

Projet ByProdAct

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En partenariat avec:



DESCRIPTION DU PROJET

Production of loaded particles and nanocelluloses from agro-industrial **By-Products**: potential application in **Active** coatings or PLA films

ACADEMIC PARTNERS



Giana Almeida Perré, UMR SayFood

Milena Martelli-Tosi, USP

FUNDING



ANR reference of the project: **ANR-22-CE43-0016-01**

Fapesp reference of the project: **FAPESP 2022/03469-9**

WHICH BY-PRODUCTS?

Grape pomace



Carrot



Coffee

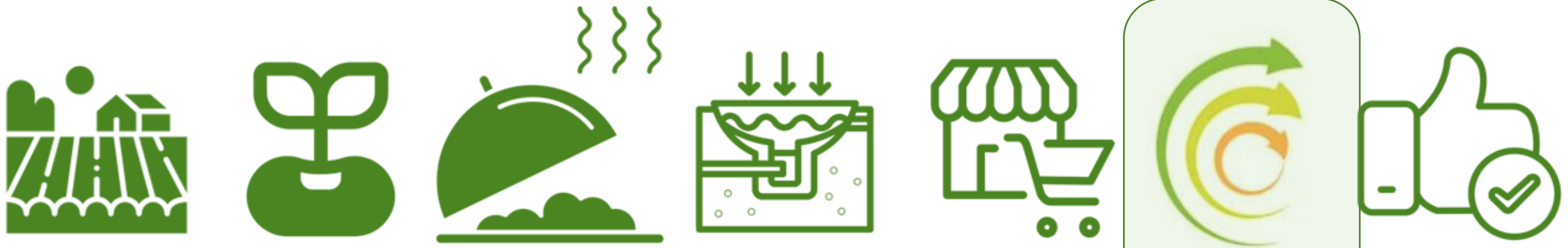


Artichoke



Corn cob





Étape 1

Étape 2

Étape 3

Étape 4

Étape 5

Étape 6

Étape 7

1 - Sélection
variétale,
production et
diversification des
plantes

2 - Qualités
nutritionnelles et
digestibilité

3 - Bioaccessibilité,
biodisponibilité,
facteurs
antinutritionnels

4 - Transformation
& fractionnement
& purification

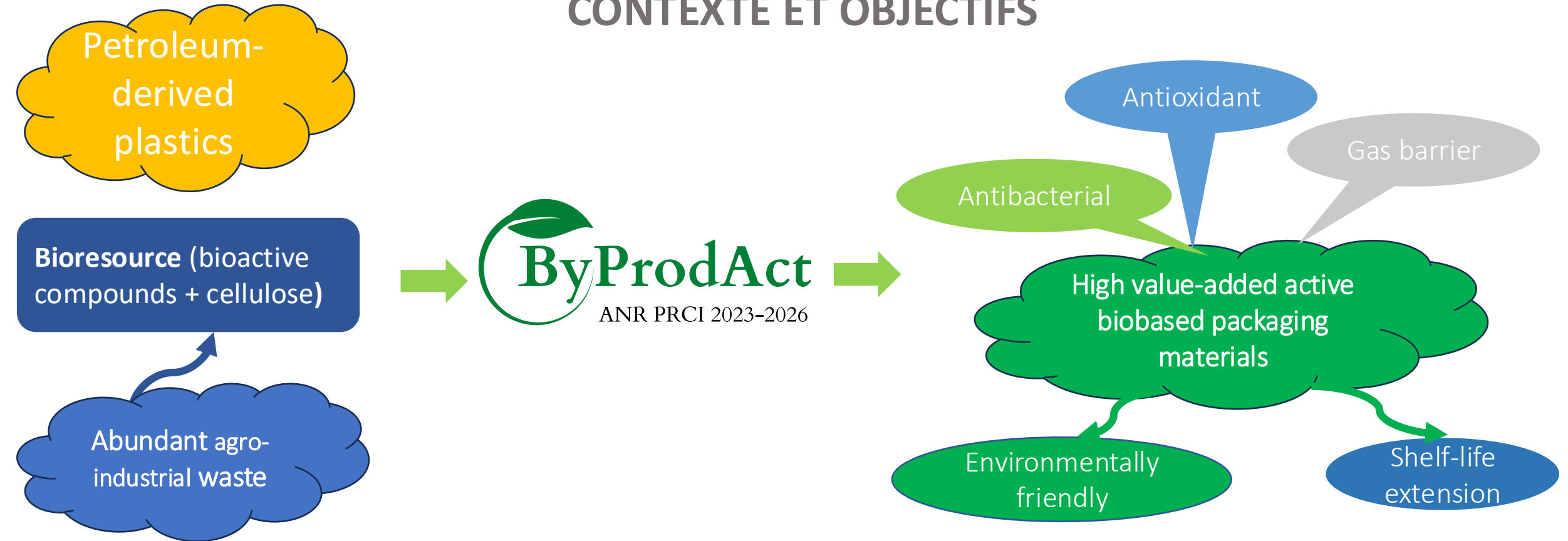
5 - Produits,
marché

6 - Co-produits

7 – Acceptabilité
du consommateur
/ Perception
sensorielle



CONTEXTE ET OBJECTIFS



Fruits and vegetables in France ~ 8 million tons (2024)¹
Fruits and vegetables in Brazil ~ 50 million tons (2018)²
25% of harvested agricultural biomass is consumed as food (2017)³

GOAL → Promote alternative uses of by-products coming from the agro-food industry

¹ CTIFL, Centre Technique Interprofessionnel des Fruits et Légumes. <https://www.ctifl.fr/flux-de-la-filiere-fruits-et-legumes-infos-ctifl-403>

² BRAZIL FRUITS AND VEGETABLES INDUSTRY - GROWTH, TRENDS, COVID-19 IMPACT, AND FORECASTS <https://www.mordorintelligence.com/industry-reports/fruits-and-vegetables-industry-in-brazil-industry>

³ Agricultural systems, 153 :190–200, 2017 <https://doi.org/10.1016/j.agsy.2017.01.014>

