

Optimization of nano spray drying parameters for production of α -amylase nanopowder for biotherapeutic applications using factorial design

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Abstract

This study was designed to optimize the effect of operating conditions and formulation parameters using various additives to develop α -amylase nanoparticles. α -Amylase was chosen due to its importance in the substantial number of industrial processing with emphasis on pharmaceutical industry. Factorial statistical design was adopted to effectively optimize the size, yield value, residual enzyme activity, and morphology of α -amylase nanoparticles using Nano Spray Dryer BUCHI B90. The physicochemical characterization of the prepared nanopowder was carried out using zetasizer and scanning electron microscopy (SEM) and enzyme activity assay. Results showed that the type of additive and mesh size significantly influenced the particles size and yield value. SEM images showed three different structure patterns where particle morphology was influenced by TweenVR 80 or sucrose at low concentration (0.05%). Optimized spherical nanoparticles (600nm) was obtained using 7 mm mesh cap size, sucrose (0.15%), 95% yield value, drying flow rate (100 L/min), and inlet temperature of 80 °C. Higher storage stability was detected for enzyme spray-dried using larger cap size. It was concluded that nano spray drying of aqueous enzyme solution under determined operating conditions produced stable α -amylase powders. This would extend the application of the enzyme in a variety of pharmaceutical products.

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