Alginate Aerogel Formulation by Supercritical Drying

De Cicco F¹, Reverchon E², Della Porta G², Aquino RP¹, Del Gaudio P¹

¹ Department of Pharmacy, University of Salerno, Fisciano (SA), Italy
² Department of Industrial Engineering, University of Salerno, Fisciano (SA), Italy.

Conventional hydrogel drying techniques can induce the gel nanostructure collapse. In this work supercritical drying of alginate hydrogel beads was demonstrated to be a very effective process for alginate aerogels production: solvent exchange followed by supercritical extraction avoided gel collapse and accurate reproduction of the nanostructure was maintained in the derived aerogels. After beads cross-linking in water, ethanol and acetone were used as water exchanging solvents; when ethanol was used (operating at 150 bar and 38°C) aerogels maintained hydrated beads internal morphology. A uniform internal nanoporous texture and well defined spherical shape was obtained for those beads. Volume shrinkage of only 0.6% with respect of the diameter of the hydrated beads was observed. Beads cross-linked directly in ethanol were also produced, without any other treatment before supercritical drying. Very different particles in comparison to that produced by solvent exchanging were obtained. Aerogels by acetone exchanging generated, at all drying conditions, showed uniform internal nanostructure; in this case, the best results in terms of internal morphology and lowest shrinkage (0.3%) were obtained operating at 100 bar and 38°C. Exchange with water/ethanol solution (2:98) also produced aerogels with homogeneous internal structure at 100 bar and 38°C; this exchange solution could be suitable for bioactive compounds encapsulated into the aerogels.