MANAGING LIQUOR CHEMISTRY TO OPTIMIZE PRODUCTION, QUALITY AND EFFICIENCY

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An Ecolab Company

Topics

1) The Need for Liquor Chemistry Management
2) Carbonate Loading in the Liquor Process
3) Sulfate Loading in the Liquor Process
4) Organic Carryover and Deposition
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The Need for Liquor Chemistry Management

- Changing macro-economic pressures being placed on mills in all regions:
  - 1. The growth in electronic data storage and communication, reducing demand for printing and writing grades.
  - 2. The growing global environmental awareness and focus, forcing mills to reduce all types of emissions
  - 3. The start-up of new, high-capacity, highly efficient pulp mills
  - 4. Increasing global competition, with many regions which had been self-reliant on pulp production increasing the importation of pulp produced in other regions due to lower cost or unique physical and chemical properties.
  - 5. Increasing demand for consumer-based paper and pulp products, requiring different pulp qualities of brightness, cleanliness, etc.

The Need for Liquor Chemistry Management

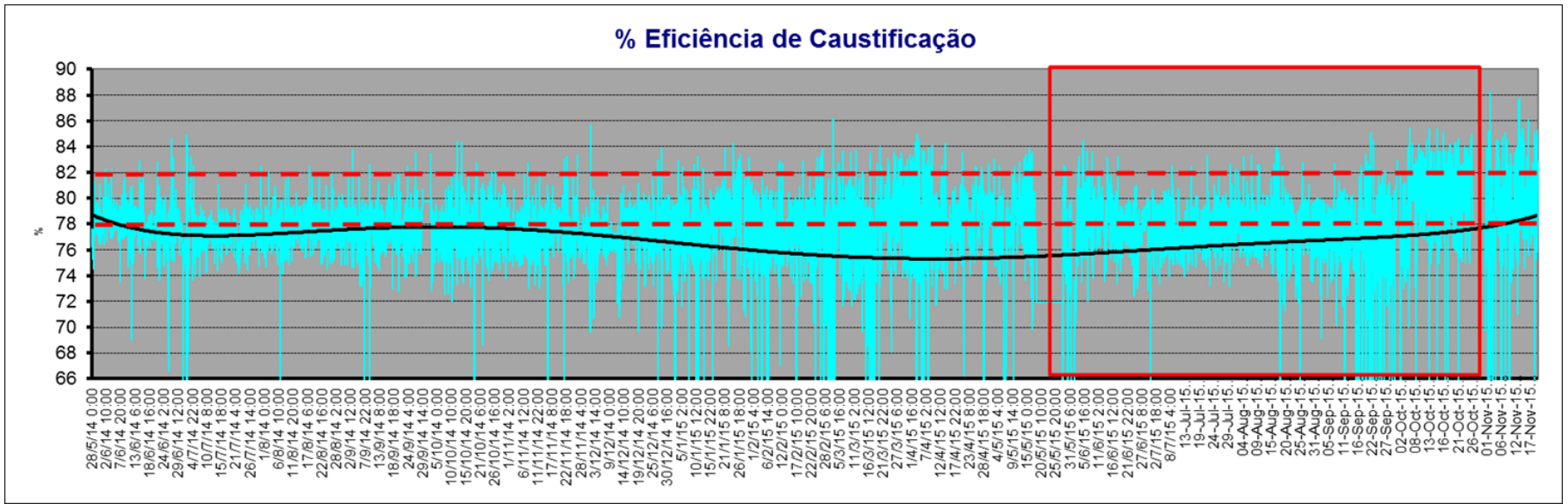
- These macro-economic demands put competing pressures on mills:
  - 1. Reduce operating costs – use of lower quality or more juvenile wood, less operators/managers/lab personnel, extended operating campaigns
  - 2. Increase production – operating beyond design capacities, particularly in liquor processing areas, higher strain on effluent and influent treatment areas. All done without capital investment
  - 3. Reduce emissions – additional water re-use to reduce the amount of water discharged, tighter operating controls on air emissions.
- All of these changes are causing significant chemistry changes to the entire liquor process, increasing deposition, reducing operating efficiency, and increasing costs!!

