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# Novel modified nanocellulose applicable as reinforcement in high-performance nanocomposites

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## Highlights

- Esterification of nanocellulose with fatty acids by either direct method or *via* linker was done.
- The vacuum and supercritical CO<sub>2</sub> drying (SCD) of functionalized NC (m-NC) was performed.
- The SCD drying improved thermal stability, surface properties and morphology of m-NC.
- The vinyl reactivity at m-NC surface contribute to reinforcement in polyester based composites.

## Abstract

The influence of modification and vacuum/supercritical CO<sub>2</sub> (scCO<sub>2</sub>) drying methods on the surface properties, morphology and thermal stability of cellulose nanocrystals (NC) was presented in this study. Introduction of reactive vinyl groups on NC surface was performed by either direct esterification with oleic acid, linseed or sunflower oil fatty acids; or by amidation of maleic acid/ethylene diamine with methyl ester of fatty acid. Obtained modified NC (m-NC) were characterized using FTIR and Raman spectroscopy; and by determination of acid, iodine and ester values. Structural analysis of m-NC showed varieties of forms, from spongy to nanostructural non-uniform layered morphology with observable agglomeration, which confirmed morphology dependence on modification/processing methods. Thermogravimetry-MS spectrometry showed different thermal stability and degradation pathways of NC/m-NC. Incorporation of 1 wt% of reactive m-NC in unsaturated polyester lead to high performance nanocomposites and contributed to increase of stress at break in the range from 76 to 93%.

**Keywords:** Nanocellulose; vinyl reactive nanocellulose; fatty acid modification; supercritical drying

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