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**Nanofibrillation of deep eutectic solvent–treated paper and board cellulose pulps**

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**Highlights**

- Deep Eutectic solvent was used as a pretreatment in nanofibrillation of cellulose
- Secondary fiber sources was used as a cellulose raw material
- Choline chloride-urea DES pretreatment enhanced the fibrillation of cellulose
- Green DES treatment is a promising method to nanofibrillate waste board and paper

**Abstract**

In this work, several cellulose board grades, including waste board, fluting, and waste milk container board, were pretreated with green choline chloride-urea deep eutectic solvent (DES) and nanofibrillated using a Masuko grinder. DES-treated bleached chemical birch pulp, NaOH-swollen waste board, and bleached chemical birch pulp were used as reference materials. The properties of the nanofibrils after disc grinding were compared with those obtained through microfluidization. Overall, the choline chloride-urea DES pretreatment significantly enhanced the nanofibrillation of the board pulps in both nanofibrillation methods—as compared with NaOH-treated pulps—and resulted in fine and long individual nanofibrils and some larger nanofibril bunches, as determined by field emission scanning electron microscopy and transmission electron microscopy. The nanofibril suspensions obtained from the DES pretreatment had a viscous, gel-like appearance with shear thinning behavior. The nanofibrils maintained their initial crystalline structure with a crystallinity index of 61% to 47%. Improved board handsheet properties also showed that DES-treated and Masuko-ground waste board and paper nanocellulose can potentially enhance the strength of the board. Consequently, the DES chemical pretreatment appears to be a promising route to obtain cellulose nanofibrils from waste board and paper.

*Keywords:* choline chloride; ; ; ; , DES, fibrillation, nanocellulose, refining, waste board

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