



# POSTERS POC 2024

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## Finding a bio-based, recyclable and transparent alternative to food packaging films

Elodie Bouvet – End of study project Grenoble INP - Pagora



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## Preparing new cellulose- and biopolymer- based materials for innovative, high performance packaging

CARIO Erin Grenoble INP Pagora



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BY FONDATION GRENOBLE INP Development of efficient and recyclable packaging : Improving the barrier properties of paper in high humidity conditions

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## Development of an innovative, highperformance and recyclable cellulosic solution for application in packaging

Intissar EL MGHIBCHI OULAD-LAHSAN Université Grenoble Alpes, Master 1 GDP Formulatior

In 2023, global plastic waste reached 460 million tonnes, and if current trends continue, it could triple by 2060. In France, packaging accounts for 46% of plastic consumption, with cushioning packaging being particularly concerning due to its single-use nature and lack of recyclability. The aim of this project was creating a low-density cellulose alternative for cushioning packaging , specially expanded polystyrene (EPS) beads by making cellulose beads that could then be assembled.

Abstract

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## Development of bio-based cushioning packaging Cellulose

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Due to increasing awareness about the environmental footprint, Cellulose Valley's industrial partners asked for advanced LCA of their products. This projet aims to study the environmental impacts of cellulose products, proposing alternative solutions to petro-sourced and recommendations for eco-designed packaging.



## Comparing processes and coating techniques on 3-D substrate for improved repellency to water

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The European Union is considering new legislation to reduce the production and consumption of single-use plastics. This includes items such as bottle caps and various other closures made from non-recyclable plastics. To address this issue, research is underway to develop bio-based, recyclable, and biodegradable caps using dry molding of fibers and pulp injection molding. The goal is to impart hydrophobic properties to these caps through innovative suspension techniques, comparing dip-coating, spray-coating, and atomic layer deposition methods.



- · Coating Technique 2 demonstrated the highest water repellency, validated through contact angle measurement and sliding angle.
- · Coating Technique 4 also exhibited good water repellency, although the sliding angle was relatively low.

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• While Technique 2 showed good repellency, it led to a loss of coating suspension lgp²

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- Conduct additional trials of the dry molding process.
- Evaluate the viscosity of the suspension.

DS Smith

Assess recyclability by mixing with other substrates. Analyze surface roughness using scanning electron

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- microscopy
- Characterize the thickness of different coating techniques.

GUILLIN

Marie

## Modification of Cellulose by Mechanochemistry for increase hydrophobic properties of Cellulose

## Laura SABATHIÉR

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Innovation in packaging for biosourced, biodegradable and recycled cellulosebased heaters

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Context

Global plastic pollution, exacerbated by inefficient waste management, particularly affects developing nations. Despite initiatives like the EU Single-Use Plastics Directive, recycling rates remain low. The bioeconomy and projects like that of Decathlon with Cellulose Valley are exploring sustainable alternatives, such as cellulose nanofibrils, to replace plastic packaging. This project aims to eliminate single-use plastics by 2026, focusing on bio-sourced and recyclable solutions and being a barrier to oxygen and humidity for heaters.



### Conclusions and perspectives

A significant improvement in moisture barrier properties was observed after the application of the coating. The water vapor transmission rate (WVTR) at 50% humidity and 23°C decreased from 168 g/m<sup>2</sup>.day to approximately 9 g/m<sup>2</sup>.day, indicating a substantial reduction in water vapor permeability. Similarly, at 80% humidity and 25°C, the WVTR for the coated paper is 33 g/m<sup>2</sup>.day, demonstrating good performance under high humidity conditions.

In terms of intrinsic permeability, the coating reduced this value from 7.42E-14 m<sup>2</sup> to 3.63E-14 m<sup>2</sup>, confirming better barriers to air and gases. The Bendtsen air permeability is zero (0 mL/min) for both coated and uncoated paper, indicating an absence of air passage through the paper pores.



#### Water Vapor Transmission Rate of different substates | 23° at 50% Humidity

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It is evident that the multilayer technique applied has improved the barrier properties of the paper, but without significant difference compared to the ALD (Atomic Layer Deposition) technique. Moreover, it is crucial to evaluate the oxygen transmission rate (OTR), as the results obtained so far are not satisfactory.

In the future, it would be interesting to explore the innovative ORMOCER (Organically Modified Ceramics) technique, which could offer comparable or even superior results. Additionally, metallization, a technique commonly used in packaging and films, also deserves consideration. A systematic comparison of the results obtained with these different techniques would help determine the most effective method for improving the barrier properties of UPM Lucent 62g/m<sup>2</sup> paper.

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Marie

Innovative technique for sealing Molded cellulose, Cardboards & Paper

Abbass Taher Biorefinery Process Engineer Ecole Centrale de Lille



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- The innovative technique was capable of assembling all of the tested materials.
- Energy, Power, Force can be determintal for accomplishing the best sealing.
- Energy was proven to be the limiting parameter for accomplishing strong adhesion of corrugated cardboards.
- Coating can be a solution for performing the innovative sealing for the bare material that didn't assemble.

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Perspectives:

DS

Designing new mold shapes for better manipulation.

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Enhancing Corrugated Cardboards manufacturing process.

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