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Advanced characterization of novel multilayer cellulose based material for food packaging

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The demand for biobased, biodegradable, recyclable, and recycled material is a growing market. The consumers and policies in European countries encourage the circular economy and the replacement of single-use plastic packaging. Cellulose fibrous materials, as a unique source recyclable and biodegradable, offer an alternative economical and technological solution to the problems caused by plastics. However, these materials are multiporous material with a large surface area accessible to contaminants.

An alternative to limit the migration of contaminant through these cellulosic materials is to add a functional barrier to the packaging, such as an MFC film. A MFC film is a thin (typically 20 micron thick) and dense fibrous network entirely made of microfibrillated cellulose (MFC), whose fiber sizes range from micrometers to nanometers. These films are biodegradable and recyclable, and can be employed to coat paper and paperboard by using a technique called wet lamination [1]. The wet lamination combines filtration, pressing, and drying process to produce a multi-scale structures, i.e. bilayer materials. These materials have promising barrier properties for food packaging [2,3], but the role of the microstructure on the contaminant transport is poorly understood.

The project aims to understand the influence of the micro-structural features (the connectivity of voids, nano-, micro-, and macro-pores) of such bilayer material on their barrier properties. For that purpose, a MCF film of 25 g/m², produced from two sources of MFC has been produced and used to laminate three base materials: (i) a Gerstar HDS paper (80 g/m²), (ii) a blotting paper (90 g/m²), and (iii) a Cupforma Natura cardboard (195 g/m²).

In the present work, we evaluate the barrier properties of the handsheet samples such as the absorption index, water vapor, and oxygen transmission rate. The obtained results are compared to standard results on the same material without any MFC film and are analysed in the light of microstructural observations performed by various imaging techniques. The findings suggested that the MFC film may cover the pores of paper which hinder the absorption of grease molecules, and the transport of water vapor and oxygen molecules through the fibrous network. The use of MFC as surface coating on various base papers considerably improve their barrier properties. However, the performance of the membrane will depend on the basic weight of the MFC film and the fiber size of the MFC film.

Participation

In-Person

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