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Post-sulfonation of cellulose nanofibrils with a one-step reaction to improve dispersibility

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Highlights

- One step reaction for rapid sulfonation of cellulose nanofibrils
- Fibril like morphology and high crystallinity index was retained
- Significant improvements in zeta potential and dispersibility

Abstract

Cellulose nanofibrils (CNF) were sulfonated and the dispersion quality was compared to unfunctionalized and 2,2,6,6-tetramethylpiperdine-1-oxyl radical (TEMPO) post-oxidation treatment of existing CNF (mechanically fibrillated pulp). A post-sulfonation treatment on existing CNF in chlorosulfonic acid and dimethylformamide (DMF) resulted in sulfonated CNF that retained a fibril-like morphology. There was a small decrease in the cellulose crystallinity index for the sulfonated CNF, but this was much lower than the reported regioselective oxidative bisulfite pretreatment method used to make sulfonated CNF. The current approach was extremely quick, and 5 minutes of reaction time was sufficient to result in significant improvements in dispersibility compared to unfunctionalized CNF. The sulfonated CNF and TEMPO oxidized CNF had better dispersibility compared to the unfunctionalized CNF when dispersed in DMF and water, and in many cases the sulfonated CNF had better dispersibility than

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