Carbonate Loading in the Liquor Process

- Primary ion which builds up in process, can cause scaling/deposition and lost efficiency!
- Increases due to failure to optimize and maintain % Causticizing Efficiency.

$$Na_2CO_3 + Ca(OH)_2 \rightleftharpoons 2NaOH + CaCO_3$$

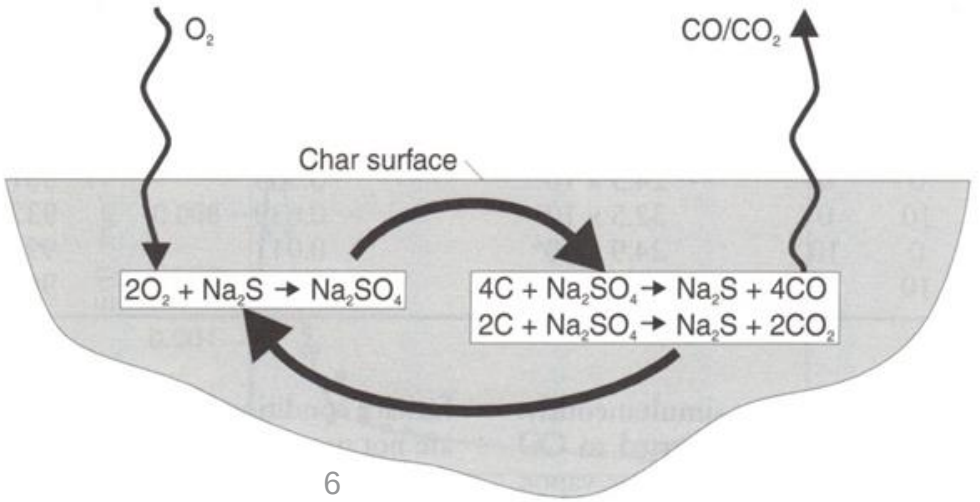
- Variation and low %CE results increase carbonate throughout entire liquor process due to disassociation of sodium carbonate!



Sulfate Loading in the Liquor Process

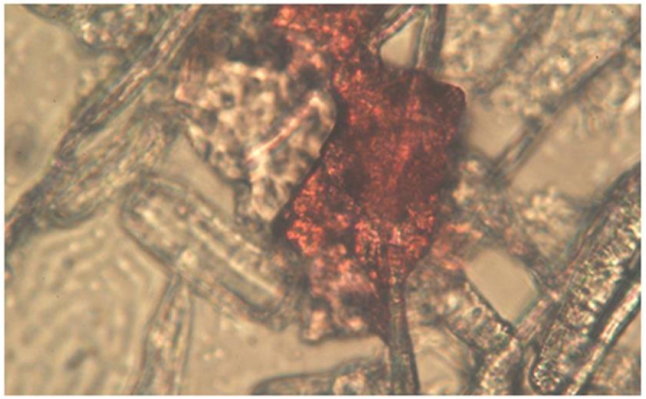
- Failure to control sulfate levels in the liquor can result in scale formation (calcium sulfate, barium sulfate, burkeite/dicarbonate, etc.) and increase operating costs due to high non-process element loading.
- Sulfate level is controlled almost completely by Reduction Efficiency of the Recovery boiler.
- Changing environmental restrictions, loading increases on boilers, etc. all can reduce % Reduction Efficiency.

Figure 6-4. The sulfate-sulfide cycle.



