

## NOVAPACK: Novel biopolymer systems containing antimicrobial and antioxidant extracts

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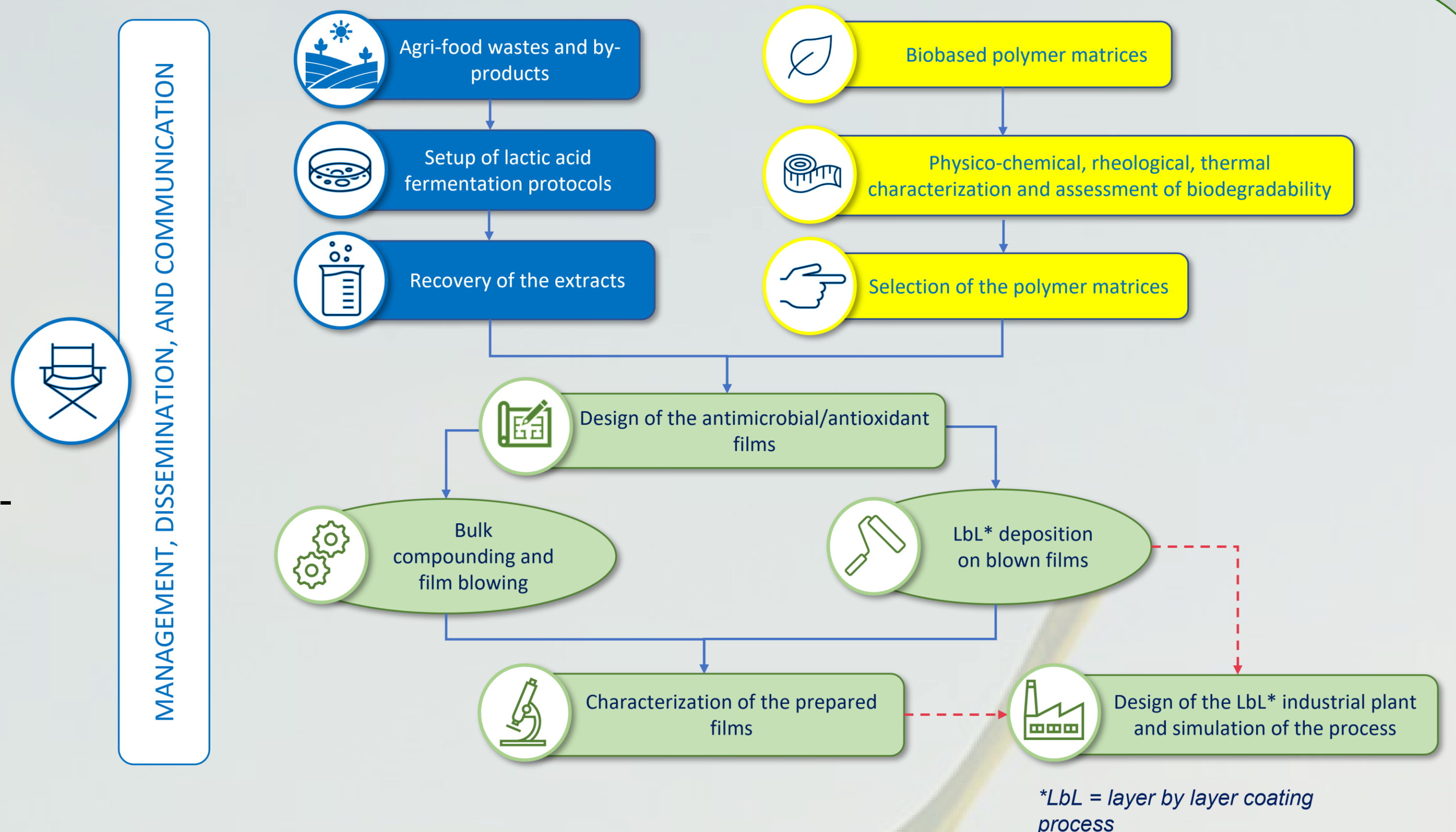
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### Introduction

Bio-based packaging is emerging as a sustainable alternative to conventional polymers, particularly in food packaging, where antimicrobial and antioxidant properties help prevent contamination and health risks.

