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Purification processes of wood based cellulose by coupling chemical and enzymatic reactions

Procédé de purification de la cellulose issue du bois par couplage de réactions enzymatiques et chimiques

Context

Hemicelluloses Extraction from Kraft Pulp

- Hemicelluloses constitute approximately 20–30% of wood-based materials, and 15 to 30% of chemical pulps.
- These hemicelluloses are complex polysaccharides, having potential of being valorized.
- Enzymes are powerful and highly specific catalysts, being able to extract exactly what are looking for.

Challenges

- Due to extensive modification of hemicelluloses during Kraft process, removal of hemicelluloses left in pulp is highly challenging.
- Hemicelluloses' structures in various kinds of wood is different, That's why selection of a unique method is challenging.

Advantages

- Valorisation of hemicelluloses
- No cellulose degradation
- Facilitation of next bleaching steps

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Methods

Extraction of Hemicelluloses

- Through enzymatic treatments on softwood and hardwood pulps, with two hemicellulases: xylanases and mannanases under conditions to be optimised.



Collaboration with Novozyme for the choice of the adequate enzymes

Analysés:

- Characterization and quantification of hemicelluloses left in treated pulp
- Characterization and quantification of solubilized hemicelluloses



- Methods of analyses: HPLC-PAED, SEC, MALDI-TOF

Results

- Two methods have been selected for extraction of hemicelluloses from pulps for analytical purposes. CCE and DMSO extractions.
- Applying enzymes separately showed better results in comparison with applying both enzymes together.
- The results of SEC on hydrolysates showed the release of oligosaccharides with a given DP as the most dominant oligomers of xylan released.
- More than 20% of xylan could be extracted from hard and softwood pulps through xylanase.
- No degradation of cellulose happened during enzymatic treatment.
- Significant impact of pulp consistency on hemicelluloses extraction was obtained.

