



**Lorette BRAULT**

Ph.D. thesis (2020-2023)  
LGP2 (N. Marlin; G. Mortha)  
Fibre-Excellence (J. Boucher)

**Thèse Confidentielle**

# Development of a process for dissolving cellulose and regenerating into textile fiber, integrated in a Kraft cellulosic fiber production plant.

Développement d'un procédé de dissolution de la cellulose et de régénération en fil textile, intégré dans une usine Kraft de production de fibres cellulosiques

## Context

### Cotton culture for textile

- Market follows the demographic growth
- Directly depending on climatic hazards
- Pollutant



### Present alternatives

- Viscose : Very pollutant (CS<sub>2</sub>)
- Lyocell, Ioncell : High production cost

### Synthetic fibers

- Fossil fuel-based materials
- > 60% of textile market
- Responsible for microplastic pollution

### Industrial context

- Development of new high value products with a greener process
- Local production of textile fibers
- Compatibility with the Kraft process

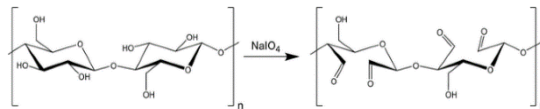
Funded by



## Objectives

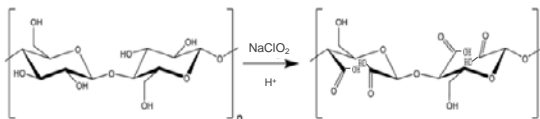
### Cellulose oxidation to promote dissolution

#### First oxydation with sodium periodate



- Regeneration of reagents

#### Second oxydation with sodium chlorite or alternatives



### Cellulosic fibers regeneration

- Cellulose dissolution in aqueous media
- Cellulose extrusion and precipitation
- Characterisation of yarn and mechanical properties study

### Industrial process development

- Integration of the developed process and analytical methods in the Kraft paper mill

## Methods

### Carboxyl content

Number and repartition of carboxyl groups are important contributors to the cellulose dissolution in aqueous-alkaline media.

The content can be adjusted with the presence of a catalyst and the repartition with a swelling process

Wood fibre



10 µm

### Cellulose DP<sub>v</sub> measurement

DP value affect the dissolution, the regeneration and the mechanical properties of the final yarn. The optimal range of DP has to be fixed and targeted, with the modulation of oxidation conditions.

### Stretching extrusion

#### References:

C. Cuissinat et P. Navard, « Swelling and Dissolution of Cellulose Part II: Free Floating Cotton and Wood Fibres in NaOH-Water-Additives Systems », Macromol. Symp., vol. 244, no 1, p. 19-30, dec. 2006.

