Multi-step pretreatment as an eco-efficient pretreatment method for the production of cellulose nanofiber from oil palm empty fruit bunch

ABSTRCT

Cellulose nanofiber (CNF) characteristics could be influenced by the pretreatment process during cellulose isolation, and generally pretreatment is conducted using harsh, less eco-efficiency chemical pretreatment. In this study, multi-step pretreatment method was evaluated for its eco-efficiency and compared with the conventional soda pulping method for cellulose isolation from oil palm empty fruit bunch (OPEFB). CNF developed from the celluloses pretreated by these methods were characterized. Some amount of hemicellulose residue left after the pretreatments whereby multi-step method showed higher amount of hemicellulose residue. This affected the diameter size of CNF obtained in which CNF from multi-step pretreated cellulose had smaller diameter range (13-33 nm) compared to that of soda pulping (18-52 nm). Crystallinity, thermal stability and degree of polymerization of the two CNFs are comparable. The superior characteristics of CNF obtained from multi-step pretreatment method, in addition to its eco-efficiency characteristic as evaluated based on the two key elements of eco-efficiency, namely, process re-engineering and by-products valorization, have recommended multi-step pretreatment method as a promising method for cellulose isolation from lignocellulose.

Keyword: Eco-efficient; Cellulose isolation; Multi-step pretreatment; Soda pulping; Oil palm empty fruit bunch; Cellulose nanofiber.