



HAL
open science

Development of renewable nanocomposites for packaging by the functionalization of nanopolysaccharides

Sandra Domenek, Etzael Espino Perez, Julien Bras

► **To cite this version:**

Sandra Domenek, Etzael Espino Perez, Julien Bras. Development of renewable nanocomposites for packaging by the functionalization of nanopolysaccharides. 6. International Symposium on Food Packaging: Scientific Developments supporting safety and innovation, Nov 2016, Barcelone, Spain. , 2016. hal-01741282

HAL Id: hal-01741282

<https://hal.science/hal-01741282>

Submitted on 5 Jan 2024

HAL is a multi-disciplinary open access archive for the deposit and dissemination of scientific research documents, whether they are published or not. The documents may come from teaching and research institutions in France or abroad, or from public or private research centers.

L'archive ouverte pluridisciplinaire **HAL**, est destinée au dépôt et à la diffusion de documents scientifiques de niveau recherche, publiés ou non, émanant des établissements d'enseignement et de recherche français ou étrangers, des laboratoires publics ou privés.

Development of renewable nanocomposites for packaging by the functionalization of nanopolysaccharides

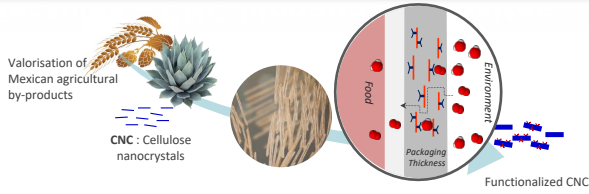
Sandra Domenek, Etzael Espino Perez, Giana Almeida Julien Bras

UMR Ingénierie Procédés Aliments (JRU Food & Process Engineering) LGP2, Grenoble

Introduction

Cellulose nanocrystals (CNC) are an organic and fully biodegradable nanocharge which can be used for the fabrication of bionanocomposites of polylactide (PLA) with improved barrier properties. In the aim to enhance the compatibility between the polymer matrix and the CNC surface, a novel surface grafting method was developed. The chemical nature of the surface grafts was furthermore designed to be a specific absorbent of permeants with the aim to enhance the barrier properties of the CNC/PLA nanocomposites.

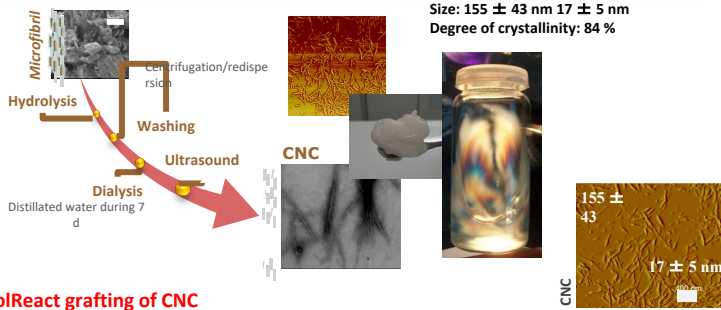
Objectives – CNC bionanocomposites



- Development of a surface grafting method to enhance CNC/PLA compatibility
- Study specific absorbent capacity of surface modified CNC
- Study impact of surface modified CNC on PLA barrier properties

