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Lipid-based nanoparticles as promising colloidal drug carriers

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Polymeric nanoparticles are of greatimportance for their potential uses in controlled and sustained drug release. Nevertheless, the cytotoxicity of the polymers after internalization intocells is a crucial and often less discussed aspect. Also, large-scaleproduction of polymeric nanoparticles can be challenging. Polymeric nanoparticle-based carrier systems have had limited success interms of their commercialization. Therefore, considerable attention has beendirected toward the development of solid lipid nanoparticles (SLNs) andnanostructured lipid carriers (NLCs) for their application as controlleddelivery systems. SLNs and NLCs consist of matrix prepared withbiocompatible and biodegradable lipids or lipidic substances, which are solid,at both room and physiological temperatures. SLNs based on puretriglycerides or waxes exhibit limited drug payloads due to the solubility ofdrug in the lipid that can lead to potential drug expulsion from the crystallattice upon polymorphic transitions into perfect crystals. Thesedisadvantages of SLNs can be overcome by the design of NLCs, which areproduced by preparing a blend of a solid and liquid lipid (oil), which leads toan imperfect matrix structure. The matrix of NLCs by virtue of theseimperfections can accommodate drugs in molecular form or as amorphousclusters. SLNs and NLCs possess specificadvantages that include production without organic solvents, long timephysical stability, and the possibility of protection of chemically labile moietiesinside the particles. Different applications of lipid nanocarriers have made them as popular drug delivery systems including enhancement of oral absorption and bioavailability of drugs with high first pass metabolism, sustained parenteral dosage forms using stealth lipid nanoparticles andenhanced transdermal permeation of the drugs by lipid nano capsule-based gels. Site specific delivery of drugs to pulmonary tract, blood brain barrier and cancer tissues using ligands anchored to lipid nanoparticles are another aspects of their applicationin targeted drug delivery which reduces the side effects and required dose of chemotherapeutics and multidrug resistance.