FORMATION OF CORE-SHELL TYPE CA-ALGINATE MACROCAPSULES BY ELECTRO-COEXTRUSION: EFFECTS OF ALGINATE CONCENTRATION AND DRYING METHOD

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Electro-coextrusion is an inexpensive, simple, and effective encapsulation technology, which allows the rapid mass production of core-shell type capsules of uniform size and quality. The objective of this study was to investigate the effects of alginate concentration and drying method on the size, morphology, and hardness of the core-shell type Ca-alginate macrocapsules produced by electro-coextrusion. Electro-coextrusion was performed by simultaneous and dropwise injection of shell (aqueous alginate solution) and core (olive oil) fluids into a 5% (w/v) aqueous CaCl₂ solution through a coaxial nozzle under the following conditions: alginate concentration = 0.5 - 4% (w/v), shell and core flow rates = 100 and 50 μl/min, respectively, voltage = 8 kV, distance between nozzle and CaCl₂ solution = 10 cm, and temperature = 20°C. The capsules were gelatinized in the CaCl₂ solution for 30 min, washed with distilled water, and then air-, vacuum-, or freeze-dried. Under all the given conditions, core-shell type Ca-alginate macrocapsules were successfully formed. With increasing the alginate concentration, the diameter and shell thickness of wet capsules increased from 1.57 to 2.05 and from 0.07 to 0.37 mm, respectively, and the diameters of air-, vacuum, and freeze-dried capsules also increased from 1.39 to 1.47, from 1.17 to 1.47, and from 1.27 to 1.50 mm, respectively. The most regularly shaped capsules were obtained when 2% alginate was used with air-drying. The hardness of wet capsules increased from 1197 to 7786 N, while that of air-dried capsules decreased from 5887 to 1706 N with the increase of alginate concentration.