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Properties of cellulose nanocrystals from oil palm trunk isolated by total chlorine free method

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Highlights

- Cellulose nanocrystals were successfully isolated by total chlorine free method
- Diameter and length of the cellulose nanocrystals obtained were smaller
- Water pre-hydrolysis affects the size and properties of cellulose nanocrystals
- Total chlorine free method improves the crystallinity and thermal stability

ABSTRACT

Cellulose nanocrystals were isolated from oil palm trunk by total chlorine free method. The samples were either water pre-hydrolyzed or non-water pre-hydrolyzed, subjected to soda pulping, acidified and ozone bleached. Cellulose and cellulose nanocrystal (CNC) physical, chemical, thermal properties, and crystallinity index were investigated by composition analysis, scanning electron microscopy, transmission electron microscopy, fourier transform infrared, thermogravimetric analysis and X-ray diffraction. Water pre-hydrolysis reduced lignin (< 0.5%) and increased holocellulose (99.6 %) of ozone-bleached cellulose. Water pre-hydrolyzed cellulose exhibited surface fibrillation and peeling off after acid hydrolysis process compared to non-fibrillated of non-water pre-hydrolyzed cellulose. Water pre-hydrolysis improved final CNC crystallinity (up to 75 %) compared to CNC without water pre-hydrolysis crystallinity (69 %). Cellulose degradation was found to occur during ozone bleaching stage but CNC showed an increase in crystallinity after acid hydrolysis. Thus, oil

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