

Hardwood fiber modification from the integration of high kappa cooking and extended oxygen delignification for Eucalyptus and Acacia

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PROJECT OBJECTIVES:

Develop an innovative integrated program for high kappa HW kraft pulping and extended oxygen delignification to produce an oxygen delignified HW kraft pulp with :

- low HexA content, high fiber charge
- high fiber/paper strength, good pulp bleachability
- low TRS black liquor, and bleaching effluent AOX reduction

PROJECT BACKGROUND:

• Roles of fiber acidic groups

- Responsible for the source of fiber charge
- Principle retention sites of various wet-end additives in pulp suspensions
- Affect their flexibility and swelling ability in water
- Affect the degree of formation of inter-fiber bonding during pressing and drying process, consequently the mechanical properties of dried paper sheets

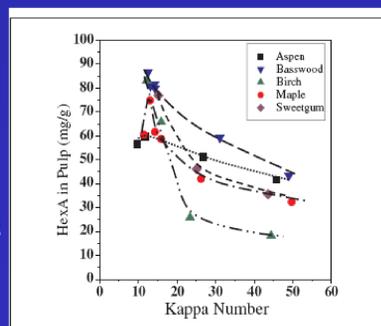
• Oxygen Delignification

- Dominant bleaching technologies for both ECF and TCF operations
- Currently a compromise between pulp quality and limit of delignification
- A promising process to increase fiber charge and pulp yield

• High kappa cooking

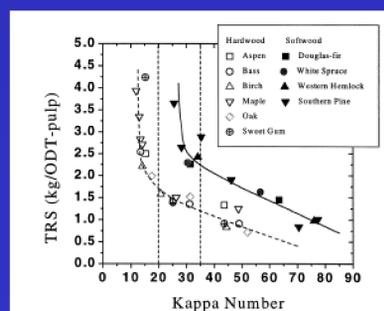
➢ HexA formation and reduction

- ❖ Detrimental to pulp bleaching operations; mill corrosion problems
- ❖ High kappa cooking leading to a lower HexA content in HW kraft pulps



➢ TRS formation and control

- ❖ Traditionally control: oxidation, scrubbing, etc: difficult and costly.
- ❖ High kappa cooking leading to reduced TRS formation



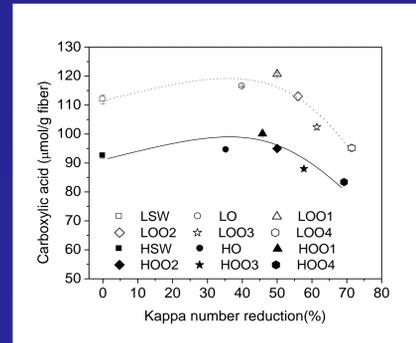
• Integrated process of high kappa cooking and Extended Oxygen Delignification



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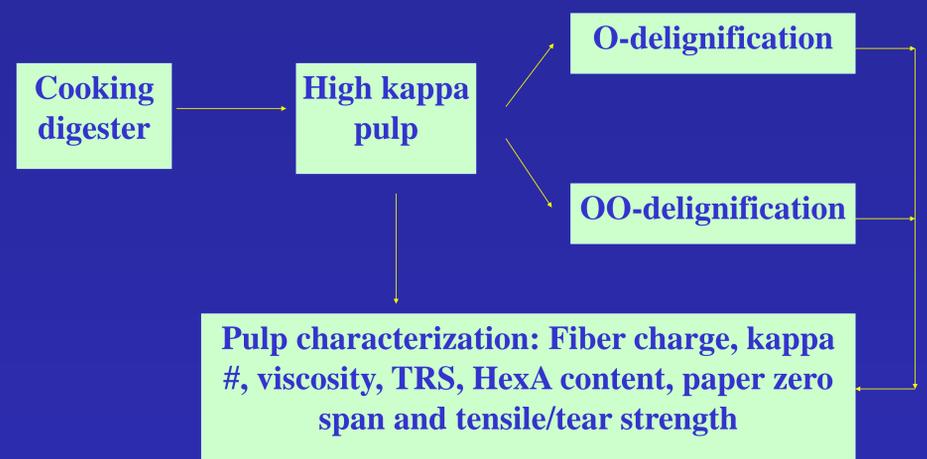
- 3-10% higher COOH content in Low AA cooking- O₂ delignified pulp than High AA for softwood kraft pulp



Total carboxylic acid content in SW kraft pulps and the corresponding oxygen delignified pulps.

RESEARCH APPROACH

Overview of Experiment Plan



- High kappa cooking and optimization
- AA (14-18%), Temp (160-170), sulfidity
- One and two-stage O₂ delignification
- fiber charge, selectivity, fiber strength, AOX

PROPOSAL DELIVERABLES

1. Conventional and modified high kappa kraft pulping of Eucalyptus or Acacia at high, medium, and low active alkali charge as well as high, medium, and low sulfidity
2. Optimization of the cooking conditions to achieve a high kappa number kraft pulp with low HexA and low TRS, high fiber charge, and high fiber and paper strength
3. Extended oxygen delignification of the high kappa HW kraft pulps at different parameters (NaOH, temperature, oxygen pressure)
4. Optimize oxygen delignification to achieve high fiber charge, yield, enhanced ClO₂ bleachability and high fiber/paper strength

PROJECT VALUE

This program will provide an innovative technology to pulp and paper industry for fiber chemical modification coupled with current oxygen delignification system with the benefit of :

- 15 - 20% Increase in Fiber Charge
- 40 - 60 % reduction in HexA formation
- 30 % reduction for TRS
- 10-15 % increase in fiber strength and paper strength



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