EXTRACTION OF CELLULOSE NANOWHISKERS FROM FLAX FIBRES AND THEIR REINFORCING EFFECT ON POLY (FURFURYL) ALCOHOL

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ABSTRACT

The aim of this study was to explore the use of flax fibres as a source of raw material for the production of cellulose nanowhiskers (CNWs). The flax fibres were first cleaned using sodium hydroxide (NaOH), sodium chloride ($NaClO_2$) and potassium hydroxide (KOH) and then separated to obtain CNWs by mechanical treatments such as the ultrasonication as well as chemical acid hydrolysis. Untreated and chemical treated flax fibres were characterized by Fourier transform infrared (FTIR), environmental scanning electron microscopy (ESEM), thermogravimetric analysis (TGA) and X-ray diffraction (XRD). The morphology of the isolated CNWs was characterized using atomic force microscopy (AFM). The resulting CNWs were rod-like shape with lengths ranging from 200 to 400 nm, while diameters were ranging from 10 to 16 nm and their aspect ratio were ranging from 20 to 25, respectively. CNWs were then incorporated into poly (furfuryl) alcohol following the *in-situ* polymerization to develop PFA/CNWs composites. The TGA results clearly showed a decrease in thermal stability of PFA/CNWs composite relative to the neat PFA. The incorporation of CNWs into PFA led to the increase in mechanical properties. FTIR suggest that there is interaction between CNWs and PFA. Glass transition temperature (T_g) and storage modulus (E′) improved after the addition of CNWs. Therefore, CNWs can improve thermomechanical properties of PFA and they are promising reinforcing elements for the development of industrial composites.

Keywords: Flax Fibres, Acid Hydrolysis, Cellulose Nanowhiskers, PFA Biocomposites