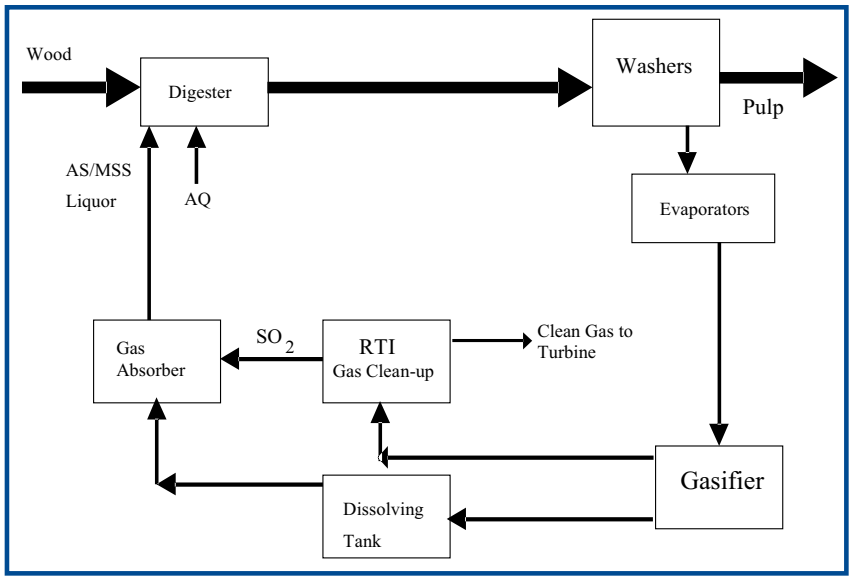
Integration of the Mini-Sulfide Anthraquinone Pulping Process and Black Liquor Gasification in a Pulp Mill

Combining Three Advanced Technologies to Achieve a New Model of Efficiency

As many of the recovery boilers and other pieces of large capital equipment of U.S. pulp mills are nearing the end of their useful life, the pulp and paper industry will soon need to make long-term investments in new technologies. The ability to install integrated, complete systems that are highly efficient will impact the industry's energy use for decades to come. Developing the process models for these new systems is key to the adoption of state-of-the-art technologies in the Forest Products industry.

This project will develop and define an integrated process model that combines mini-sulfide sulfite anthraquinone (MSS-AQ) pulping and black liquor gasification with a proprietary desulfurization process developed by the Research Triangle Institute. Black liquor gasification is an emerging technology that enables the use of MSS-AQ pulping, which results in higher yield, lower bleaching cost, lower sulfur emissions, and the elimination of causticization requirements. The recently developed gas cleanup/absorber technology can clean the product gas to a state suitable for use in a gas turbine and also regenerate the pulping chemicals needed to for the MSS-AQ pulping process.

Because the three technologies are complimentary, their adoption as a streamlined package will ensure their ability to deliver maximum energy and cost savings benefits. The process model developed by this project will enable the successful integration of new technologies into the next generation of chemical pulping mills.



Schematic of the MSS-AQ Pulping Processes with the RTI Absorber

Benefits for Our Industry and Our Nation

- The combination of three advanced technologies into an integrated design will enable the pulping industry to achieve a new level of efficiency, environmental performance, and cost savings.
- Adoption of the integrated system could save 100 trillion Btus annually in the U.S., while delivering cost savings to the pulping industry of $20-30 million per year.

Applications in Our Nation's Industry

Mills that are interested in installing the next generation of super-efficient pulping technologies need to know how they will be integrated into existing production processes and how they will impact a plant's bottom line. The process model developed by this project will provide mills with the technical and economic data they need in order to make informed investment decisions.

Project Description

The goal of this project is to create an integrated process model that combines three advanced technologies for the chemical pulp mill, each of which has been technically demonstrated. Namely, those technologies are (1) the mini-sulfide sulfite (MSS-AQ) pulping process, (2) black liquor gasification, and (3) the Research Triangle Institute (RTI) gas cleanup process. The project will identify the process changes necessary to generate the MSS-AQ pulping liquors using black liquor gasification, in addition to identifying the requisite process conditions and their impact on product quality. The result will be a conceptual process design and an economic benefits analysis for the conversion of an existing Kraft linerboard mill to the integrated MSS-AQ process.

Pathways

The objectives of this project will be achieved by performing tests on gasification of MSS-AQ liquors, followed by testing of the RTI absorber. These tests will identify process characteristics and enable the development of design parameters for an integrated system. The results will be used to develop a WinGEMS process model for detailed technical and economic evaluation.

Progress and Milestones

- Conduct pulping tests to define the optimum process conditions for MSS-AQ pulping (expected completion: Spring 2007)
- Conduct bench-scale gasification trials with MSS-AQ liquors to define product gas composition and identify gasifier design parameters (expected completion: Summer 2007)
- Conduct trials on a pilot scale RTI absorber with MSS-AQ product gas compositions to quantify the adsorption and desorption characteristics and identify design parameters for the absorber (expected completion: Winter 2007)
- Define the process and equipment changes required in an existing linerboard mill digester to integrate the MSS-AQ process along with the black liquor gasifier and RTI absorption technology (expected completion: Spring 2008)
- Use test results to develop a WINGems process model
- Complete a conceptual design analysis and an economic evaluation of the implementation of the integrated process at an existing Kraft linerboard mill (expected completion: Summer 2008)

Commercialization

Many chemical recovery boilers operating in North America are nearing the end of their useful life and will need to be upgraded or replaced in the near future. The process model developed by this project will facilitate decisions to replace old systems with black liquor gasifiers, and will increase the market penetration of complimentary technologies that promise substantial energy and environmental benefits.

Project Partners

North Carolina State University Department of Wood and Paper Science

Research Triangle Institute

ThermoChem Recovery International

For additional information, please contact

Drew Ronneberg, Ph.D.
Industrial Technologies Program
Phone: (202) 586-0205
Fax: (202) 586-9234
E-mail: Drew.Ronneberg@ee.doe.gov

Hasan Jameel
North Carolina State University
Department of Wood and Paper Science
Raleigh, NC 27695-8005
Phone: (919) 515-7739
Fax: (919) 515-6302
E-mail: jameel@ncsu.edu

A Strong Energy Portfolio for a Strong America

Energy efficiency and clean, renewable energy will mean a stronger economy, a cleaner environment, and greater energy independence for America. Working with a wide array of state, community, industry, and university partners, the U.S. Department of Energy's Office of Energy Efficiency and Renewable Energy invests in a diverse portfolio of energy technologies.

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