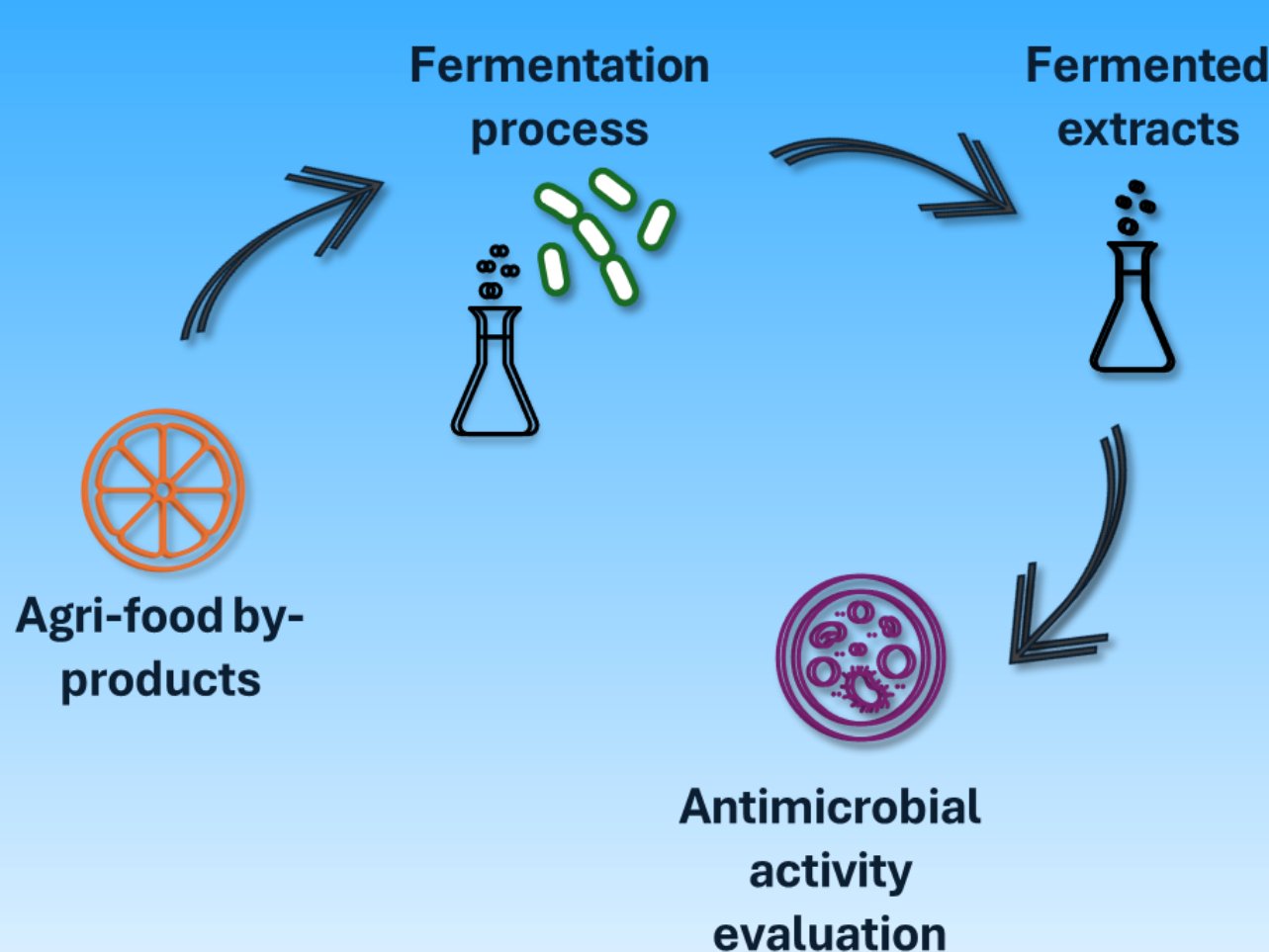
The **NOVAPACK Project** focuses on the following:

