BioPack

Design of biocomposites based on nanocellulose and hemicelluloses for future packaging materials

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Project Duration: 36

Project Consortium

Project Coordinator

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Project Partners

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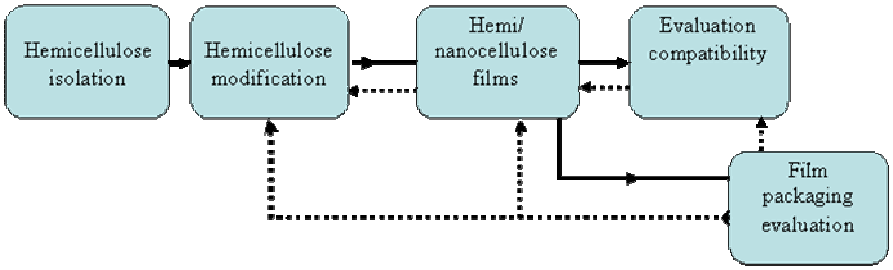
Project Objectives

The objective is to develop a new biobased packaging material based on nanocellulose and hemicelluloses providing both good mechanical properties such as strength and flexibility as well as good oxygen barrier properties.

Project Approach

In order to achieve the goals of producing new, improved biobased packaging material hemicelluloses from various sources will be isolated and characterized. These hemicelluloses will also be further modified in order to study the desired property criteria for packaging applications of barrier properties, flexible and strong films. The films produced will be evaluated both with respect to mechanical properties, especially the improvements obtained by the cooperation between the polymers, as well as for gas permeation properties. All of the partners will work on the same materials following the flow scheme illustrated below from that of the isolation of the hemicelluloses, xylans and glucomannans, to the evaluation of the films for packaging applications.



The project involves;

Isolation and characterization of various hemicelluloses. Xylan and glucomannan from different sources will be produced by Chalmers University of Technology. These hemicelluloses will be further purified using selective enzymatic degradation of the other component followed by precipitation of the residual polymeric component.

Engineering of hemicelluloses with targeted properties. Enzymatic and chemical modifications will be explored by University of Helsinki. This involves both removal of side groups as well as a functionalisation of the chains

Material development based on combining of nanocellulose and suitable hemicelluloses. Blending of hemicelluloses with nanocellulose as well as growing of bacterial cellulose in hemicellulose media will be explored by Chalmers University of Technology in collaboration with STFI-Packforsk and University of Helsinki. The suspension obtained in this way will be dried into homogenous films with isotropic properties for material characterisation.

Material characterisation; physical properties and polymer interaction. Hygro-mechanical characterisation of the films as well as a characterisation of the degree of co-operation between the components will be carried out by STFI-Packforsk in collaboration with University of Helsinki. The thermo-hygro-rheological properties of the hemicelluloses and its cooperation with the cellulose will be evaluated with dynamic mechanical analysis and spectroscopic measurements using humidity scans at different temperatures as well as with vapour sorption analysis.

Assessing functional packaging applicability. Oxygen permeabilities and oxygen solubility will be one of the key questions investigated (permeability, diffusivity and solubility measurements) which will be carried out by INRA in collaboration with University of Helsinki. Oxygen solubility (S), diffusion (D) and permeability (P) coefficients will be determined for pure hemicellulose films to guide in the choosing of the most suitable ones for composite systems. Also the oxygen transfer for promising systems will be evaluated as a function of the water content.

Expected Project Impact

This research project will first develop a new bio-based packaging material based on blends of hemicelluloses and nanocellulose. Secondly it will provide an increased knowledge regarding bio-based packaging materials in general. This new material and knowledge may lead towards an improved use of sustainable materials in the packaging area. In this way dependence of oil-based raw materials will diminish leading to an improved environmental impact. The main industrial beneficiaries from this project are found in the pulp and paper as well as in the packaging sector.

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