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# Research for the best coupling Strategy between mechanical treatment (refining) of cellulosic pulp and the utilization of chemical products/enzymes.

*Recherche d'une meilleure stratégie de couplage entre le traitement mécanique de raffinage de la pâte à papier et l'utilisation d'enzymes et de produits chimiques*

## Context

### Upgrading paper pulp to dissolving pulp.

- Expanding market for dissolving pulp ( textile production, cellulose derivatives and nanocellulose).
- Pure cellulose is a green and sustainable alternative for the production of chemicals and materials.



### Challenges

- Elimination of residual hemicellulose and poor reactivity of cellulose.

### Proposed solution

- Mechanical treatment (refining) prior to hemicellulose extraction.

Samples %	K pulp	K-5.5% CCE	RK 5.5% CCE	K-9% CCE	PHK
Glucose	81,5	89,10	95,22	95,82	95,14
Xylose	16,6	9,55	4,04	3,52	4,07

*K pulp: kraft pulp, RK: Refined Kraft pulp, CCE: Cold Caustic Extraction, PHK: Prehydrolysis Kraft*

*Chao Duan et al, 2016*

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## Objectives

### Optimize hemicellulose removal and recovery from Paper grade pulp.

- Without the transformation of native cellulose to cellulose II.
- Valorization of sugars

### Minimize chemical and enzyme consumption during purification and dissolution of cellulose.

- Increased accessibility of chemicals to active site due to refining.

### Increase cellulose reactivity to existing and new solvents.

- Increased surface area, cell-wall porosity due to refining.
- Increase in cellulose amorphous region.

### Extrapolation of the results obtained on an industrial scale.

- Determination of the optimum refining intensity and energy for a given refiner.

## Methods

### Mechanical treatment

- Bleached hardwood pulp will be refined on both valley beater and disc refiner.
- Refining trials will be performed at SR-45 without fines.

### Alkaline Extraction

- CCE at different NaOH concentrations will be performed at room temperature.

### Enzymatic treatment

- Xylanase and monocomponent cellulase.

### Characterization techniques

- Morfi, PULMAC, Bauer McNett (*fiber classifier*), XRD, HPAEC-PAD, SEM

### References:

*Jianguo Li et al, (2015) Bioresource technology, 192, 501-506.*

*Arnoul-Jarriault, et al (2015). Industrial Crops and Products, 65, 565-571*

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