- **Optimize** lactic acid fermentation protocols for high-yield extraction of antimicrobial and antioxidant compounds from agro-food waste,
- **Develop** bio-based packaging films with enhanced biodegradability and antimicrobial properties,
- **Design** and fabricate a pilot demonstrator



### Identification and optimization of the protocols for agrifood wastes and by-products fermentation

#### MICROBIOLOGY

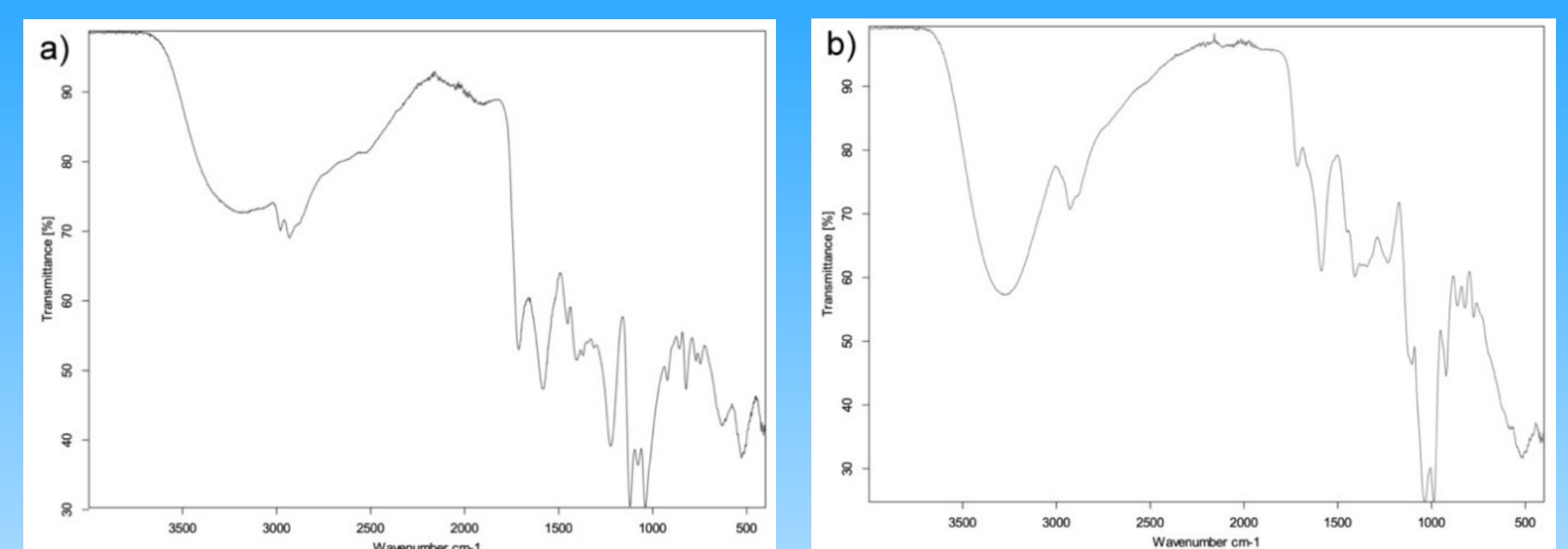


Different agri-food by-products (as tomato, melon, carrots, etc.) were fermented with lactic acid bacteria and extracted to obtain extracts with antimicrobial properties.



