THE INFLUENCE OF PRE-HYDROLYSIS KRAFT (PHK) CONDITIONS ON PULP FOCK REACTIVITY

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Abstract

• Regenerated cellulose boasts numerous advantageous properties that position its fibers as a natural alternative to synthetic materials derived from non-renewable resources.

•Pre-hydrolysis kraft cooking is emerging as the predominant approach to producing dissolving pulp, the raw material for regenerated cellulose.

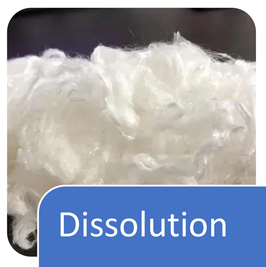
• This study focuses on investigating the effect of pre-hydrolysis kraft cooking and how intrinsic viscosity and hemicellulose content of pulps impact the Fock reactivity (analytical method for dissolving potential of cellulose fibers by the viscose method).

Keywords: Dissolving pulp, Fock test, Prehydrolysis kraft, Recycled pulp

Introduction

Raw Material
- Wood
- Cotton Linters

Chemical Treatment
- Pre-Hydrolysis Kraft
- Sulfite
- Organosolv
- Ionic Liquid



Dissolution
- Viscose
- Lyocell
- Acetate
- Cupro production
- Ionic liquid

Cotton linters have a chemical efficiency advantage over wood for dissolving pulp quality, but sustainability issues, such as the use of dangerous pesticides and high-water consumption, hinder their ecological performance. In contrast, wood stands out as a more environmentally friendly raw material for dissolving pulp production. In which, pre-hydrolysis kraft and sulfite cooking are the predominant chemical treatments.

Methods

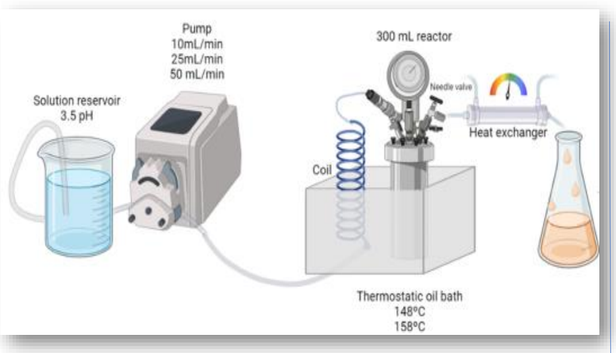


Figure 1 – Schematic diagram of the flow-through reactor

- A two-step chemical treatment was employed in recycled pulp

- Two different reactors were used to produce PHK dissolving pulp.

- Chemistry composition and intrinsic viscosity were assessed and linked with the Fock Reactivity of each pulp.

Results

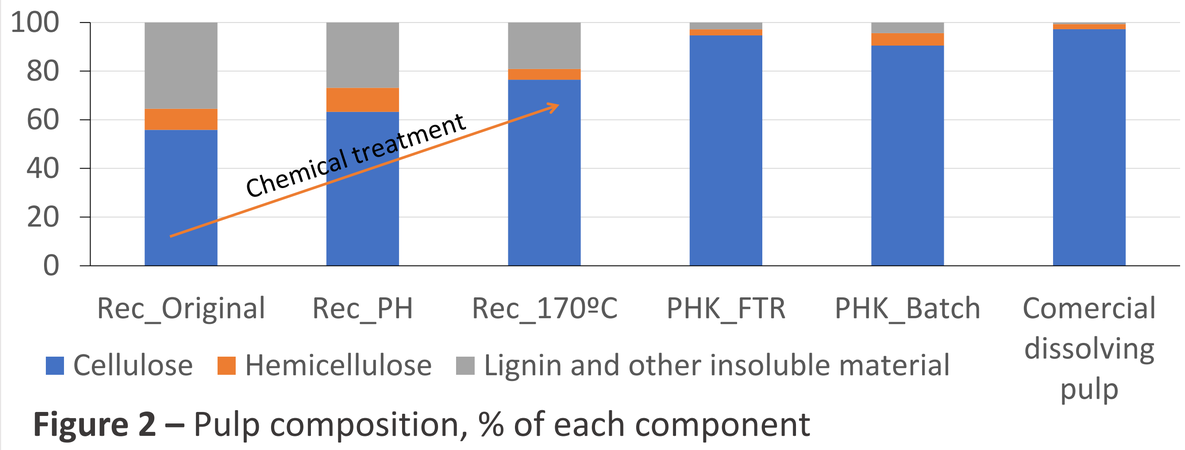


Figure 2 – Pulp composition, % of each component

The chemical treatment effectively removes lignin and hemicelluloses from the recycled pulp, although it falls short of achieving market-standard dissolving pulp quality. The harsher conditions employed to achieve a higher purity pulp also results on higher cellulose degradation. Table 1 illustrates the intrinsic viscosity of the various pulp samples for reference.

Table 1 - Intrinsic viscosity of the different pulps.

	Rec_Original	Rec_Treated	PHK_FTR	PHK_Batch	DPc
Intrinsic viscosity, cm^3/g	669	413	549	874	474

Conversely, this degradation is looked for and allows to achieve of the optimized intrinsic viscosity for dissolving pulps (400-600 cm^3/g). The lower viscosity enhances the solvent diffusion in the cellulose chain and can result in higher reactivity. Table 2 shows the Fock reactivity of the tested pulps.

Table 2 - Fock reactivity of the produced pulps.

	Rec_original	Rec_Treated	PHK_FTR	PHK_Batch	DPc
Reactivity, %	45	84	71	57	91

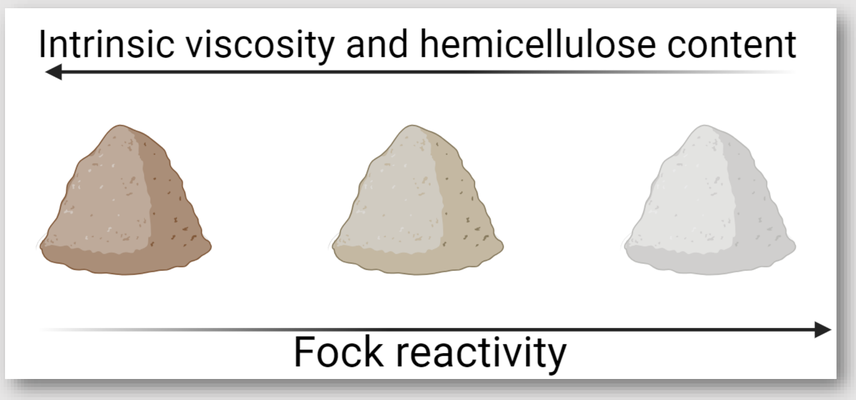
Lab-processed pulps need more treatments/optimization, nonetheless the reactivity of the recycling pulp showcases the chemical treatment potential to enhance Fock reactivity.

Conclusion

- The two-step chemical treatment 2-folded the Fock reactivity of recycled pulp.

- The enhanced pre-hydrolysis employed with the flow-through reactor resulted in higher reactivity vs batch reactor.

- There are other parameters that must be accounted for; however, hemicellulose and intrinsic viscosity seem to have a direct influence on Fock reactivity and must be accounted for.



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