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Preparation of hybrid advanced materials made of biobased nanofibers (cellulose and chitin) and lignin particles for packaging application  
Preparation de matériaux hybrides à partir de nanofibres biosourcées (cellulose et chitine) et de particules de lignine pour des applications en emballage

**Context**

Bio-based & Biodegradable food packaging  
Today's need: replace petroleum-based materials  
Advantages of biobased polymers:  
+ They are abundant and available as waste or by-product  
+ No need for chemical modifications  
+ Capacity to form active packaging

**Methods**

Raw materials  
2 different types of fibers  
- Cellulose nanofibers (CNF)  
- Chitin nanofibers (ChNF)

In-situ preparation of LP  
Study of the interactions depending on the nanofiber surface chemistry.

Formation of functional multilayers  
Optimization of each layers and of the layer's association.

Characterizations:  
- Nanofibers/particles interactions  
- Dispersion of the particles in the films  
- Film structure and layers interactions

**Results**

Characterization of the suspensions  
For in-situ LP preparation, particles sizes and distribution varies depending on the lignin amount and the fibers type.

Functional film analysis  
- Barrier properties (oxygen and water vapor)  
- Mechanical properties  
- Contact angles  
- Transparency  
- Anti-oxidant activity

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Bio-based and chitin nanofibers  
- Good mechanical properties  
- Particulate suspension stabilizer  
- Good O₂ barrier properties

Lignin particles (LP)  
- Anti-oxidant properties  
- Tunable particles size  
- High specific surface area

Lignin particles and cellulose nanofibers  
Sediment  
Supernatant  
Lignin particles and chitin nanofibers  
Sediment  
Supernatant

The higher lignin content, the better AO activity but the lower transparency