Extracts obtained from fermentation process

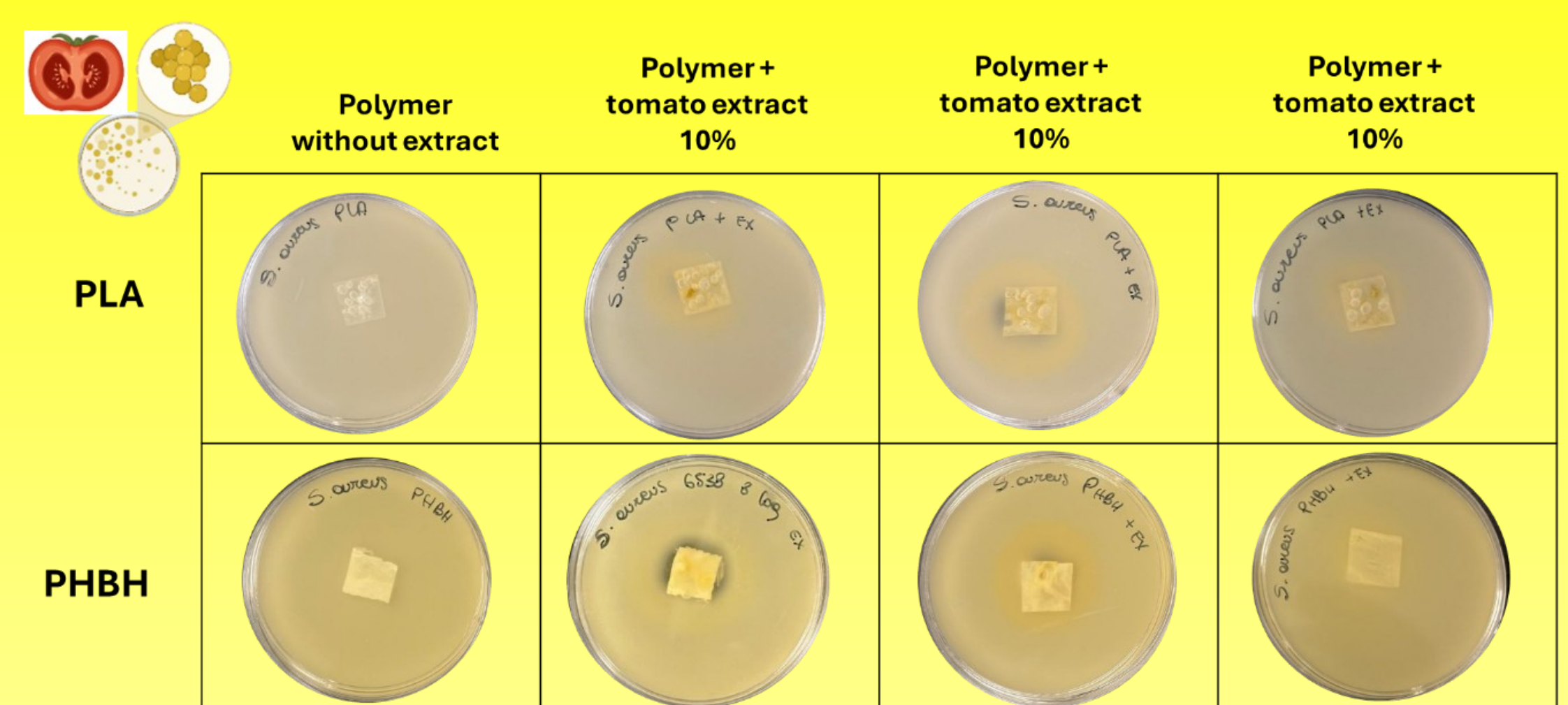
