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Ph.D. thesis (2024-2027)
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Processes for the Oxidation of Lignin kraft for the Integration of Antibacterial Nanoparticles in the Papermaking Process

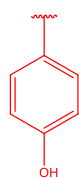
Procédés d'oxydation de la lignine Kraft pour l'intégration de nanoparticules antibactériennes dans un process papetier

BioChip

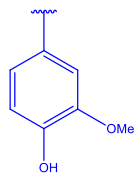
Context

What is Lignin?

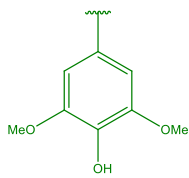
- **Origin:** One of the three main components of wood
- Currently mainly valorized for energy production by combustion
- **Structure:** Highly heterogeneous polymer, constituted of monolignols with phenolic nature:



H unit



G unit



S unit

Lignin Nanoparticles (LNPs)

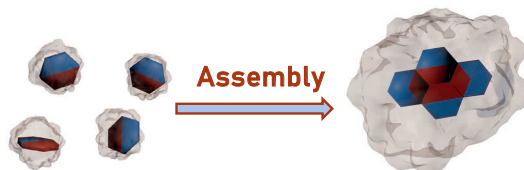
- **Benefits:** increased surface area, homogeneity and reactivity.

Funded by:



Objectives

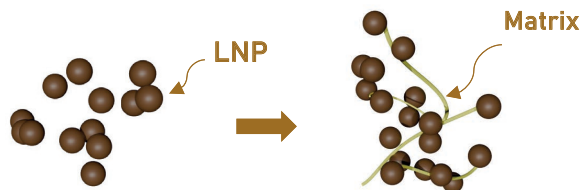
- **Transform** raw kraft lignin into uniform nanoparticles (LNPs)
- **Synthesize** LNPs with controlled size, morphology, and surface properties.



☒ Soluble functions

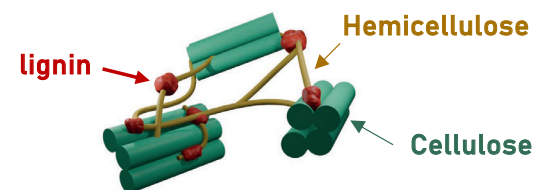
☐ Non-soluble functions

- **Investigate and modify** to bring specific antibacterial properties by chemical modifications
- **Integration** of LNPs on a ligno-cellulosic matrix



Methods

Lignin extraction from Kraft black liquor



- Characterisation:

- Phenolic, carboxylic, methoxy content
- Molecular weight and sugar content
- Antibacterial properties

Lignin nanoparticle formulation by self assembly using an antisolvent with and without chemical modification

- Characterisation:

- Shape, size and morphology via DLS, AFM and TEM
- Antibacterial properties