Solid Lipid Nanoparticles Loaded with Vancomycin for Oral Bioavailability Enhancement

Lewis Dymock[1,2], Paul Evans[2], Clare Hoskins[1]

[1] Pure and Applied Chemistry, University of Strathclyde, Glasgow, G1 1RD, UK.

[2] NextPharma, Livingston, EH53 0TH, UK.

Background: Owing to the incredibly low bioavailability of vancomycin, utilisation of solid lipid nanoparticles (SLNs) as a nanocarrier platform for delivery of the drug offers a potential to increase the oral bioavailability. SLNs have been shown to effectively traffick drugs and offer an increased effect when compared to the bare drug. Formulation of SLNs with long-term stability and the ability to entrap large quantities of vancomycin allows for the possibility of the surface characteristics to be modified to greater increase the potential therapeutic effect.

Methods: Two vancomycin loaded SLN platforms were formulated by ultrasonication of an emulsion comprised of a molten lipid phase and an aqueous phase containing surfactants and vancomycin. Once formed, SLNs were cooled at 2-8 °C and then purified by high-speed centrifugation at 75,000 xg for 90 minutes, washed thrice with deionised water and redispersed. Analysis of the finals SLNs was carried out by DLS to determine the average size, polydispersity index and zeta potential, and by UV-Vis spectroscopy for the entrapment efficiency, loading capacity, and drug release profile.

Results: Physical characterisation of both SLN platforms showed sizes of 150 and 275 nm with PDI values of 0.238 and 0.285, and zeta potentials of -19.5 and -28.3 mV. Analysis of vancomycin entrapment showed concentrations of 1.33 and 1.48 $mgmL^{-1}$ in the final formulation post-purification.

Drug release in PBS (pH = 7.4) reached 35-40 % in the first 30 minutes, with a further 30 % being release over the subsequent 24 hours.

Conclusions: The current data gained from both platforms shows good dispersity in suspension, and a large final entrapment of vancomycin, on the order of 50 % of the initial loading concentration.