



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 (CS₂)
- Lyocell, Ioncell : High production cost

Synthetic fibers

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

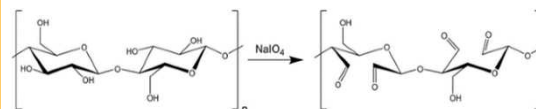
Industrial context

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

Objectives

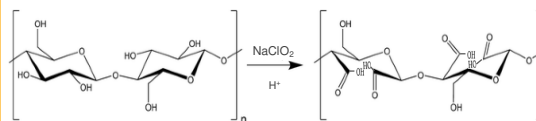
Cellulose oxidation to promote dissolution

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_v 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.

