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Controlled Drug Delivery System for Delivery of Poor Water Soluble Drugs

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Abstract : The poor aqueous solubility of many pharmaceutical drugs and potential drug candidates is a big challenge in drug development. Nanoformulation of such candidates is one of the major solutions for the delivery of such drugs. We initially developed the evaporation assisted solvent-antisolvent interaction (EASAI) method. EASAI method is use full to prepared nanoparticles of poor water soluble drugs with spherical morphology and particles size below 100 nm. However, to further improve the effect formulation to reduce number of dose and side effect it is important to control the delivery of drugs. However, many drug delivery systems are available. Among the many nano-drug carrier systems, solid lipid nanoparticles (SLNs) have many advantages over the others such as high biocompatibility, stability, non-toxicity and ability to achieve controlled release of drugs and drug targeting. SLNs can be administered through all existing routes due to high biocompatibility of lipids. SLNs are usually composed of lipid, surfactant and drug were encapsulated in lipid matrix. A number of non-steroidal anti-inflammatory drugs (NSAIDs) have poor bioavailability resulting from their poor aqueous solubility. In the present work, SLNs loaded with NSAIDs such as Nabumetone (NBT), Ketoprofen (KP) and Ibuprofen (IBP) were successfully prepared using different lipids and surfactants. We studied and optimized experimental parameters using a number of lipids, surfactants and NSAIDs. The effect of different experimental parameters such as lipid to surfactant ratio, volume of water, temperature, drug concentration and sonication time on the particles size of SLNs during the preparation using hot-melt sonication was studied. It was found that particles size was directly proportional to drug concentration and inversely proportional to surfactant concentration, volume of water added and temperature of water. SLNs prepared at optimized condition were characterized thoroughly by using different techniques such as dynamic light scattering (DLS), field emission scanning electron microscopy (FESEM), transmission electron microscopy (TEM), atomic force microscopy (AFM), X-ray diffraction (XRD) and differential scanning calorimetry and Fourier transform infrared spectroscopy (FTIR). We successfully prepared the SLN of below 220 nm using different lipids and surfactants combination. The drugs KP, NBT and IBP showed 74%, 69% and 53% percentage of entrapment efficiency with drug loading of 2%, 7% and 6% respectively in SLNs of Campul GMS 50K and Gelucire 50/13. In-vitro drug release profile of drug loaded SLNs is shown that nearly 100% of drug was release in 6 h.

Keywords : nanoparticles, delivery, solid lipid nanoparticles, hot-melt sonication, poor water soluble drugs, solubility, bioavailability
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