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Commentary

Characteristics, Synthesis and Applications of Solid Lipid Nanoparticles (SLNs)

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DESCRIPTION

Lipid Nanoparticles (LNPs) are lipid-based nanoparticles. They are a novel pharmaceutical formulation and drug mode of transmission (a component of nanoparticle drug delivery).

Characteristics

A typical lipid nanoparticle has a spherical shape with an average diameter of 10 to 1000 nanometers. Lipophilic compounds can be solubilized by the solid lipid core matrix of solid lipid nanoparticles. Surfactants stabilise the lipid core (emulsifiers). For parenteral administrations, there are greater restrictions on the emulsifier that can be employed.

Lipid is used more widely to refer for triglycerides, which including tristearin, diglycerides, such as glycerol bahenate, monoglycerides, glycerol monostearate, fatty acids, stearic acid, steroids, cholesterol, and waxes (eg: cetyl palmitate). All elements of emulsifiers have been utilised to stabilise the lipid dispersion. An SLN (Solid Lipid Nanoparticles) is generally spherical in shape and is composed of a solid lipid core that is surfactant-stabilized. Fatty acids, acylglycerols, waxes, and combinations of these surfactants can all be the core lipids. Stabilizers include bile salts (sodium taurocholate), sterols (cholesterol), phospholipids, sphingomyelins, and other biological membrane lipids. Due to higher mass transfer resistance, biological lipids with low carrier cytotoxicity and solid state lipids allow for better regulated drug release.

The four types of lipids that make up LNPs (Lipid Nanoparticle) are an ionizable cationic lipid (whose positive charge binds to negatively charged mRNA), a PEGylated lipid (for stability), a phospholipid (for structure), and cholesterol. LNPs are included in mRNA vaccines for SARS-CoV-2 (the virus that causes COVID-19). Neutral ionizable amino lipids were produced as a result of the positively charged lipid's rapid immune system clearance.

Synthesis

Different formulation techniques such as high-shear homogenization, ultrasonic, solvent emulsification/evaporation, or micro emulsion are used for the synthesis of Solid lipid nanoparticles. Ultra sonification can be used to obtain size distributions in the 30-180 nm range, but at a significant expense: a long sonication period. With the advantage of avoiding heat, solvent-emulsification is suitable for producing homogeneously sized, tiny lipid nanoparticle dispersions.

Applications

One of the rapidly developing aspects of lipid nanotechnology is the creation of solid lipid nanoparticles, which has a wide range of potential implications in medication delivery, clinical treatment, and a variety of other sectors. Lipid nanoparticles provide the potential to create novel therapies due to their distinct size-dependent characteristics. The ability to incorporate pharmaceuticals into nanocarriers offers a new drug delivery prototype that may hold considerable promise for achieving enhanced bioavailability in addition to regulated and site-specific drug administration.

SLNs are also thought to be generally well tolerated since they are made of lipids that are comparable to those found in the body. For the administration of pharmaceuticals to intestinal lymphatics, conventional technologies such the use of permeation enhancers, surface modification, prodrug synthesis, complex formation, and colloidal lipid carrier-based strategies have been established. Liposomes, micro emulsions, micellar solutions, and most recently Solid Lipid Nanoparticles (SLN).

CONCLUSION

Lipophilic compounds can be solubilized by the solid lipid core matrix of solid lipid nanoparticles. Surfactants stabilise the lipid core (emulsifiers) for parenteral administrations, there are restrictions on the emulsifier that can be employed. One of the rapidly developing aspects of lipid nanotechnology is the creation of Solid Lipid Nanoparticles (SLN). Lipid Nanoparticles provide the potential to create novel therapies due to their size-dependent characteristics. They generally well tolerated since they are made of lipids that are comparable to lipids in the body.

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