Effect of supercritical CO_2 drying process conditions on starch aerogel properties

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Starch is an abundant and low-cost polysaccharide obtained from renewable resources. Biocompatibility, biodegradability, and versatility of starch enable its application in several industries including food and pharmaceutical.

In this work, supercritical CO_2 drying process was tested for preparation of stable and porous starch-based material. First, a hydrogel was formed from an aqueous solution (cornstarch to water mass ratio 1:10) at 95 °C. Subsequently, water was replaced with acetone during several days to form an acetogel. Finally, acetogels were subjected to supercritical CO_2 drying at pressures of 8, 10, 20 MPa and temperatures of 35 and 45 °C up to 3 h to form aerogels. Obtained aerogels were compared with starch xerogels prepared by air drying of acetogels.

The SEM, FTIR, and porosity analysis confirmed significant effect of supercritical CO_2 drying process conditions on starch aerogels properties and their suitability to form nanostructured matrices. SEM analysis showed that aerogels were filamentous with filament diameter less than 100 nm. Due to their low density (0.273-0.773 g/cm^3) and high porosity (48-82%) obtained starch aerogels present promising candidates as matrices and carriers for bioactive substances.

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