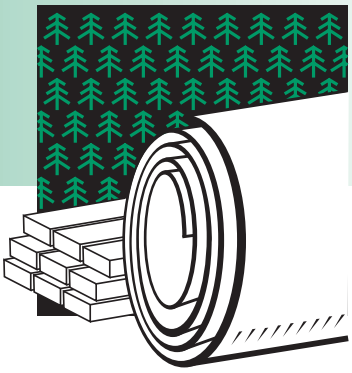
FOREST PRODUCTS

Project Fact Sheet



Pressurized Ozone/Ultrafiltration Membrane System for Removing Total Dissolved Solids from Paper Mill Process Water

Novel Process Dramatically Reduces Energy Use, Improves Process Water Quality, and Reduces Effluent Discharge

Benefits

- Offers potential annual savings of 73.4 billion Btu of natural gas per mill producing 500 tons of paper a day
- Offers potential total annual savings of 8.2 trillion Btu by 2010
- Eliminates CO_2 discharges of 815 tons a year for the same size plant
- Eliminates most liquid effluent discharge to waterways
- Potentially reduces landfill waste by 50%, depending on the mill configuration and by-product conversion systems
- Potentially reduces use of processing chemicals by $5/ton of paper produced
- Potentially reduces mill process water treatment system downtime

Applications

While the pulp/paper industry stands to benefit from this innovation other industries requiring filtration technology, such as food processing, will also reap great savings in operating costs.

Project Partners

NICE³ Program
Washington, DC

South Carolina Energy Office
Columbia, SC

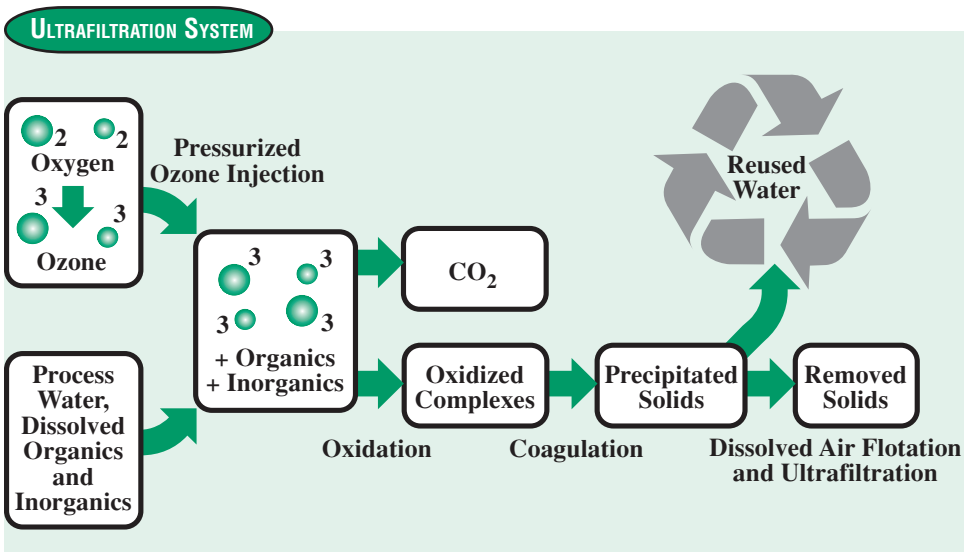
Linpac Paper
Cowpens, SC

Resource Recycling Systems, Inc. (RRSI)
Ann Arbor, MI

Western Michigan University
Department of Paper Science and Engineering

Paper mills require large amounts of heated process water for their papermaking operations. Process water becomes contaminated with dissolved organics and inorganic substances after rounds of processing with the various raw materials, chemicals and additives used in papermaking. When the process water becomes too contaminated with total dissolved solids, it must be purged from the system. New fresh water is then taken in to replace the purged process water. The fresh water must be heated to process water standards, which requires significant energy, and new chemicals and additives for papermaking must be added. Additionally, the purged process water allows energy, chemicals, additives, and papermaking fiber to escape the mill as effluent. This effluent requires expensive environmental treatment prior to discharge into waterways. Existing systems do not cost effectively remove total dissolved solids and also result in substantial operational costs and downtime.

