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Ph.D. thesis (2018-2021)
LGP2 (G. Mortha; N. Marlin)

Design of new chemical celluloses by unconventional oxidation processes using conventional pulp bleaching reagents.

Conception de nouvelles celluloses chimiques par des procédés d'oxydation non-conventionnels utilisant des réactifs classiques de blanchiment des pâtes à papier.

Context

Dissolving Pulp

- Increasing market ↗↗
- (>60% increased in 5 years, in order to replace petroleum-based polymers, plastics and textile fibres).
- Mainly produced by: Prehydrolysis Kraft (PHK) and Acid Sulphite (AS).
- Applications: Regenerated fibres, cellulose ethers and esters, micro and nano cellulose, and others.

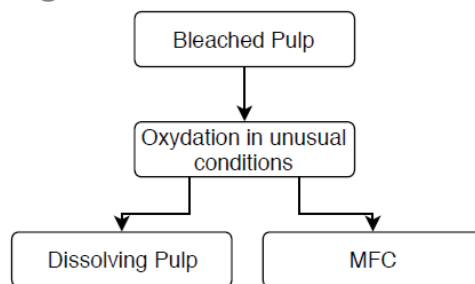
*DRAWBACKS: Current ways of production are very polluting and/or depolymerize cellulose.
(Dissolving ability is linked to DPv)*

Microfibrillated Cellulose (MFC)

- Novel biomaterial
- Composed of high aspect ratio nanosized cellulose fibrils.
- Provides new functionalities and potential applications to cellulose in suspension or in the solid state.
- *Manufacturing challenges: costs and technology.*

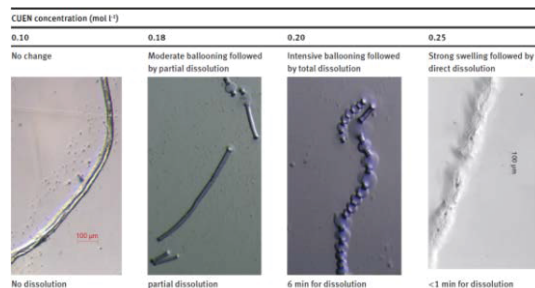
Objectives

Design new chemical celluloses



Define characterisation methods

- Study of the kinetics of cellulose dissolution during derivatisation (carbanilation and acetylation).
- Correlation with a new test for dissolving ability.



*Microscopic observation on pulp fibres.
(Arnoul-Jarriault, 2016)*

The more interesting conditions will be later adjusted to *develop a new oxidising process to replace TEMPO treatment for MFC production.*

Methods

The new oxidation process

Optimisation of

- Chemicals dosage (ClO₂ & H₂O₂)
- Retention time, pH and temperature
- Combination with other chemicals.

Reduction of polluting chemicals usage

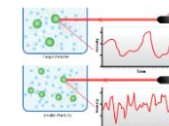
Two products

- Dissolving Pulp
- Microfibrillated Cellulose

Cellulose Characterisation

To be considered:

- Molecular Weight Distribution
- Alkali resistance
- Chemical functionalities
- Pulp morphology
- Microscopic analysis
- Porous structure
- Rheology
- Dissolution ability



Equipment to be used

- DLS nanosizer
- SEC
- Morfi Analyser
- IR
- Others...

