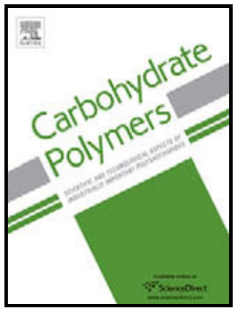

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Cellulose I and II nanocrystals produced by sulfuric acid hydrolysis of Tetra pak cellulose I

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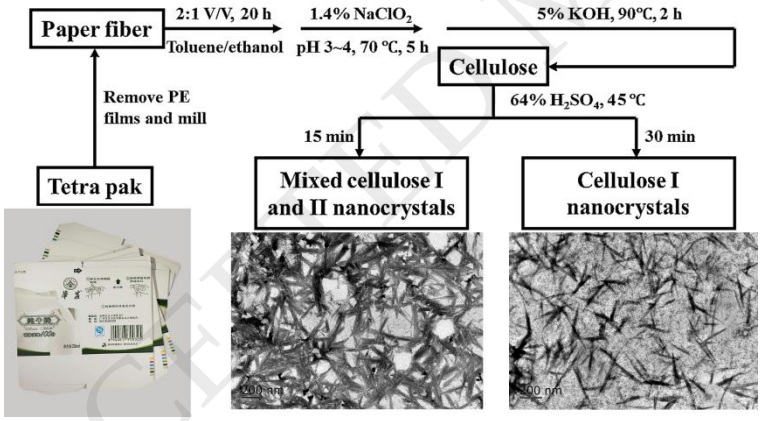
ABSTRACT

Polymorphism is an important factor associated with the cellulose nanomaterial properties. In this study, cellulose fibers (CFs) were efficiently isolated from waste Tetra pak packages, and cellulose I and II nanocrystals were produced by treatment of CFs with 64 % sulfuric acid and controlling the reaction time from 15 to 30 min. Cellulose I (CI) was partially converted to cellulose II (CII) within 15 min and the resulting cellulose nanocrystal product (i.e. CNC15) contained 93.2% CII. Further extending the hydrolysis time decreased the CII content of CNC20 to 25.5% and CNC30 was completely CI without CII. CNC15 (285.1±120.7 nm long, 50.6±16.5 nm wide, 0.64 at% sulfur) was much thicker, slightly longer, less thermal stable and contained more sulfate groups than CNC30 (207.2±77.8 nm long, 23.2±7.8 nm wide, 0.34 at% sulfur). CNCs with controllable allomorph may have potentially diverse applications.

Graphical abstract



HIGHLIGHTS

- Cellulose I fibers were isolated from waste Tetra pak packages.
- Sulfuric hydrolysis generated nanocrystals with different cellulose I to II ratios.