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Perspective

Advantages and Disadvantages of Solid Lipid Nanoparticles

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DESCRIPTION

Solid Lipid Nanoparticles (SLN) has a number of potential uses in research and drug delivery and are at the forefront of the quickly evolving field of nanotechnology. Lipid nanoparticles present a chance to create novel therapies because of their special size-dependent characteristics. Drug targeting is made possible by the ability to combine pharmaceuticals into nanocarriers, which gives a new drug delivery concept. Thus, solid lipid nanoparticles have garnered a lot of interest from researchers due to their significant potential for achieving the goal of regulated and site-specific drug delivery.

Lipid nanoparticles are known as SLNs use solid lipids like matrix media that are stabilized by surfactants in an aqueous medium. Over liposomes, SLNs offer the benefits of enhanced stability and prolonged drug release. Because of their occlusivity, SLNs are therefore used for epidermal targeting, follicular delivery, and better skin hydration.

Lipid nanocarriers are being used increasingly in the pharmaceutical industry to carry and deliver a variety of therapeutic agents, from biotechnological products to tiny medication molecules. Phospholipids are a crucial component of lipid and lipid-based drug delivery systems due to their range of characteristics, including their amphiphilic nature, biocompatibility, and multifunctionality. However, the complex manufacturing process, low percentage Entrapment Efficiency (% EE), and challenging large-scale manufacture of liposomes, lipospheres, and microsimulation carrier systems, as well as their other shortcomings, have led to the development of the SLN delivery system. SLNs typically have a spherical shape with a diameter between 50 and 1000 nm. Lipids, which are solid at room temperature, emulsifiers, and occasionally a combination of both, Active Pharmaceutical Ingredients (APIs), and a suitable solvent system, are the main components of SLN formulations. Drug delivery systems based on nanocarriers can be divided into different categories according to factors like administration method, degree of degradation, etc.

The first generation of lipid-based nanocarriers, known as Solid Lipid Nanoparticles (SLNs), is made from lipids, which are solid at body temperature and stabilized by emulsifiers. Submicron (less than 1000 nm) sizes apply to SLNs. They offer many benefits, including the capacity to protect drugs from extreme environmental conditions, facilitate large-scale synthesis utilising the high pressure homogenization technique, and be biocompatible and biodegradable.

Advantages of solid-lipid nanoparticles

The benefits of various colloidal systems including liposomes, nanoemulsions, and polymeric nanoparticles are all combined in SLNs. The following succinctly describes the main benefits of SLNs:

- SLNs have no bio toxicity because the lipids utilised are biocompatible and biodegradable materials.
- It is possible to make SLNs without employing organic solvents.
- The physical stability of SLNs is high.
- SLNs can be used to achieve both drug targeting and controlled drug release.
- Incorporating active compounds into SLNs can boost their stability.
- Lipophilic and hydrophilic medications may be encapsulated in SLNs.
- It is simple to produce SLNs on a big scale.
- SLNs are sterilizable.

Disadvantages of solid-lipid nanoparticles

The flawless crystalline structure of SLNs has several drawbacks as well, including a low drug loading efficiency and the potential for drug expulsion due to crystallization during storage.

- Lipid dispersions have high water content.
- Limited transdermal medication delivery.
- Hydrophilic drug loading capacity is constrained.
- Polymorphic change.
- Increase in particle size while being stored.
- Lipid dispersion gelation.
- The toxicity of lipid nanoparticles on retinal cells has not yet been thoroughly investigated.

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