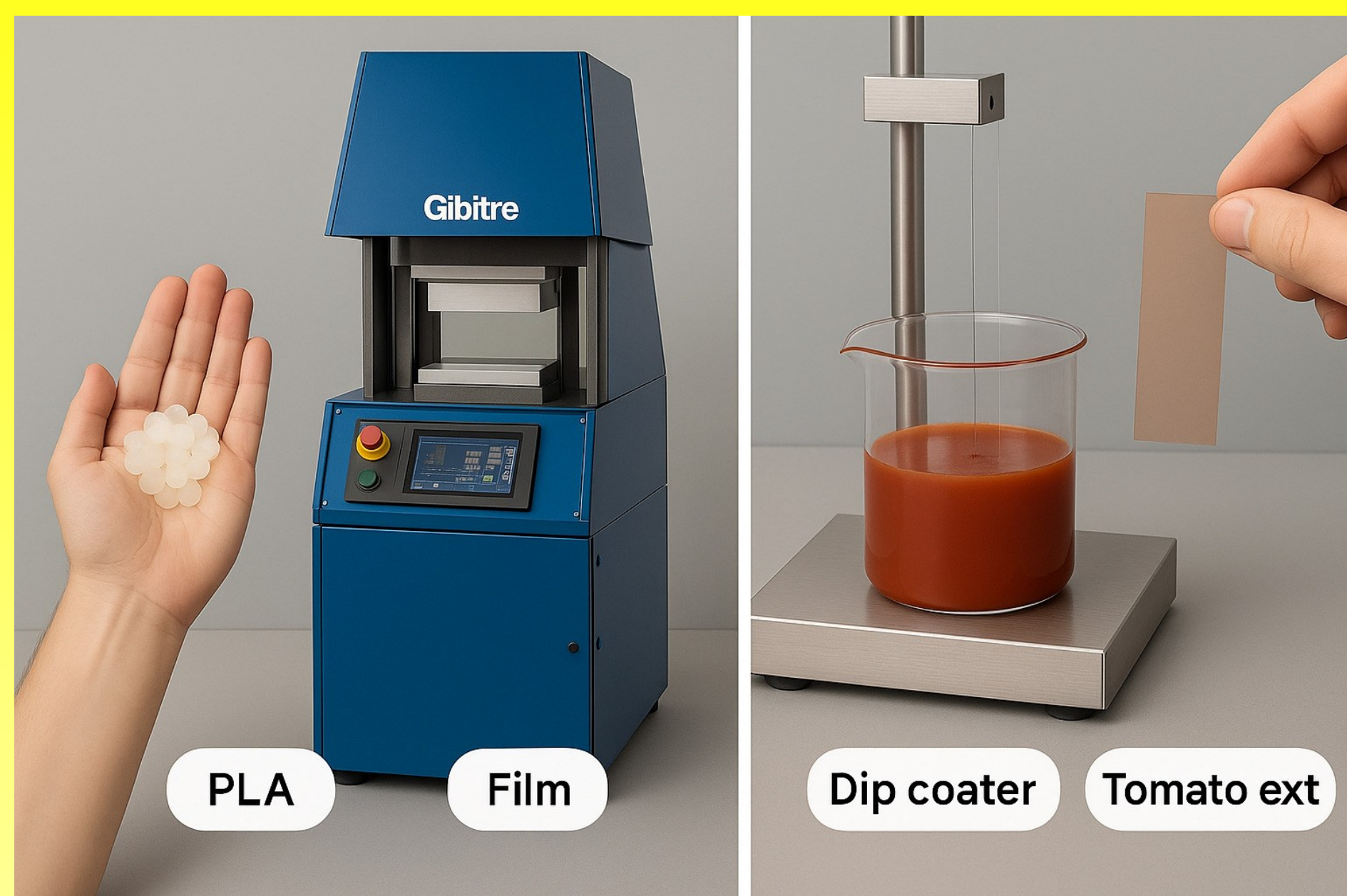
#### FT-IR Analysis of Extracts



