

Optimization of 5-fluorouracil solid-lipid nanoparticles: a preliminary study to treat colon cancer

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Abstract :

Solid lipid nanoparticle (SLNs) formulae were utilized for the release of 5-fluorouracil (5-FU) inside the colonic medium for local treatment of colon cancer. SLNs were prepared by double emulsion-solvent evaporation technique (w/o/w) using triglyceride esters, Dynasan™ 114 or Dynasan™ 118 along with soyalecithin as the lipid parts. Different formulation parameters; including type of Dynasan, soyalicithin:Dynasan ratio, drug:total lipid ratio, and polyvinyl alcohol (PVA) concentration were studied with respect to particle size and drug entrapment efficiency. Results showed that formula 8 (F8) with composition of 20% 5-FU, 27% Dynasan™ 114, and 53% soyalithicin and F14 (20% 5-FU, 27% Dynasan™ 118, and 53% soyalithicin), which were stabilized by 0.5% PVA, as well as F10 with similar composition as F8 but stabilized by 2% PVA were considered the optimum formulae as they combined small particle sizes and relatively high encapsulation efficiencies. F8 had a particle size of 402.5 nm ± 34.5 with a polydispersity value of 0.005 and an encapsulation efficiency of 51%, F10 had a 617.3 nm ± 54.3 particle size with 0.005 polydispersity value and 49.1% encapsulation efficiency, whereas formula F14 showed a particle size of 343 nm ± 29 with 0.005 polydispersity, and an encapsulation efficiency of 59.09%. DSC and FTIR results suggested the existence of the lipids in the solid crystalline state. Incomplete biphasic prolonged release profile of the drug from The three formulae was observed in phosphate buffer pH 6.8 as well as simulated colonic medium containing rat caecal contents. A burst release with magnitudes of 26%, 32% and 28.8% cumulative drug released were noticed in the first hour samples incubated in phosphate buffer pH 6.8 for both F8, F10 and F14, respectively, followed by a slow release profile reaching 50%, 46.3% and 52% after 48 hours.

Key Word :

Solid lipid nanoparticles, double emulsion, colon cancer, Dynasan, 5-fluorouracil, polyvinyl alcohol

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