Linpac Paper operates a closed-loop zero effluent discharge mill that produces 100% recycled premium linerboard and medium for use in the packaging industry. Linpac's novel technology for closed-loop systems uses pressurized ozone with dissolved air flotation and an ultrafiltration membrane in series and allows total dissolved solids in process water to be readily converted to total suspended solids for efficient removal. This novel system allows contaminated mill process water to be continually and cost effectively cleaned to the high-quality process water standards required for reuse in the mill. After passing through the new system, process water is far cleaner and of higher quality than



Linpac Paper's unique system removes total dissolved solids from paper mill process water, giving plant operators the ability to run a cost-effective and highly efficient closed-loop system.

water from other processes and requires far less energy for reheating than fresh water. The system reduces the production problems associated with buildup of total dissolved solids in paper mill operations and provides operational benefits including savings from the need for less energy and fewer chemicals and additives. The system also results in production and quality gains because of the higher-quality process water. The environmentally friendly system allows paper mills (and other water-intensive manufacturing mills) to operate in a closed loop, thereby eliminating or drastically reducing effluent discharge to rivers and waterways. By using this new system, effluent discharge and the need for fresh water are both substantially reduced.

Project Description

Goal: Commercial demonstration of a full-scale pressurized ozone dissolved air flotation and an ultrafiltration membrane system for process water quality improvements that make paper mill operations significantly more energy-efficient and environmentally cleaner.

Existing paper mills cannot reuse contaminated process water. Linpac's novel system combines pressurized ozonation to treat dissolved solids in paper mill effluent water, causing them to coagulate and precipitate so that they can be removed by membrane ultrafiltration. This combination of technologies allows mills to operate a closed-loop system with zero effluent discharge. Linpac is developing the system with the assistance of the South Carolina Energy Office, Resource Recycling Systems, and Western Michigan University and with the help of a grant funded by the NICE^3 Program in the U.S. Department of Energy's Office of Industrial Technologies.

Progress and Milestones

- Complete design engineering.
- Plan project and purchase equipment.
- Install the pressurized ozone/membrane ultrafiltration system.
- Conduct system startup and verification effort.
- Complete commercial demonstration, data compilation, and operational adjustments.
- Prepare final report.
- Conduct facility tours and outreach activities.
- Conduct commercialization activities.

Economics and Commercial Potential

The paper industry is under regulatory pressure to reduce its effluent discharges of process water, which cannot be recycled because suspended and dissolved solids have negative impacts on paper quality and production efficiency. Fresh water used to replace purged process water in papermaking production has to be heated to operational standards and new chemicals need to be added. Linpac's process allows a closed-loop system, with most of the energy saved being from avoiding heating costs for incoming fresh water. The primary market for the new system is the pulp and paper industry; however, other water-intensive industries with process water quality concerns and/or wastewater effluent problems are part of the potential future market.

The reduced heating requirements will save an average mill producing 500 tons of paper a day a total of 73.4 billion Btu/year. First sales of the technology are expected by 2003. Based on 15% market penetration by 2010, annual savings would be 8.2 trillion Btu with 112 units installed. Market penetration of 35% by 2020 will save 19.5 trillion Btu from 256 units. Reduced fuel consumption will translate into reduced CO_2 emissions of 815 tons a year/plant. Solid waste sent to landfills from paper mills can potentially be cut in half or eliminated if the proper by-product conversion systems are used in combination with the new technology, and the 1.2 million tons/year of effluent discharge from a typical mill would be nearly eliminated.

NICE^3 – National Industrial Competitiveness through Energy, Environment, and Economics:
An innovative, cost-sharing program to promote energy efficiency, clean production, and economic competitiveness in industry.
This grant program provides funding to state and industry partnerships for projects that demonstrate advances in energy efficiency and clean production technologies. Awardees receive a one-time grant of up to $525,000. Grants fund up to 50% of total project cost for up to 3 years.

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