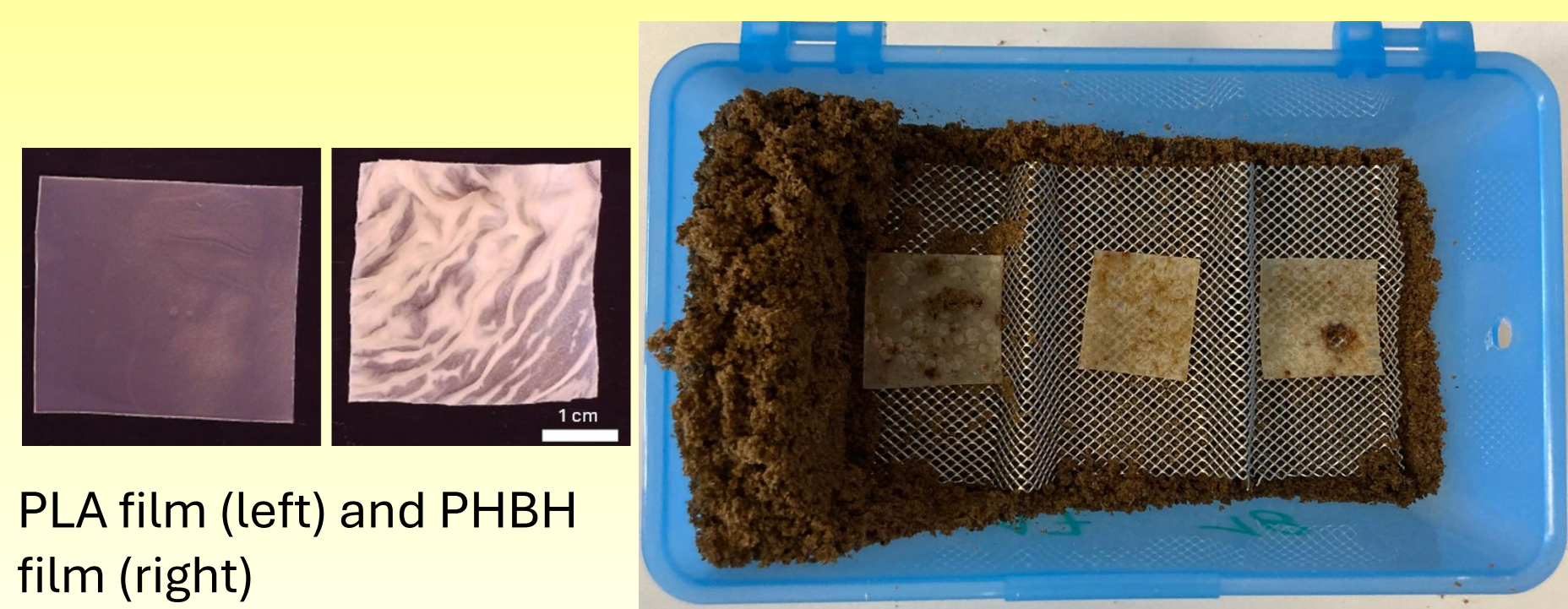
a) Tomato extract and b) Melon extract. The FT-IR spectra display a broad peak around  $3400\text{ cm}^{-1}$ , which can be attributed to O-H or N-H groups or to the presence of water in the sample. Both spectra exhibit peaks at  $1600$  and  $1730\text{ cm}^{-1}$ , associated with carbonyl groups (C=O).

