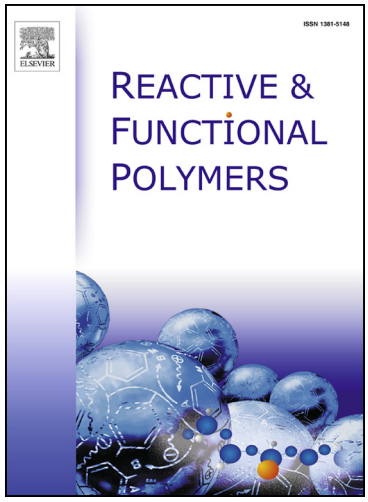

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Jessica Lucenius, Kirsti Parikka, Monika Österberg

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Nanocomposite films based on cellulose nanofibrils and water-soluble polysaccharides

Jessica Lucenius[1], Kirsti Parikka[2], Monika Österberg[1*]

[1]Aalto University, School of Chemical Engineering, Dept. of Forest Product Technology, P.O. Box 16300, FI-00076 Aalto, Finland

[2]Department of Food and Environmental Sciences, University of Helsinki, P.O. Box 27, FI-00014 Helsinki, Finland

*Corresponding author: phone: +358-505497218, fax: +358-947024394, email: monika.osterberg@aalto.fi

Abstract

All-polysaccharide composite films were prepared from native, unmodified cellulose nanofibrils (CNF) mixed with various natural water-soluble polysaccharides like carboxymethyl cellulose, galactoglucomannan, xyloglucan and guar gum. Composite films were manufactured by pressurized filtration and hot pressing. The mechanical properties of the films were systematically evaluated in the dry and the wet state. GG was furthermore selectively oxidized using galactose oxidase (EC 1.1.3.9), and the effect of the degree of oxidation on the final composite film properties was shown. It was found that all the tested polysaccharides increased the strength and toughness of the *dry* composite films at 2 weight percent (wt-%) addition to CNF. After soaking the samples for 24h in water, striking differences between the samples were found: already at 2 wt-% CMC the wet strength of the composite films diminished, while the uncharged polysaccharides improved the wet strength. For example, the addition of 2 wt-% GGM increased Young's modulus by a factor of 1.3, the tensile strength by a factor of 2.8, and the toughness by a factor of 3.4. The results are discussed in relation to the amount of water absorbed in the films and possible reasons for the improved properties are suggested.

KEYWORDS: Cellulose nanofibrils, composite film, tensile strength, guar gum, galactoglucomannan

1. Introduction

Due to increased environmental awareness and rising oil prices there is a demand to replace petroleum- based materials with materials from renewable resources. However, properties of the