# Chemical composition, crystallinity, and thermal degradation of bleached and unbleached kenaf bast (Hibiscus cannabinus) pulp and nanofibers

## ABSTRACT

Kenaf (Hibiscus cannabinus) nanofibers were isolated from unbleached and bleached pulp by a combination of chemical and mechanical treatments. The chemical methods were based on NaOH-AQ (anthraquinone) and three-stage bleaching (DEpD) processes, whereas the mechanical techniques involved refining, cryo-crushing, and high-pressure homogenization. The size and morphology of the obtained fibers were characterized by environmental scanning electron microscopy (ESEM) and transmission electron microscopy (TEM), and the studies showed that the isolated nanofibers from unbleached and bleached pulp had diameters between 10-90 nm, while their length was in the micrometer range. Fourier transform infrared (FTIR) spectroscopy demonstrated that the content of lignin and hemicellulose decreased in the pulping process and that lignin was almost completely removed during bleaching. Moreover, thermogravimetric analysis (TGA) indicated that both pulp types as well as the nanofibers displayed a superior thermal stability as compared to the raw kenaf. Finally, X-ray analyses showed that the chemo-mechanical treatments altered the crystallinity of the pulp and the nanofibers: the bleached pulp had a higher crystallinity than its unbleached counterpart, and the bleached nanofibers presented the highest crystallinity of all the investigated materials.

**Keyword:** Kenaf bast; Nanofiber; Bleached pulp; Unbleached pulp; Thermal properties; Crystallinity; Microstructure