CONTEXTE ET OBJECTIFS

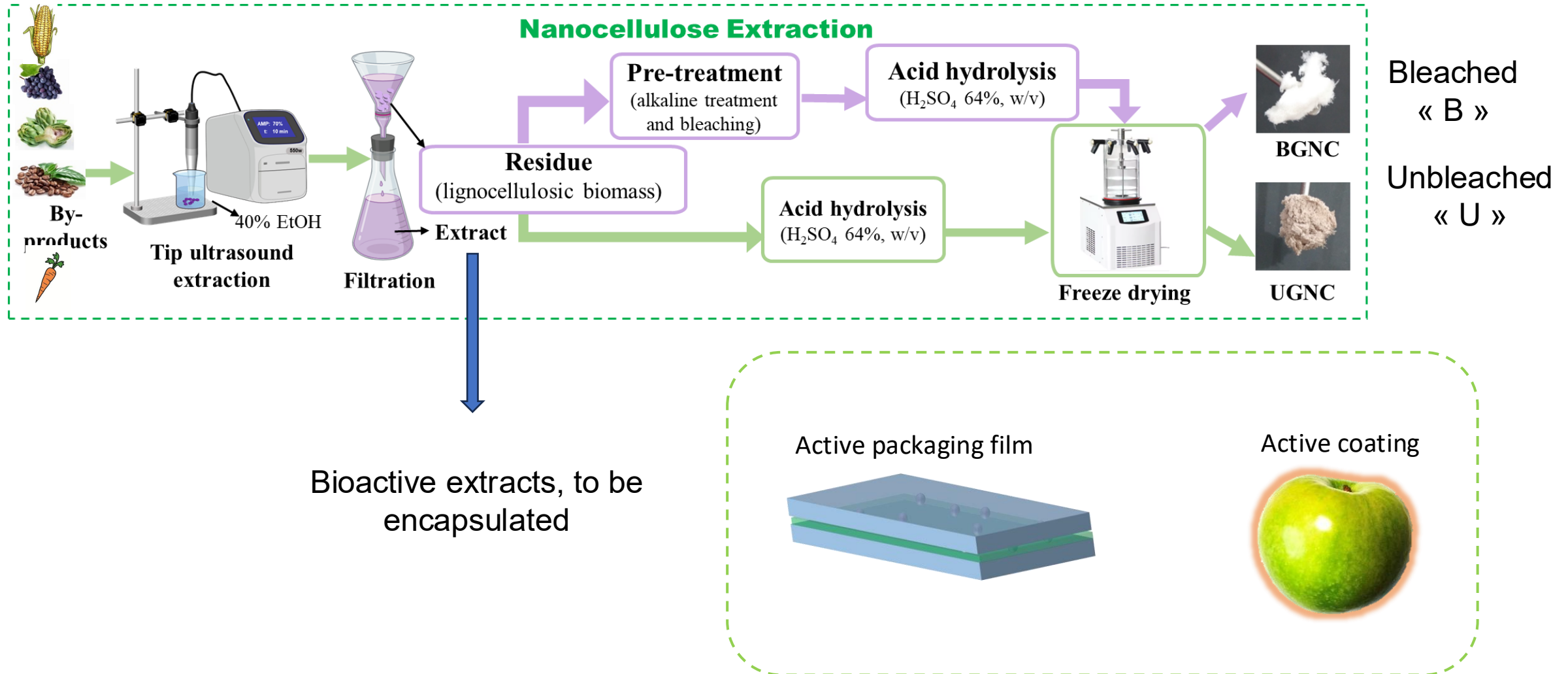


The **main objectives** of this project are :

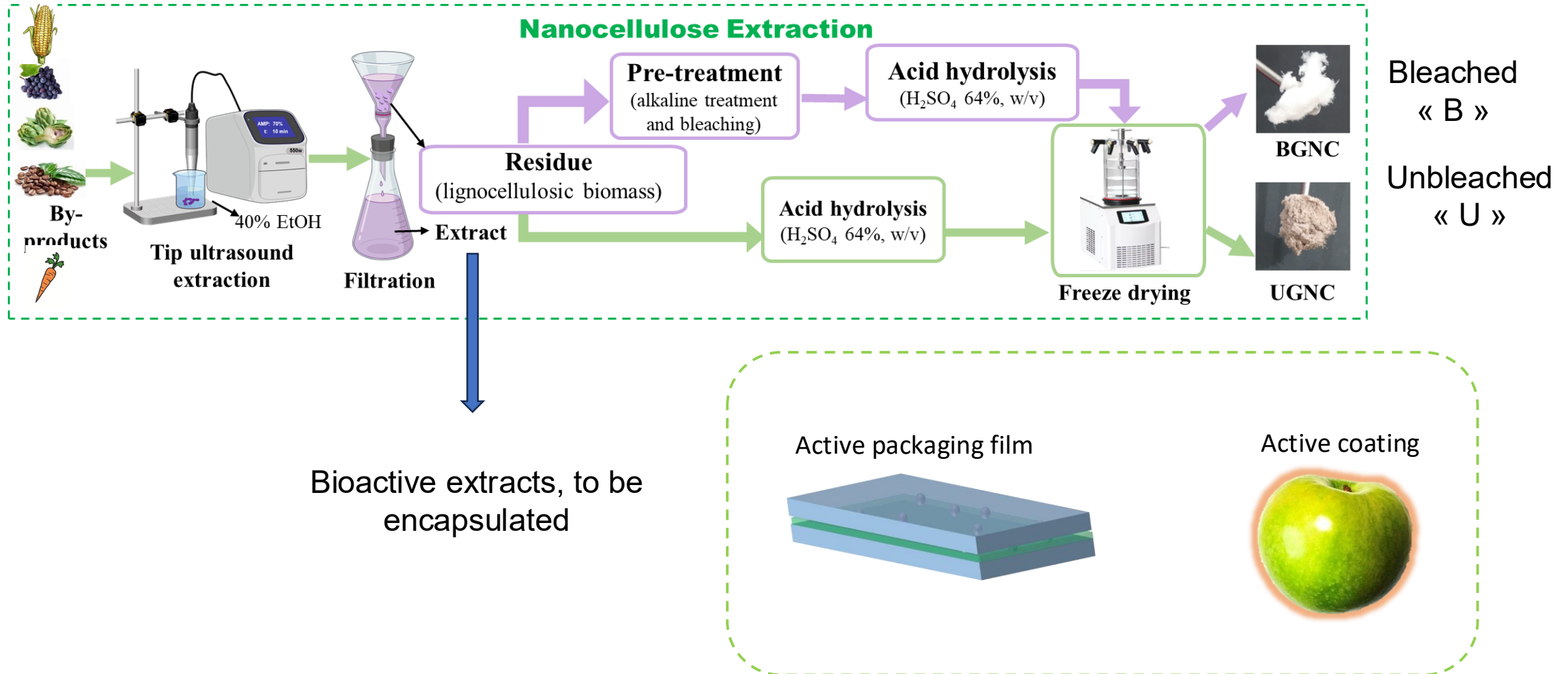
- **Extraction of active compounds** from by-products and their encapsulation;
- **Production**, by enzymatic hydrolysis and mechanical treatments, and characterization of **nanocelluloses** obtained from fibrous by-products;
- **Application** of loaded particles and nanocelluloses for **coatings** and **PLA film** functionalization and reinforcement;
- **Predictive modeling** and **life cycle analysis** as tools for design purposes.



