

Highly Energy Efficient D-GLU (Directed Green Liquor Utilization) Pulping

Novel Process recovers green liquors from the back end of the mill and directs them to the front end of the mill.

Introduction

In an effort to address increasing wood cost and stagnant mill productivity, the pulp and paper industry has made maximizing the economics of its pulping operations a high priority. However, the high cost of capital retrofits for improving the pulping process can be prohibitive.

Results from a previous project demonstrated in pulp mills in Finland, showed that the novel pulping innovation employing directed green liquor utilization (D-GLU) can provide important energy benefits for mills in the U.S. In addition, pretreatment of pulp before cooking with controlled delivery of mill green liquor GLin a mild pretreatment phase temperature and time, has proven to significantly enhance pulp properties. By rerouting a significant portion 20 to 30 percent) of the GL flow from causticizing to the pulp digester, kraft pulp mills typically handling North American furnishes i.e., Southern pine could significantly improve energy efficiency and productivity.

Figure 1 demonstrates how diffusional differences may affect pulping kinetics, especially if a pretreatment is applied before pulping. Each chip was exposed to a uniform environment of hydroxide and hydrosulfide, halved, and then dyed to show the absorption profile of one of the two chemicals. The black color (right) half chips demonstrate sulfide penetration, while the red half chips (left) demonstrate hydroxide penetration. Because of obvious differences between the two chemicals' absorption profiles, kinetic differences in pulping are expected and may be subject to control.

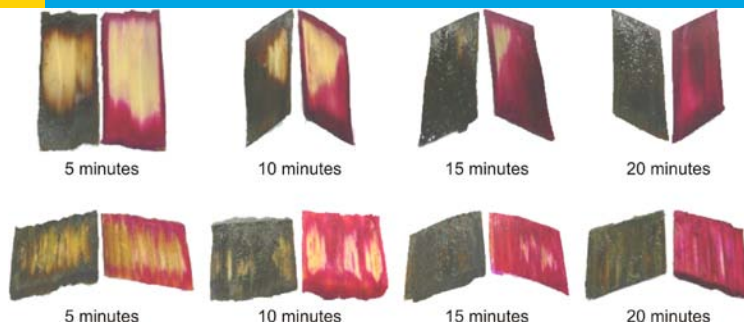


Figure 1. Top row: Penetration of sulfide (left) and hydroxide (right) into sweet gum chips at 103° C.

Bottom row: Penetration of sulfide (left) and hydroxide (right) into Southern softwood chips at 103° C.

Image courtesy of Georgia Institute of Technology.

Benefits for Our Industry and Our Nation

D-GLU pulping will provide the following benefits:

- Reduce energy by up to 25%
- Increased pulp yield
- Higher fiber strength
- Lower H-factor at similar control cook kappa numbers
- Reduce digester alkali demand by as much as 50%
- Offload the lime kiln by up to 30%
- Increase bleachability of the pulp

This valuable and economical pulping innovation is optimized to provide significant energy savings and increased productivity in the U.S. pulp and paper industry.

Applications in Our Nation's Industry

The novel D-GLU pulping technology will be a retro-modification to kraft pulp mills producing linerboard and bleachable grade pulp.

Project Description

The project seeks to develop feasible chemical modifications during kraft pulping operations to obtain significant energy and product benefits for U.S. kraft pulp and paper mills. This project will also focus on providing a cost-effective retro-modification to kraft pulp mills (i.e., linerboard and bleachable grades), in addition to developing an engineering design and implementation plan for the additive-enhanced GL process.

Barriers

- Engineering of capital, liquor flows, and recovery for maximum benefits
- Environmental and scaling issues regarding nitrogen emissions during recovery due to inclusion of the organic additive, higher sulfide off gassing in cooking, and scale in the digester and/or evaporators
- Understanding the function of the nitrogen-based organic additives

Pathways

The objectives will be achieved through (1) determining how to handle the GL flows; (2) performing applied the fundamental studies for the pulping catalyst; (3) selecting a mill and exploring and mill-specific issues related to odor, environmental concerns, solid impacts, and corrosion; and (4) performing mills trials.

Milestones

- Address questions to feasibility and planning of GL pulping process in target mill by combinatorial mill testing complete
- Perform both initial and expanded mill trials by securing multiple corporate sponsors
- Analyze economic use and application of additive-enhanced GL pulping in order to entice corporate testing and participation complete
- Research mechanisms of scale build-up downstream in the pulp and its effects on the pulping process

- Determine possibility of significantly altering green liquor recausticization and the economic viability of this avenue
- Demonstrate 15% energy savings during D-GLU pulping mill trials

Commercialization

The industrial sponsors will provide mill pulping facilities, personnel, and other resources (i.e., chips, liquors) to implement work and coordinate mill trials. Success in the program will generate interested stakeholders and ultimately increase market penetration.

Project Partners

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