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Abstract

Guar galactomannan (GM) was crosslinked using a sustainable enzymatic oxidation approach to form hydrogels. Nanofibrillated cellulose was used as reinforcement prior to crosslinking. Thirteen solvents were tested for replacing water in the gels, and the volumetric yields of hydrogels are discussed in relation to the solvents' Hansen solubility parameters. Ethanol and dimethyl sulfoxide (DMSO) were selected for further stepwise solvent exchange, to characterize the hydrogels' shrinkage in response to solvents at each step. DMSO displayed a good compatibility with GM-based hydrogels as compared to ethanol during stepwise solvent exchange, and the overall shrinkage value was similar with those two solvents after supercritical CO_2 drying. The obtained aerogel exhibited highly porous composite structures with a large surface area (up to 333 m^2/g) and good mechanical stiffness. Negligible ethanol residue was detected, which makes the aerogels safe materials for food and other life science applications.

Keywords: A. Biocomposite, A. Cellulose, B. Microstructures. D. Mechanical testing.

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