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Chapter 2: Liposomal Drug Delivery System

Maitri A. Patel, Dhvani D. Joshi, Meet R. Patel

Department of Pharmaceutical Quality Assurance and Pharmaceutical Chemistry, Nootan Pharmacy College, Sankalchand Patel University, Visnagar, Gujarat, India.

Abstract

Liposomes are spherical, self-assembling vesicular systems composed of one or more phospholipid bilayers surrounding an aqueous core. Owing to their amphiphilic nature, they can encapsulate both hydrophilic and lipophilic therapeutic agents, thereby enhancing solubility, stability, and bioavailability. Since their introduction in the 1960s, liposomes have progressed from simple model membranes to clinically approved nanocarriers with broad therapeutic applications. They provide significant advantages such as targeted delivery, controlled release, reduced systemic toxicity, and improved pharmacokinetic profiles. This chapter provides a comprehensive overview of liposomal technology, including their structural characteristics, classification, and formulation strategies. Various preparation methods such as thin-film hydration, solvent dispersion, extrusion, microfluidics, and detergent removal are critically discussed with respect to scalability, reproducibility, and regulatory compliance. Advances in stealth liposomes, immunoliposomes, and stimuli-responsive systems are highlighted, with emphasis on their clinical relevance. Furthermore, the chapter outlines the current and emerging applications of liposomes in oncology, infectious diseases, ophthalmology, dermatology, vaccine delivery, and gene therapy. Challenges related to stability, large-scale manufacturing, and quality-by-design (QbD) based regulatory considerations are also addressed. Overall, liposomes continue to serve as a cornerstone of nanomedicine, bridging fundamental pharmaceutical science with translational and clinical success.

Keywords: Liposomes; Nanocarriers; Drug delivery systems, Targeted therapy, Controlled release, PEGylation, Pharmaceutical nanotechnology.

2.1 Introdution

Lipo which means "fat" and Soma which means "body" are the Greek terms from which the term liposome is derived. a liposome is a drug delivery system that resembles a colloidal, vesicular structure and is composed of one or more lipid bilayers (the outer layer) with an equal number of aqueous layers (the inner layer) enclosed within. The

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