

Conventional Concept of Formulations of Nanosuspensions

Abstract

Poor water solubility of some of the drug molecules is a major problem that is found to be accountable in drug formulation. So, drug nanosuspensions are found to observe an emerging solution which can be used for safe delivery of such kind of hydrophobic drugs. Scaling down of biocompatible nanoparticles or nanobiomaterials enhances drug aqueous solubility and bioavailability by increasing drug surface area when that comes into contact with biological media. Formulated nanosuspensions are stabilised by various polymers to get effective targeted delivery in cancer tissues and infarct zones with minimal damage to healthy tissues. So, in this review, conventional concept of preparation and application of nanosuspensions are highlighted for achieve effective drug delivery design and their administration routes e.g. parenteral, pulmonary, oral, and ocular which may be helpful for future clinical and pharmaceutical considerations.

Keywords: Nanosuspensions; Nanobiomaterial; Nanodelivery; Drug delivery; Nanoemulsion; Parenteral; Pulmonary; Oral; New chemical entities; Biopharmaceutical classification systems

Mini Review

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Introduction

Approximately 40% of new chemical entities (NCE) are lipophilic compounds that have poor aqueous solubility and dissolution which causes their low bioavailability of loaded drug that reaches the systemic circulation [1].

Therefore, formulating new poorly water soluble molecules are coined to be of two types of molecules called, "Grease ball" and "brick dust" molecules. Grease ball molecules are highly lipophilic as compared to Brick dust molecules, but Brick dust molecules have high melting point above 200°C that have strong intermolecular bonding and high lattice energy in solid state [2,3].

Poorly water soluble molecules are typically formulated for improving their dissolution rate and storage stability by increasing active drug surface area that come in the contact with the dissolution medium [4]. Most important characteristics of nanosuspensions are their exhibited particle size; polydispersity index, drug saturation solubility, physical stability, dissolution rate and bioavailability that make them more effective drug delivery system as compared to other conventional clinical and pharmaceutical designs [5].

Their demonstrated advantages are summarised the Biopharmaceutical Classification Systems (BCS) of lipophilic that allocates these drugs further into one of 4 classes: high solubility, high permeability (class I); low solubility and high permeability (class II); high solubility and low permeability (class III); low solubility and low permeability (class IV) [6-8].

Nanofabrication of azithromycin has found to be demonstrated a proven tool to increase its dissolution percentage more than 65% to get increased drug bioavailability and to achieve the

maximum possibility of lipophilic drugs to incorporate them in various nanosuspensions dosage formats such as tablets, pellets, and capsules following standard manufacturing techniques [9,10]. For example, ketoprofen nanosuspension has been reported that was successfully transformed into pellets with its lower fed/fasted variability [11].

Previously, "Emulsion Diffusion Method" has been also reported to prepare these kind of drug loaded nanosuspensions by using partially water-miscible and volatile organic solvent such as butyl lactate, benzyl alcohol, triacetin, and ethyl acetate as the dispersed phase systems [12,13]. These kinds of nanoemulsion formations are prepared by dispersing the drug in a mixture of solvents or an organic solvent by using high pressure homogenisation that lead diffusion of the internal phase into the external phase when droplets convert into semisolid to solid nanoparticles. The only major drawback of this technology was noted to have potential environmental hazards and human safety issues because of using organic solvents such as ethyl acetate, ethanol, methanol, and chloroform [12,14].

Conclusion

So, this mini review article can be very useful for depicting the most common conventional methods using various chemical entities which lead to form more effective nanosuspensions which might be used for further advanced clinical therapies and pharmaceutical trials including their high surface area, controllable nanosize dimensions, and tailored surface chemistry. However, these nanosuspensions may have good opportunity for further fabrication of nanoparticles to increase their surface properties to get optimized bioavailability response for treating a number of diseases such as cardiovascular disease, cancer,

diabetes, Parkinson's, Alzheimer's. Hence, further studies are also necessary to understand the behaviour of fabricated nanosuspensions in vivo systems, including their interactions with cells and different biological barriers such as the blood-brain barrier and their surface engineering for getting effective active or passive targeting to combat the various clinical challenges that are associated with poorly soluble drugs in order to achieve excellent bioavailability, high dissolution velocity and more potent bioadhesion of the loaded drug to the targeted sites.

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