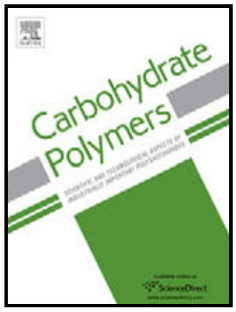

Title: Novel modified nanocellulose applicable as reinforcement in high-performance nanocomposites

Authors: Jelena D. Rusmirović, Jasna Z. Ivanović, Vladimir B. Pavlović, Vesna M. Rakić, Milica P. Rančić, Veljko Djokić, Aleksandar D. Marinković

PII: S0144-8617(17)30097-8
DOI: http://dx.doi.org/doi:10.1016/j.carbpol.2017.01.086
Reference: CARP 11964

To appear in:

Received date: 26-9-2016
Revised date: 16-1-2017
Accepted date: 22-1-2017

Please cite this article as: Rusmirović, Jelena D., Ivanović, Jasna Z., Pavlović, Vladimir B., Rakić, Vesna M., Rančić, Milica P., Djokić, Veljko., & Marinković, Aleksandar D., Novel modified nanocellulose applicable as reinforcement in high-performance nanocomposites.*Carbohydrate Polymers* http://dx.doi.org/10.1016/j.carbpol.2017.01.086

Novel modified nanocellulose applicable as reinforcement in high-performance nanocomposites

Jelena D. Rusmirović[a], Jasna Z. Ivanović[b], Vladimir B. Pavlović[c,d], Vesna M. Rakić[e], Milica P. Rančić[f], Veljko Djokić[g], Aleksandar D. Marinković[h]

[a]*Innovation center, Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11120 Belgrade, Serbia, jrusmirovic@tmf.bg.ac.rs*
[b]*Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11120 Belgrade, Serbia, jasnai@tmf.bg.ac.rs*
[c]*Faculty of Agriculture, University of Belgrade, Nemanjina 6, 11080 Belgrade-Zemun, Serbia*
[d]*Institute of Technical Sciences of the SASA, Knez Mihailova 36, 11000 Belgrade, Serbia, vladimirboskopavlovic@gmail.com*
[e]*Faculty of Agriculture, University of Belgrade, Nemanjina 6, 11080 Belgrade-Zemun, Serbia, vesna@ffh.bg.ac.rs*
[f]*Faculty of Forestry, University of Belgrade, Kneza Višeslava 1, 11030 Belgrade, Serbia, milica.rancic@sfb.bg.ac.rs*
[g]*Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11120 Belgrade, Serbia, vdjokic@tmf.bg.ac.rs*
[h]*Faculty of Technology and Metallurgy, University of Belgrade, Karnegijeva 4, 11120 Belgrade, Serbia, marinko@tmf.bg.ac.rs*

Corresponding author: Jelena Rusmirović, jrusmirovic@tmf.bg.ac.rs, telephone: +381 11 3303750

Highlights

- Esterification of nanocellulose with fatty acids by either direct method or *via* linker was done.
- The vacuum and supercritical CO_2 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_2 ($scCO_2$) 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