Validation of a titration method to determine chondroitin sulfate loaded to solid lipid nanoparticles in an experimental factorial design

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Abstract:

Previous efforts at the Faculty of Pharmacy and Food Sciences of the University of Barcelona, have achieved to obtain cationic solid lipid nanoparticles (cSLN), with an average size of less than 200 nm, by the hot microemulsion method. It is of scientific interest to evaluate the capacity of SLN transporting chondroitin sulfate (CHON), which is a potential therapeutical agent in Osteoarthritis (OA), and studies recommend the development of topical systems with nanotechnology as a new perspective for future treatment of OA.

An experimental factorial design, to optimize the production of SLN of CHON, was employed. The variables were defined as Concentration (mg/ml), Stirring rate (rpm) and Reaction time (min). Different properties were tested, including entrapment efficiency of CHON, zeta potential and particle size. The optimal factors were attained by Minitab® program, using design of experiment (DOE) and pareto chart. A titration method was validated to test entrapment efficiency of CHON. A calibration curve was obtained from 0.10 to 1.20 mg mL–1 ($r > 0.9994$). Within-day % RSD was 0.7 and between-day % RSD was 1.11. Specificity/ selectivity experiments revealed the absence of important interference from excipients, mean recovery from spiked samples for CHON was 93.6 %.

In conclusion, the titration method is a simple, rapid and reliable method for the determination of chondroitin sulfate loaded to SLN. The DOE revealed that reaction time does not have a significant impact in the evaluated responses. However, concentration (0.4 mg/ml) and stirring rate (20 000 rpm) were determinant to maximize entrapment efficiency of CHON in SLN and to get the optimum size and zeta potential of SLN.

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