LITERATURE REVIEW: FORMULASI NANOVESICLE DEFORMABLE UNTUK TRANSDERMAL

SKRIPSI

Diajukan sebagai salah satu syarat untuk memperoleh gelar sarjana farmasi

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INTISARI

LITERATURE REVIEW: FORMULASI *NANOVESICLE DEFORMABLE* UNTUK TRANSDERMAL

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Penghantaran obat melalui rute transdermal memiliki keunggulan berupa penghindaran metabolisme lintas pertama, pelepasan obat yang terkontrol, serta peningkatan kepatuhan pasien. Namun, efektivitas sistem ini dibatasi oleh stratum korneum sebagai penghalang utama penetrasi obat. Dalam satu dekade terakhir, nanovesikula deformabel seperti transfersome, ethosome, dan transethosome dikembangkan sebagai strategi inovatif untuk meningkatkan permeasi obat melalui kulit. Literature review ini bertujuan untuk mengkaji perkembangan formulasi nanovesikula deformabel untuk sistem penghantaran obat transdermal selama periode 2015–2025, dengan fokus pada karakteristik formulasi, mekanisme penetrasi, aplikasi terapeutik, serta kelebihan dan keterbatasannya. Penelusuran literatur dilakukan melalui basis data PubMed dan Google Scholar menggunakan kata kunci terkait nanovesikula deformabel dan sistem penghantaran transdermal. Hasil telaah menunjukkan bahwa nanovesikula deformabel memiliki deformabilitas tinggi yang memungkinkan penetrasi melalui pori antarkorneosit tanpa merusak integritas kulit, sehingga meningkatkan permeasi, deposisi obat, dan bioavailabilitas dibandingkan sistem vesikular konvensional. Faktor formulasi seperti komposisi lipid, jenis dan konsentrasi edge activator atau etanol, ukuran partikel, potensial zeta, serta efisiensi penjeratan obat berperan penting dalam menentukan keberhasilan sistem ini. Berbagai studi melaporkan peningkatan efektivitas terapeutik pada obat antiinflamasi, antijamur, antihipertensi, hingga antikanker. Meskipun demikian, tantangan terkait stabilitas formulasi, potensi iritasi kulit, kompleksitas produksi, dan biaya masih menjadi kendala. Secara keseluruhan, nanovesikula deformabel menunjukkan potensi besar sebagai sistem penghantaran obat transdermal yang efektif dan non-invasif, namun memerlukan optimasi lanjutan untuk mendukung aplikasi klinis dan komersial.

Kata Kunci : nanovesikula deformabel, *transdermal*, drug delivery system.

ABSTRACT

LITERATURE REVIEW: FORMULATION OF DEFORMABLE NANOVESICLES FOR TRANSDERMAL DRUG DELIVERY

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Transdermal drug delivery offers several advantages, including avoidance of first-pass hepatic metabolism, controlled drug release, and improved patient compliance. However, its effectiveness is limited by the stratum corneum, which acts as the primary barrier to drug penetration. Over the past decade, deformable nanovesicles such as transfersomes, ethosomes, and transethosomes have been developed as innovative strategies to enhance drug permeation through the skin. This literature review aims to examine the development of deformable nanovesicle formulations for transdermal drug delivery during the period 2015–2025, with a focus on formulation characteristics, penetration mechanisms, therapeutic applications, as well as their advantages and limitations. Literature searches were conducted using PubMed and Google Scholar databases with keywords related to deformable nanovesicles and transdermal drug delivery systems. The reviewed studies demonstrate that deformable nanovesicles possess high elasticity, enabling them to penetrate intercorneocyte pathways without disrupting skin integrity, thereby enhancing drug permeation, skin deposition, and bioavailability compared to conventional vesicular systems. Formulation factors such as lipid composition, type and concentration of edge activators or ethanol, particle size, zeta potential, and drug entrapment efficiency play critical roles in determining system performance. Numerous studies report improved therapeutic efficacy of anti-inflammatory, antifungal, antihypertensive, and anticancer drugs. Nevertheless, challenges related to formulation stability, potential skin irritation, production complexity, and cost remain. Overall, deformable nanovesicles show significant potential as effective and non-invasive transdermal drug delivery systems, although further optimization is required to support clinical and commercial applications.

Keywords: deformable nanovesicles, transdermal, drug delivery system.