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REVIEW ARTICLE

# Lipid-based Nanocarrier Drug Delivery Approach for Biomedical Application

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**Abstract:** The development of nanosized drug-carrier systems has been investigated over the past few decades using various techniques. The two main categories of these systems are polymeric nanoparticles and lipid nanoparticles (LNPs). The toxicological risk associated with lipid nanoparticles is significantly lower than the danger associated with polymeric nanoparticles due to the materials' natural and biological origins. Lipid-based drug delivery systems like Nanostructured lipid carriers (NLCs) and Solid Lipid Nanoparticles (SLNs) are well-established nanotechnology systems for preparing all major pharmaceuticals. These delivery systems can be scaled up with easy manufacturing procedures and are biocompatible. NLCs are the second generation of lipid-based nanocarriers (SLNs), formed by combining solid and liquid biocompatible lipids to form an unstructured matrix that provides high entrapment efficiency of active constituents. LNPs can promote the distribution of active pharmaceutical ingredients to the target site. Increasing the active drug concentration to target organ LNPs enhances the therapeutic effectiveness and reduces the side effects. This paper reviews the structure of SLNs and different NLCs, various steps involved in manufacturing lipid nanoparticles, excipients used in the formulation, and applications for targeted drug delivery.

**Keywords:** Solid Lipid Nanoparticles (SLNs), Nanostructured Lipid carriers (NLCs), targeted drug delivery, biocompatible, biodegradable.



## 1. INTRODUCTION

One of the most important areas of interest in pharmaceutical sciences is the direct delivery of drugs to the targeted site. We know this type of drug delivery as "targeted drug delivery." To strengthen drug delivery, novel challenges have emerged through the progress in colloidal delivery structures, such as micelles, liposomes, and nanoparticles.

The development of nanosized drug-carrier systems has been investigated over the past few decades using various techniques. The two main categories of these systems are polymeric nanoparticles and lipid nanoparticles. Polymeric nanosystems are solid colloidal particles made of either biodegradable macromolecular materials from synthetic, semisynthetic, or natural sources or synthetic, non-biodegradable synthetic polymers. The cytotoxicity of polymers and the lack of effective large-scale production methods are the disadvantages of polymeric nanoparticles. The toxicological risk associated with lipid nanoparticles is significantly lower than the danger associated with polymeric nanoparticles due to the materials' natural and biological origins [1].

Oil-in-water nanoemulsions are produced by substituting solid lipids for liquid oil, forming solid lipid nanoparticles (SLNs). Beginning in 1990, the first generation of SLNs was created. The use of physiological lipids, the avoidance of chemical solvents, and the viability of large-scale production are the benefits of SLNs. As drug delivery vehicles, SLNs can enhance the bioavailability, shield delicate medications from harsh conditions, and regulate drug-release properties. However, due to the crystalline structure of solid lipids, SLNs exhibit some drawbacks as drug transporters, such as an unexpected gelation tendency, polymorphic transition, and low incorporation. Nanostructured lipid carriers (NLCs) were created at the turn of 2000 to address some of the issues brought up by SLNs. Controlling the mixing of solid lipids with liquid oil creates NLCs, which result in unique nanostructures in the matrix. The new generation can eliminate the potential downsides of SLNs, including their restricted drug-loading capacity and drug expulsion during storage [2]. In this review, we'd like to demonstrate how far NLCs have come in terms of drug delivery and targeting applications. The many NLCs for pharmaceuticals and potential delivery methods are also covered in this review.

A drug delivery system based on lipids is a recognized, well-known, and commercially reasonable process for fabricating medicines in various dosage forms. Lipid-based formulations like solid lipid nanoparticles and nanostructured

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