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Novel electrosprayed nanospherules for enhanced aqueous solubility and oral bioavailability of poorly water-soluble fenofibrate

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The purpose of the present research was to develop a novel electrosprayed nanospherule providing the most optimized aqueous solubility and oral bioavailability for poorly water-soluble fenofibrate. Numerous fenofibrate-loaded electrosprayed nanospherules were prepared with polyvinylpyrrolidone (PVP) and Labrafil® M 2125 as carriers using the electrospray technique, and the effect of the carriers on drug solubility and solvation was assessed. The solid state characterization of an optimized formulation was conducted by scanning electron microscopy, powder X-ray diffraction, differential scanning calorimetry, and Fourier transform infrared spectroscopic analyses. Oral bioavailability in rats was also evaluated for the formulation of an optimized nanospherule in comparison with free drug and a conventional fenofibrate-loaded solid dispersion. All of the electrosprayed nanospherule formulations had remarkably enhanced aqueous solubility and dissolution compared with free drug. Moreover, Labrafil M 2125, a surfactant, had a positive influence on the solubility and dissolution of the drug in the electrosprayed nanospherule. Increases were observed as the PVP/drug ratio increased to 4:1, but higher ratios gave no significant increases. In particular, an electrosprayed nanospherule composed of fenofibrate, PVP, and Labrafil M 2125 at the weight ratio of 1:4:0.5 resulted in a particle size of 200 nm with the drug present in the amorphous state. It demonstrated the highest solubility (32.51±2.41 µg/mL), an excellent dissolution (~85% in 10 minutes), and an oral bioavailability ~2.5-fold better than that of the free drug. It showed similar oral bioavailability compared to the conventional solid dispersion. Thus, the electrosprayed nanospherules, which provide improved solubility and bioavailability, are promising drug delivery tools for oral administration of poorly water-soluble fenofibrate.

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