### Develop bio-based packaging films with enhanced biodegradability and antimicrobial properties

#### MATERIALS ENGINEERING

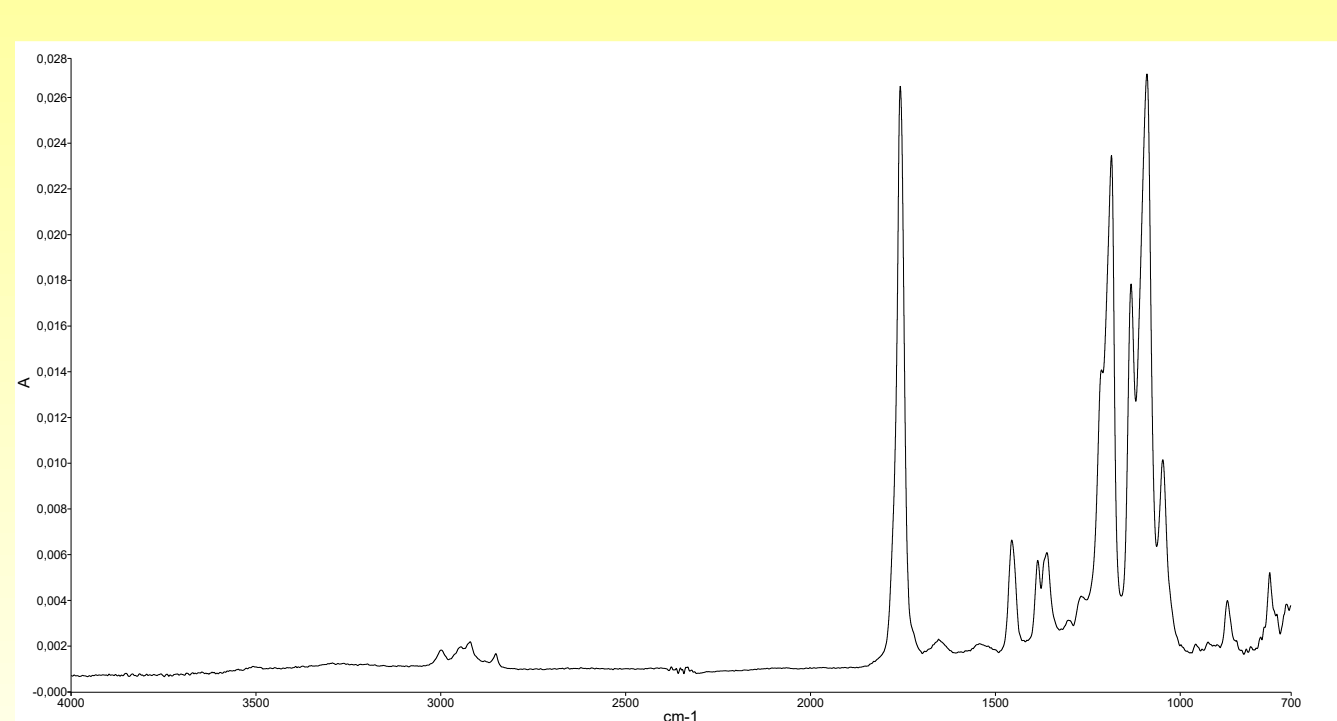


Antimicrobial activity of PLA and PHBH films + 10% of tomato extract against *S. aureus*.