Nanocelluloses and Bioactive extraction



Nanocelluloses and Bioactive extraction



Nanocelluloses extraction



Artchoke
Stem NC



Bleached
Artchoke
Stem NC



Ground
Coffee NC



Bleached
Ground
Coffee NC



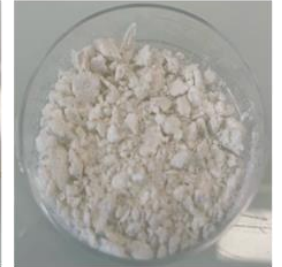
Grape
Pomace
NC



Bleached
Grape
Pomace NC



Corn Cob
NC

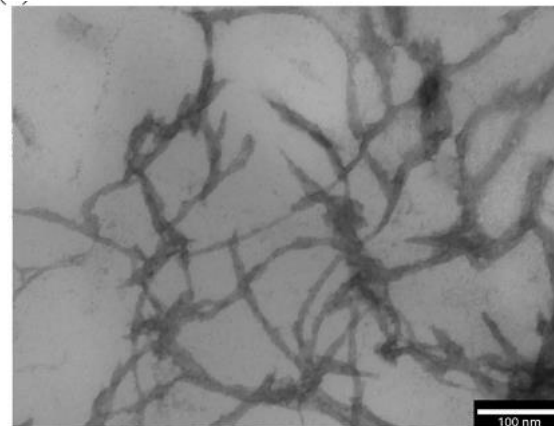
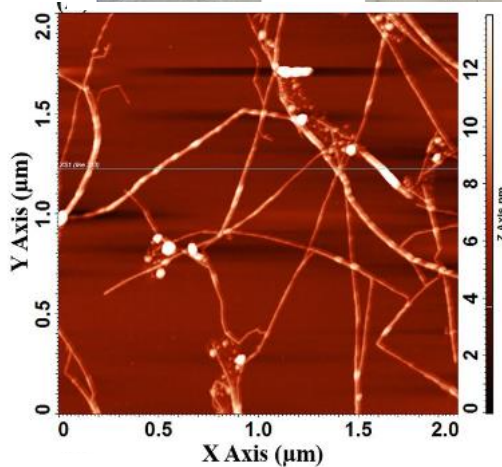
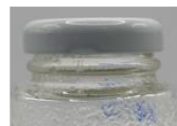


