Isolation and characterization of microcrystalline cellulose from roselle fibers

ABSTRACT

In this study, microcrystalline cellulose (MCC) was extracted from roselle fiber through acid hydrolysis treatment and its properties were compared with those of commercially available MCC. The physicochemical and morphological characteristics, elemental composition, size distribution, crystallinity and thermal properties of the obtained MCC were analyzed in this work. Fourier transform infrared spectroscopy (FTIR) analysis provided clear evidence that the characteristic peak of lignin was absent in the spectrum of the MCC prepared from roselle fiber. Rough surface and slight aggregation of MCC were observed by scanning electron microscopy (SEM). Energy dispersive X-ray (EDX) analysis showed that pure MCC with small quantities of residues and impurities was obtained, with a similar elemental composition to that of commercial MCC. A mean diameter of approximately 44.28 μm was measured for MCC by using a particle size analyzer (PSA). X-ray diffraction (XRD) showed the crystallinity increased from 63% in roselle pulp to 78% in roselle MCC, the latter having a slightly higher crystallinity than that of commercial MCC (74%). TGA and DSC results indicated that the roselle MCC had better thermal stability than the roselle pulp, whereas it had poorer thermal stability in comparison with commercial MCC. Thus, the isolated MCC from roselle fibers will be going to use as reinforcing element in green composites and may be a precursor for future roselle derived nanocellulose, and thus a promising subject in nanocomposite research.

Keyword: Roselle fiber; Microcrystalline cellulose; Fourier transform infrared spectroscopy; Scanning electron microscopy; Thermal properties