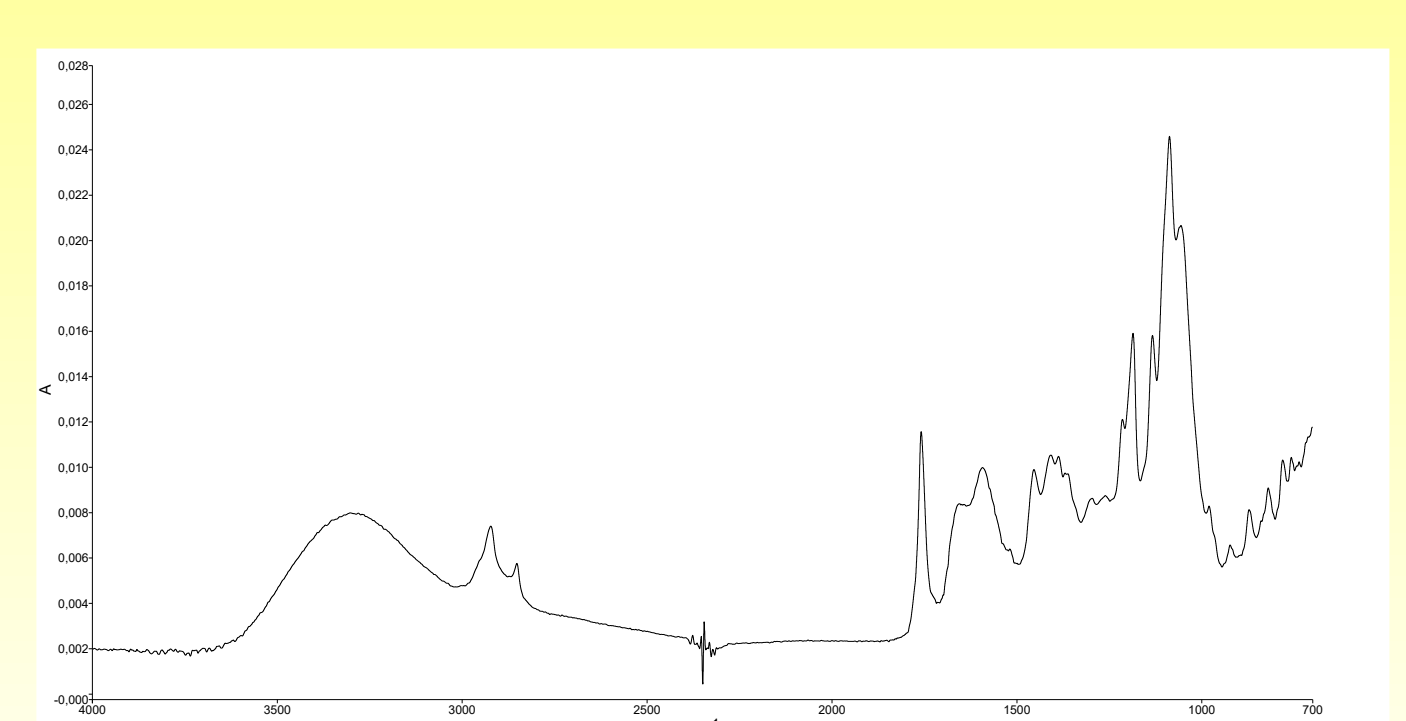


PLA film (left) and PHBH film (right)

Disintegration Test



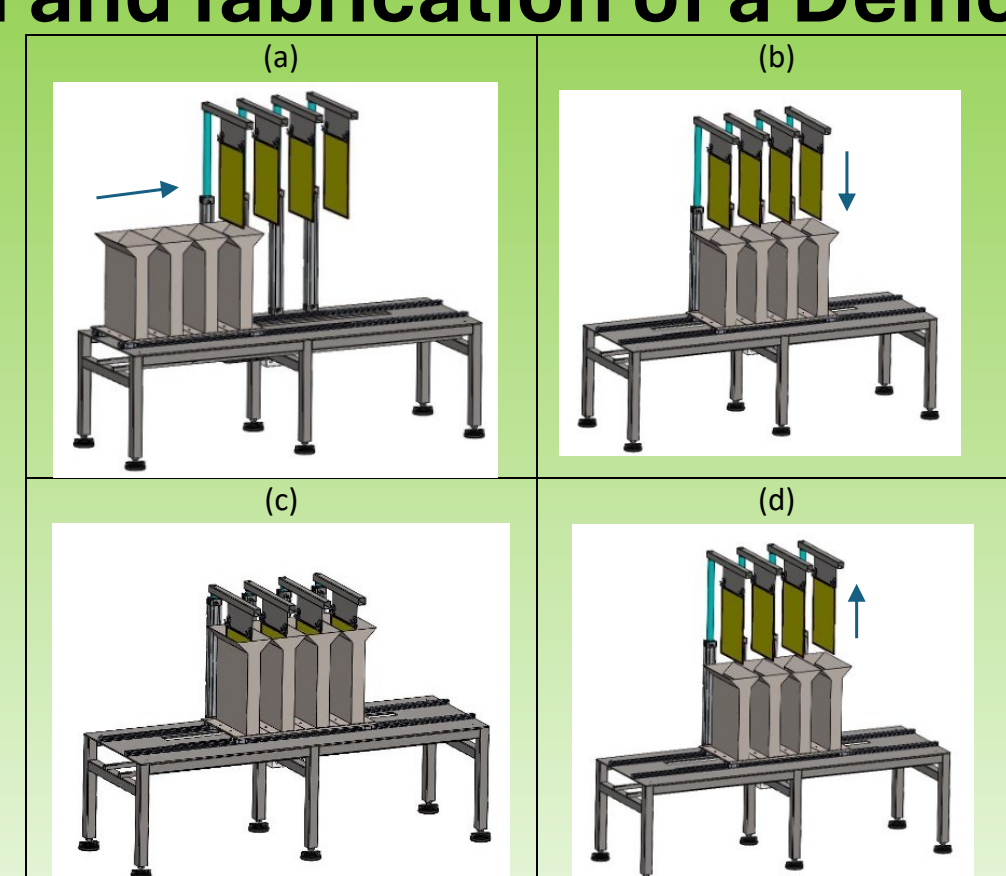
FTIR-ATR spectrum of PLA film before layer-by-layer deposition of tomato extract



FTIR-ATR spectrum of PLA film after layer-by-layer deposition of tomato extract

### Design and fabrication of a Demonstrator for the production of LbL-coated films

#### INDUSTRIAL PLANT



Design of Multifunctional LbL-coated films



Demonstrator Unit Plant

The design of an industrial plant that operates continuously will be carried out.



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