Bleached
Corn Cob NC



Suspensions: 1,3% w/w

Nanocelluloses extraction





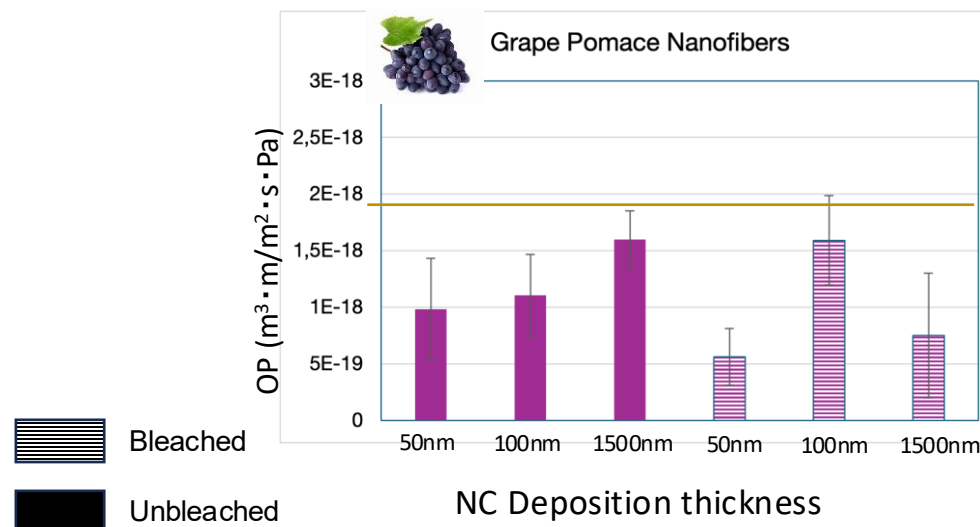
Bleached grape NC
on PLA*



Unbleached grape
NC on PLA*

*Theoretical thickness of cellulose
layer: 50nm

Oxygen Permeability of PLA + NC films



OP (PLA)¹

OP (PET): $(1.14-5.71) \times 10^{-19} \text{ m}^3 \cdot \text{m} / \text{m}^2 \cdot \text{s} \cdot \text{Pa}$ ^[2]



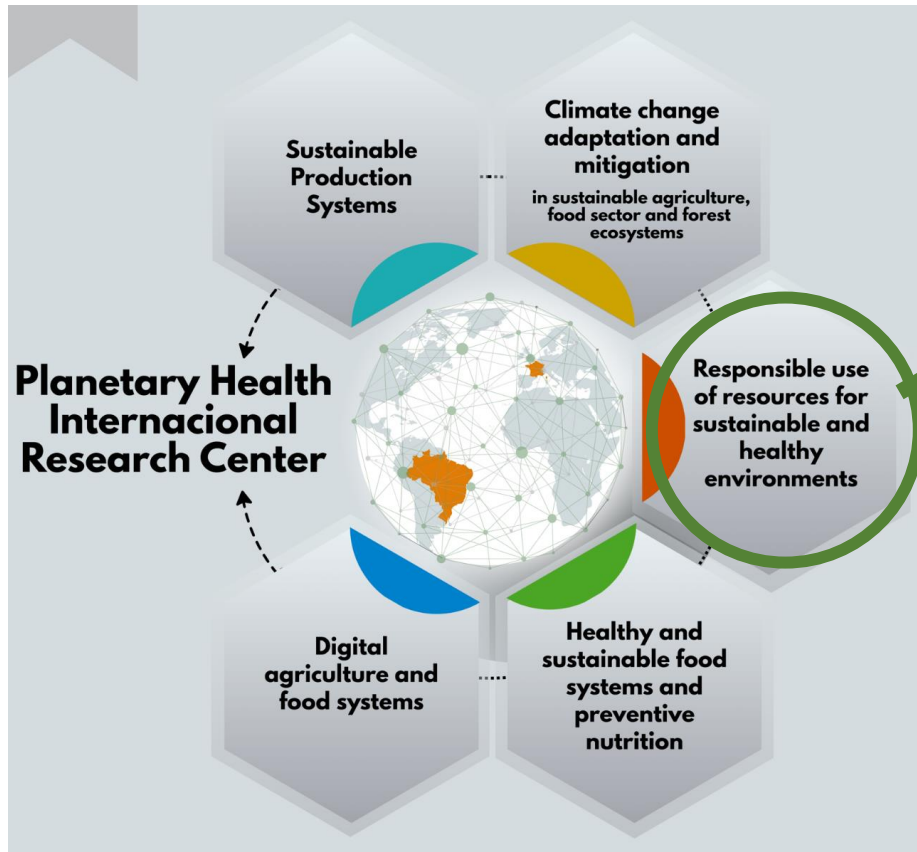
Analysis of films reinforced with other NCs are currently
underway

1. Guivier, et al. (2023) <https://doi.org/10.1016/j.carbpol.2023.120761>

2. Michiels et al. (2017) <https://doi.org/10.3390/app7070665>

- Performance of active coating
- Barrier properties to water vapour
- Environmental impact of this by-products-based, high value-added packaging material (LCA in progress)
- July 2026, Scientific workshop: *Valorisation of agri-food by-products and wastes. USP, Ribeirao Preto, Brazil*

PERSPECTIVES



Valorisation of Agricultural and Agro-industrial By-Products and Wastes Towards Circular Bioeconomy



ESALQ



Aknowledgements



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Saclay Plant'Innov'

Le Rendez-vous de l'innovation végétale 

Diversification des productions végétales et nouveaux défis pour l'alimentation

Campus Agro Paris-Saclay – 12 mars 2025

Merci pour votre attention



En partenariat avec:

