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Chitosan electrospraying: Mapping of process stability and micro and nanoparticle formation

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Abstract

Chitosan (CS) micro and nanospheres were produced by a one-step electrospraying process. The influence of several solution and process parameters on droplet morphology, collection yield and process stability was investigated. In addition, the mapping of the process stability was established according to various dimensionless numbers: Reynolds (*Re*), electric Peclet *(Pe*), Weber (*We*), Froude (*Fr*) and an electrostatic force parameter (Ω). CS (medium molecular weight)/acetic acid (CS/AcOH) solutions at 1 and 2 wt/v % CS, and at 70 and 90 v/v % AcOH content, allowed the production of micro and nanoparticles. A solution surface tension below 36 mN/m, a relatively low conductivity between 0.015 to 0.089 S/m and a shear viscosity between 0.08 to 1.65 Pa s, were required for process stability, micro and nanoparticle formation and collection. The optimal process conditions included pumping of CS/AcOH solutions through a 22G needle, at flow rate of 0.2 mL/h, a voltage of 33 kV and a distance of 11 cm from the needle tip to collector plate. In general, the stability in the electrospraying of CS/AcOH solutions required relatively low values for *Re*, *Fr* and Ω, but relatively high values for *Pe* and *We* numbers.

Key words: Chitosan, electrospraying, dimensionless numbers