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Nanocellulose functionalization in supercritical carbon dioxide for biomedical applications

Fonctionnalisation de nanocellulose en milieu supercritique

Context

Antimicrobial wound dressings

Using nanocellulose

Most abundant natural polymer on earth

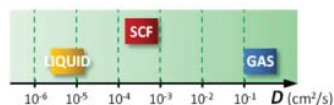
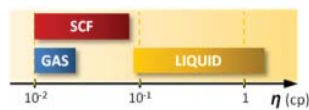
Biocompatible

Generation of cellulose nanocrystals (CNCs) and nanofibrils (CNFs)

Functionalization using supercritical carbon dioxide

Advantages of scCO₂

- Good diffusion of apolar molecules
- Compatible with fragile structures



- Non toxic
- Safe
- Cheap
- Easy recovery

Funded by



Collaborations



Methods

Structured materials design

Surfaces obtained from casting and vacuum filtration

Cryogels obtained from freeze-drying

Aerogels obtained from supercritical CO₂ drying

Supercritical CO₂ functionalization

450 mL pressurized chamber (up to 120 bars), automated deposition



- Antimicrobial silane grafting
- Antibiotics impregnation
- Essential oils impregnation

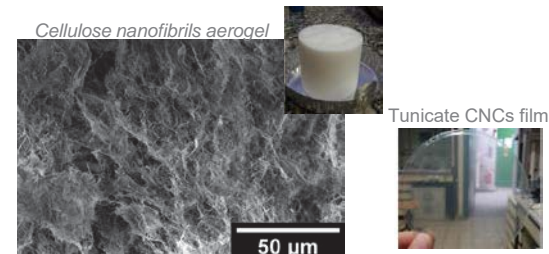
Antimicrobial properties assessment

- Against two bacteria and one eukaryote
- Zones of bacterial inhibition
- Contact antimicrobial activity

Results

Wide range of structures

with tunable and controlled porosity, mechanical resistance and high specific surface areas (up to 480 m²/g)

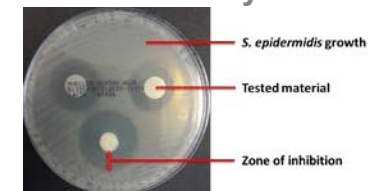


Green functionalization

confirmed by ¹³C NMR, XPS analysis and fluorescence coupling.

Drug release experiments of impregnated molecules

Antimicrobial activity confirmed



Conferences:

European Polysaccharide Network of Excellence EPNOE (2017) Jena, Germany
International Symposium on Supercritical Fluids (2018) Antibes, France
Congrès de la société française de microbiologie (2018), Paris