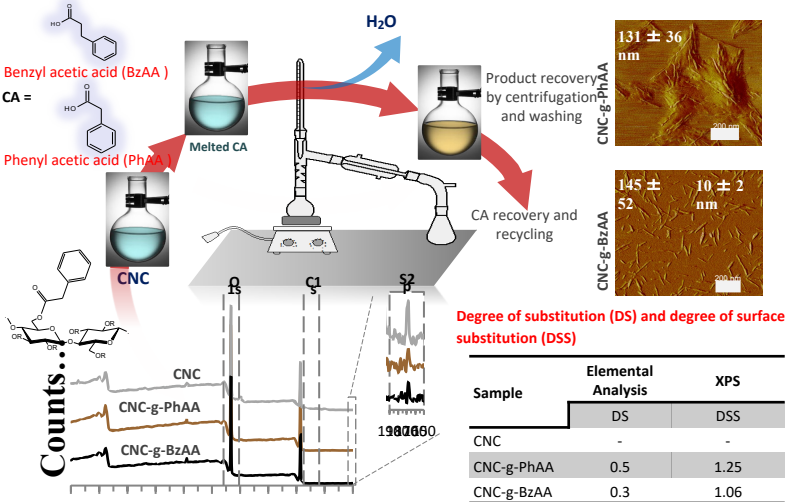
SolReact CNC surface grafting

Fabrication of CNC

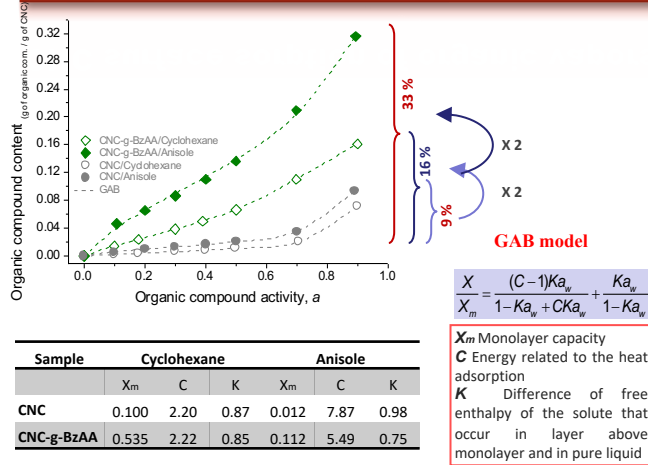


SolReact grafting of CNC

Heterogeneous surface esterification by in situ solvent exchange



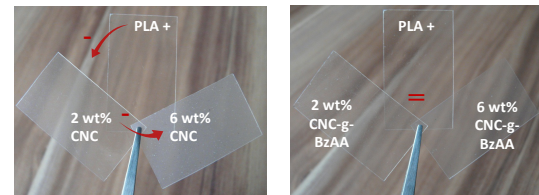
CNC surface sorption of organic vapors



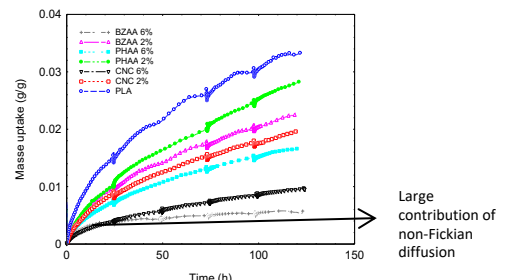
Sample	Cyclohexane			Anisole		
	X_m	C	K	X_m	C	K
CNC	0.100	2.20	0.87	0.012	7.87	0.98
CNC-g-BzAA	0.535	2.22	0.85	0.112	5.49	0.75

Barrier properties of PLA/CNC

Transparent nanocomposites with surface grafted CNC



Anisole uptake in PLA/CNC nanocomposites



	wt %	P(O ₂) x 10 ⁻¹⁸ (m ³ m/m ² Pa)	D x 10 ⁻¹⁵ (m ² s ⁻¹)	m _{eq,F} (wt%)	m _{r,120h} (wt%)
PLA	0	2.7 ± 0.3	3.2 ± 1.6	2.6 ± 0.2	0.7
PLA/CNC	2	1.8 ± 0.2	1.6 ± 0.8	1.4 ± 0.2	0.6
PLA/CNC	6	1.7 ± 0.2	3.7 ± 1.8	0.4 ± 0.2	0.6
PLA/CNC-g-PhAA	2	1.9 ± 0.2	11 ± 6	2.2	2.2
PLA/CNC-g-PhAA	6	1.6 ± 0.2	3.9 ± 2.0	1.0	1.0
PLA/CNC-g-BzAA	2	1.6 ± 0.2	2.5 ± 1.3	1.2 ± 0.2	0.9
PLA/CNC-g-BzAA	6	1.9 ± 0.2	8.7 ± 4.3	0.3 ± 0.2	0.2

• Tailoring nanoparticle surfaces allows to largely change transport properties in nanocomposites