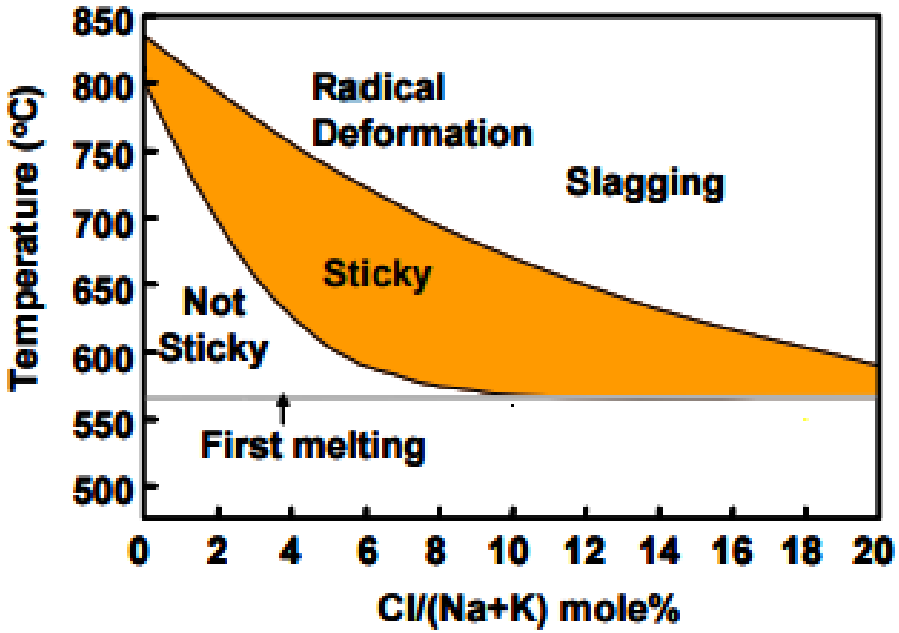
Organic Carryover and Deposition

- There are a number of items which impact organic deposition or high COD to effluent:
  - 1. Cooking uniformity – Reduces uncooked wood shives, liberates encapsulated pitch from the fiber and into the liquor to be washed.
  - 2. Residual alkalinity control – since most organics are soluble under alkaline conditions, maintaining alkaline levels throughout the washing process is critical to take advantage of natural removal!
  - 3. Brown Stock Washing Efficiency – maximum washing efficiency, combined with proper residual alkalinity control, will remove most of the organic materials present.
  - 4. Stabilizing ions – minimizing calcium and silica in particular is critical – bark removal and % Causticizing Efficiency!



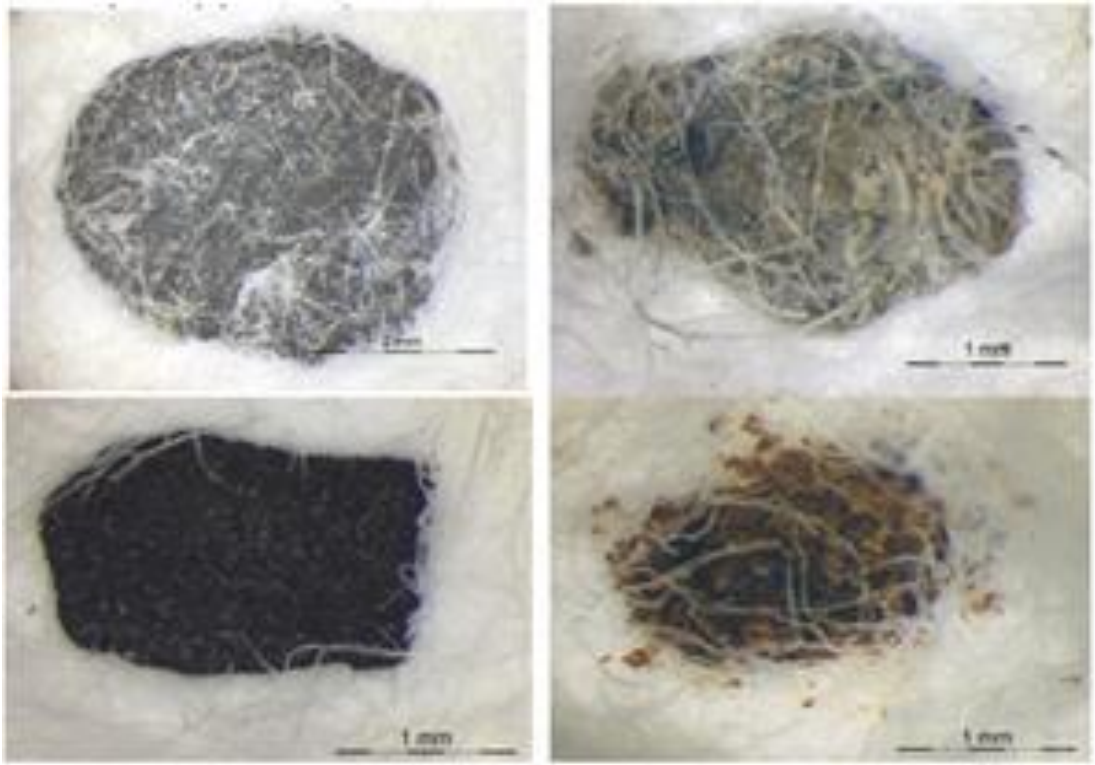
Concentration of Non-Process Elements

- Over time, if sulfate, carbonate, and other non-process elements (chlorides, potassium, silica, etc.) are not controlled, they will concentrate due to reduced discharge or “cycling up”.
  - Normally results in formation of deposits (burkeite, calcium carbonate, calcium silicate, etc.), plugging in the Recovery Boiler draft (due to reduced “sticky temperature” from chlorides/potassium), etc.



Case Study

- **Background:** European mill struggled with high “dirt” count in sheet forcing downgrade of 5-8% of all pulp produced each month. Multiple project teams, focus groups, etc. but could not resolve despite process changes to washing and bleaching.

