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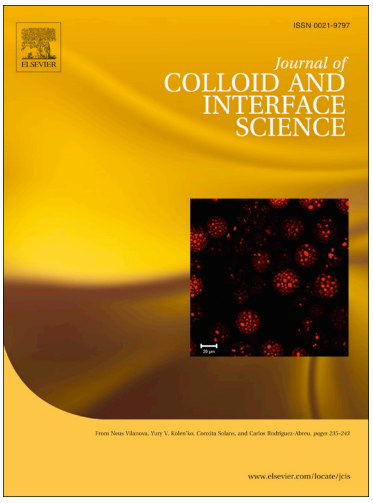

Regular Article

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Ultrasonication of spray- and freeze-dried cellulose nanocrystals in water

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Abstract

The structural and rheological properties of aqueous suspensions of spray-dried cellulose nanocrystals (CNCs) were investigated and compared to those of freeze-dried. The cellulose nanocrystals were obtained from sulfuric acid hydrolysis of wood pulp. Ultrasonication was used to disperse cellulose nanocrystals in Milli-Q water and the power applied during ultrasonication was shown to be the controlling parameter for their dispersion, more than total energy. Dynamic light scattering measurements showed a decrease of the average hydrodynamic diameter down to the same limiting value, *i.e.* ~ 75 nm, for both spray and freeze-dried cellulose nanocrystals. Since the same maximum dispersion state was reached for both CNC types, it indicated that the spray drying process did not limit dispersion, provided that sufficient ultrasonication was provided. Moreover, no desulfation occurred during ultrasonication at ambient temperature. Strong ultrasonication also caused a decrease of intrinsic viscosity, along with an increase in maximum packing concentration. These properties were correlated to agglomerates break-up, which released both ions and water in suspension. The ionic strength increase may lead to a thinner electrostatic double layer surrounding the cellulose nanocrystals, reducing their apparent concentration.

Keywords: cellulose nanocrystals (CNCs); spray drying; ultrasonication; aqueous suspension; structure; rheology