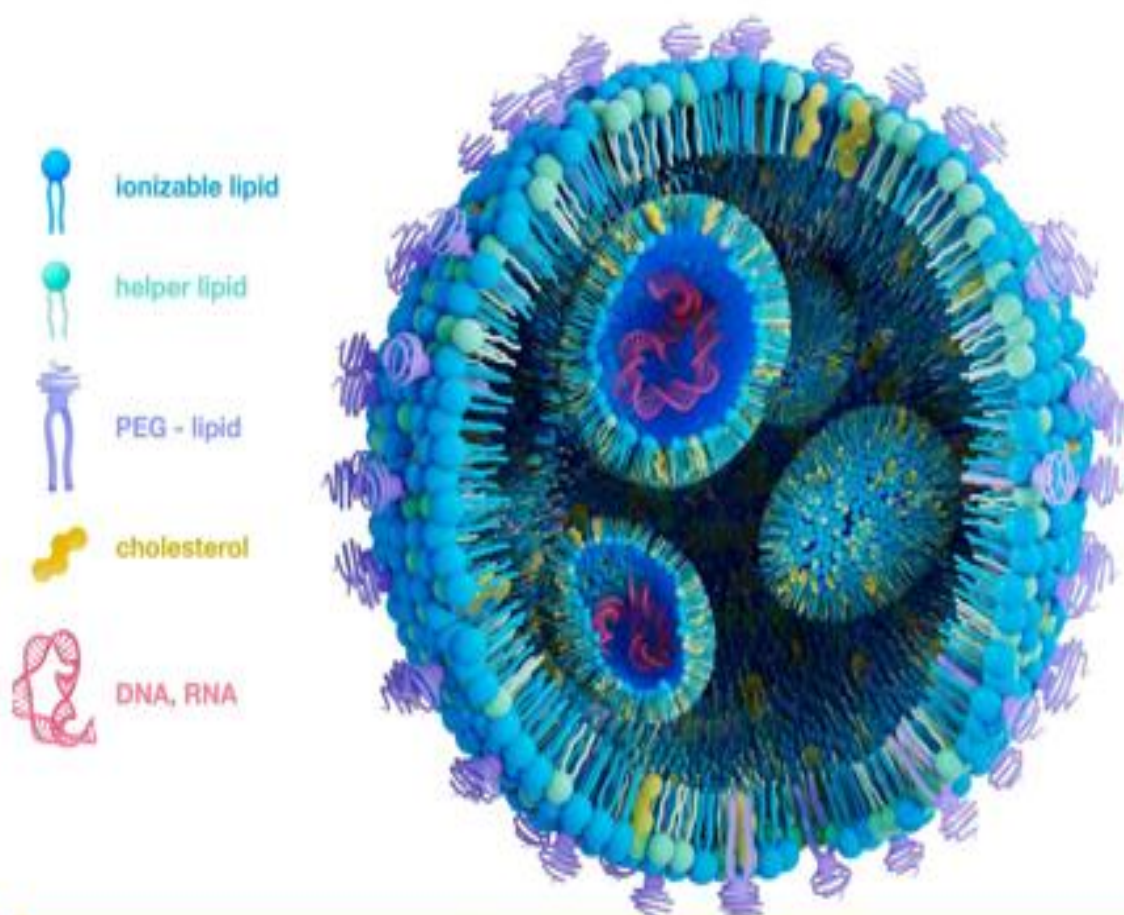


ADVANCES IN PHARMACEUTICAL NANOTECHNOLOGY AND DRUG DELIVERY



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4 NANOTECHNOLOGY-BASED TRANSDERMAL DRUG DELIVERY

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Abstract

Transdermal drug delivery systems have gained significant attention as an alternative to conventional routes because of their ability to bypass first-pass metabolism and provide controlled drug release. However, the major limitation of traditional transdermal systems is the barrier function of the stratum corneum, which restricts the permeation of many therapeutic agents. To overcome this challenge, nanotechnology-based approaches have been widely explored. Nanocarriers, such as nanoparticles, liposomes, niosomes, and nanoemulsions, enhance drug permeation through the skin by improving solubility, stability, and controlled-release characteristics. These nanosystems interact with the skin at the molecular level, facilitating deeper penetration and targeted delivery of drugs. Additionally, they can reduce the dosing frequency and minimize systemic side effects, thereby improving patient compliance. In this approach, the formulation and optimization of nanocarrier-based transdermal systems focus on parameters such as particle size, surface charge, drug entrapment efficiency, and release kinetics. The integration of nanotechnology with transdermal delivery offers a promising platform for delivering a wide range of drugs, including poorly soluble and potent molecules. Overall, nanotechnology-based transdermal drug delivery represents an advanced and effective strategy for achieving enhanced therapeutic outcomes and overcoming the limitations of conventional drug delivery systems.

KEYWORDS: Nanotechnology, transdermal drug delivery system, nanocarriers, optimization.