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

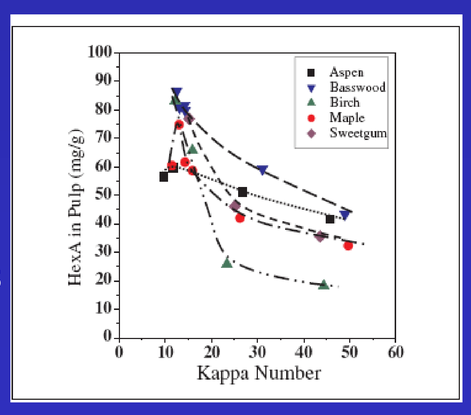
- **Oxygen Delignification**

  - 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**

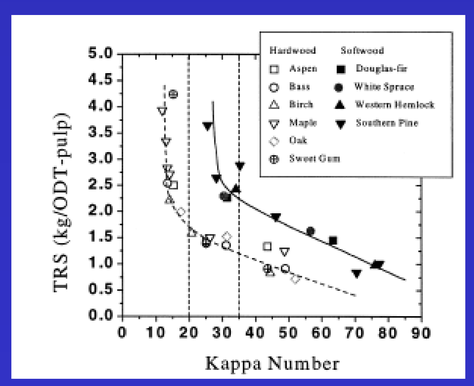
  - **HexA formation and reduction**

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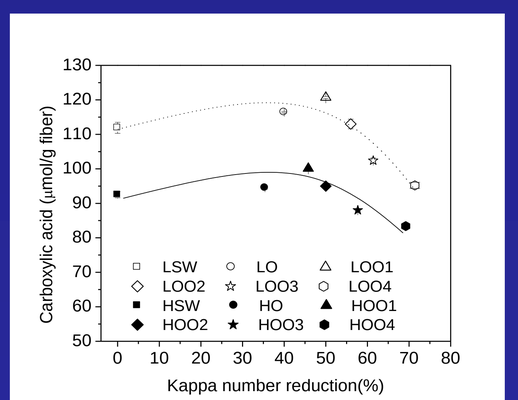
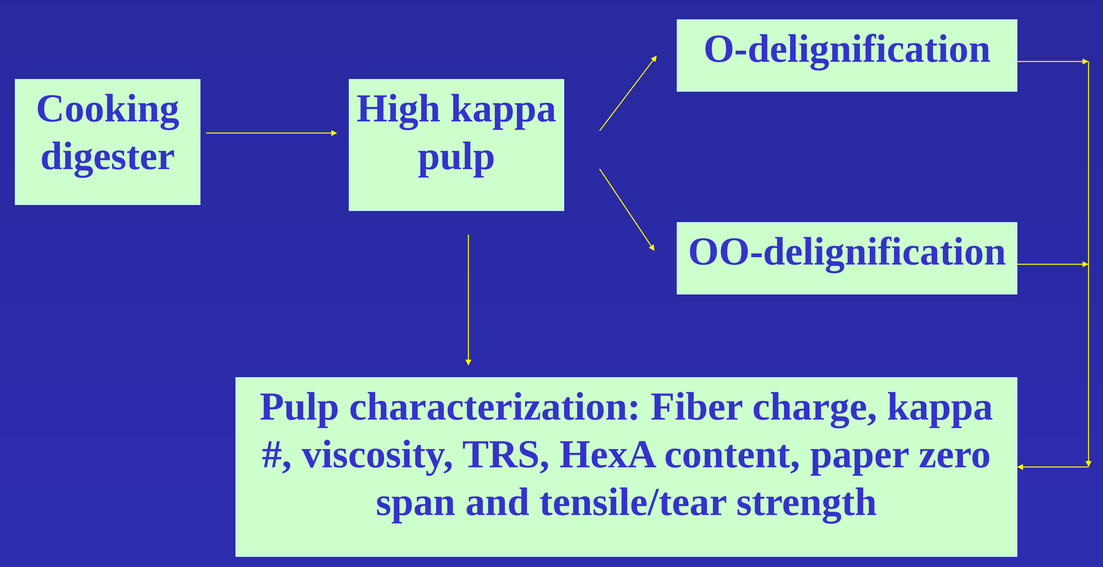
- 3-10% higher COOH content in Low AA cooking- O2 delignified pulp than High AA for softwood kraft pulp



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 ClO_2 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