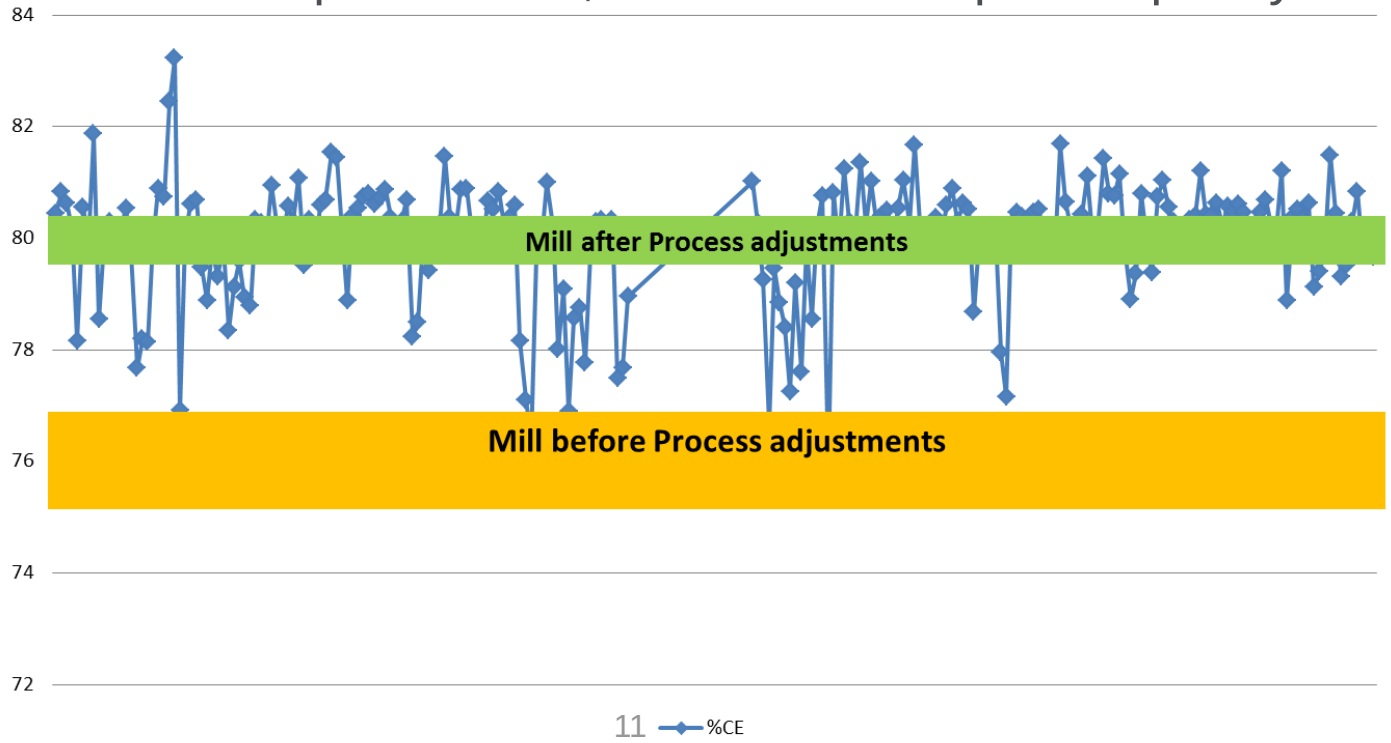


Case Study

- Completed liquor process analysis and review. Samples taken:
  - Wood chips being fed to the digester
  - Black Liquor – Weak, Intermediate, and Burning Liquors
  - Green Liquor – Clarified, Unclarified, GL Dregs
  - White Liquor – Clarified, Unclarified
  - Lime/Lime Mud – Reburned Lime, Purchased Lime, Mud to Lime Kiln
- Also inspected system during annual outage.

Case Study

- Identified three areas of correction based on information:
  - Improve % Causticizing Efficiency to reduce carbonate-based scale
  - Change wash aid to reduce polydimethyl siloxane (PDMS) carryover
  - Improve alkalinity control to improve organic washing.
- Initial focus was to improve %CE, which was completed quickly



Case Study

- Next, made slight adjustments to continuous digester alkalinity profile to increase alkalinity of blown pulp.
- Finally replaced wash aid with highly dispersible, lower-molecular weight silicone formulation.
- **FINAL RESULTS:** ***Increased average First Quality pulp to in excess of 99%.***

Summary

- With mills facing additional pressures to reduce costs and meet ever-tightening environmental restrictions, it is critical that the chemistry of the entire liquor cycle be closely monitored and controlled.
- Failure to control the liquor chemistry will result in:
  - Decreased operating efficiency
  - Increased product quality issues
  - Reduced production
  - Increased costs of operation.
- Chemistry issues often are not found in the area where the issue is first noted, so evaluation of the entire process is mandatory to solve issues that arise.

Questions???


Silicato
Forno de cal
Drier pulp
Digestor
Scale control
Carbonato
Pitch Control
wash aid
IDM
NALCO