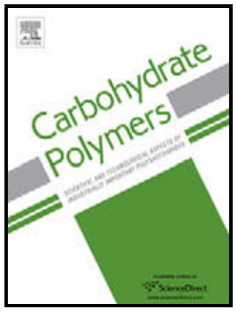

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Rheological properties of micro-/nanofibrillated cellulose suspensions: wall-slip and shear banding phenomena

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Abstract

The rheological properties of enzymatically-hydrolyzed and TEMPO-oxidizedmicrofibrillated/nanofibrillated cellulose (MFC/NFC)aqueoussuspensions wereinvestigated in oscillation and steady-flow modes and were comparedwith the morphology of the studied materials.The flow instabilities, which introduce an error in the rheological measurements, were discovered during flow measurements. Awall-slip (interfacial slippage on the edge of geometry tools and suspension)was detectedat low shear rates for two types of NFC suspensionswhile applying cone-plate geometry.A roughening of the tool surfaces was performed to overcome the aforementioned problem. Applying to TEMPO-oxidized NFC,a stronger suspension response was detected at low shear rates with higher values of measured shear stress. However, a shear banding (localization of shear within a sample volume) became more pronounced. The use ofserrated toolsfor enzymatically-hydrolyzed NFCproducedlower shear stress at the moderate shear rates, which was influenced by water release from the suspension.

Keywords

Rheology,nanofibrillated cellulose (NFC), microfibrillated cellulose (MFC), cellulose nanofibers (CNF), wall-slip, shear banding

1 Introduction

The use of nanocellulose has gained much interest lately, especially in such areas as composites, packaging, adhesives, biomedicine, automotive *etc*. Since it is a renewable and biodegradable material, possessing specific properties, it has a great potential for industrial application.