

KRAFT MILL CHEMICAL MAKE-UP

Sodium and sulfur are lost from Kraft Mill recovery cycles in air emissions, dregs and grits, washing losses, and spills. Sulfur losses range from 6 - 18 lb / ton pulp, while sodium losses range from 30 - 40 lb / ton pulp. Replacing these lost chemicals is a significant operating cost.

The sodium sesquisulfate stream from ClO₂ generation is used to replace some of the lost chemicals. Enough sesquisulfate is added to keep the sulfidity at a constant level. The sesquisulfate contains some sodium, but not enough to maintain sodium levels. Replacement sodium has to be added in the form of purchased caustic. Excess sesquisulfate is often sent to sewer.

THE NEW SOLUTION

The GAP™ system has been developed by Paprican to convert sodium sesquisulfate into sodium sulfate and sulfuric acid. GAP™ can be applied to both atmospheric and sub-atmospheric generators.

CHEMICAL SAVINGS

Converting sodium sesquisulfate to sodium sulfate returns 33% more sodium for every pound of sulfate returned to the recovery cycle - reducing the amount of caustic to be purchased.

The sulfuric acid can be used to displace merchant acid for bleach plant acidification, sewer neutralization, or in other areas around the mill. Some or all of the acid may be recirculated to the generator if this is preferred.

THE ACID PURIFICATION UNIT™

The GAP™ system utilizes Eco-Tec's patented Acid



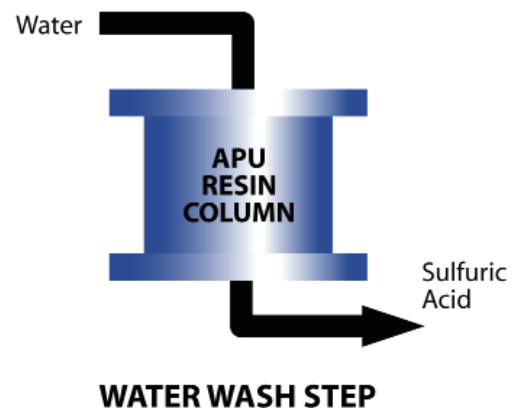
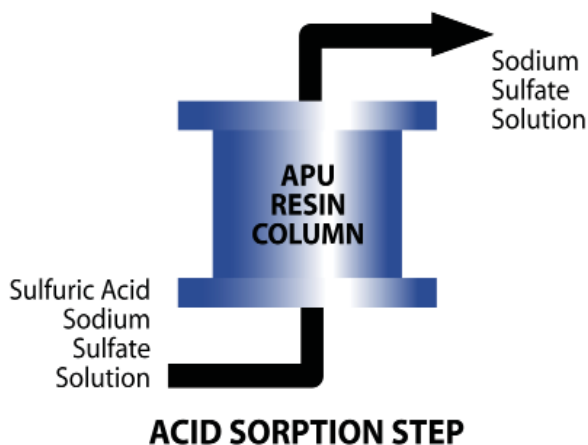
Purification Unit (APU™) to achieve selective removal of sulfuric acid from sodium sesquisulfate. First applied to metal-pickling waste acids, the rugged and reliable APU has benefited from experience gained in hundreds of applications. **No chemicals are required for resin bed regeneration - only water.**

NO ADDITIONAL REBOILER LOAD

If the acid is not recirculated, the GAP™ system imposes no additional evaporation load on the ClO₂ generator. Competing systems require up to 1 ton of steam per ton of ClO₂ produced to recirculate sodium bisulfate - reducing the project savings.

NO SHUTDOWN REQUIRED

The GAP™ system requires no shut down for installation. It runs independently of the generator and will not affect a mill's ClO₂ supply.



NORAM Engineering and Constructors Ltd.



COMPANY PROFILE

NORAM is an engineering and technology development firm based in Vancouver, Canada. Founded in 1988, NORAM employs a highly qualified technical staff of approximately one hundred. NORAM has a global client base and has successfully completed projects on five continents.

Today NORAM is the world's leading supplier of mononitrobenzene (MNB) plants, a key intermediate in the production of polyurethane. In addition, NORAM offers sulfuric acid equipment, biological treatment facilities, energy systems, and technologies for the chemical, minerals processing, environmental, and pulp & paper industries.

NORAM offers proprietary technology to customers through engineered equipment and complete chemical plants. NORAM's core competencies include:

- Biological Treatment Technologies
- Electrochemical Systems
- Energy Systems
- Environmental Technologies
- Feasibility Studies
- Fluid Dynamics & Finite Element Analysis
- Heat Transfer Systems Design
- Nitration Technology
- Project Management
- Pulp & Paper Technologies
- Sulfuric Acid Manufacture

PARTNERING WITH INNOVATION AND EXPERIENCE

NORAM is focused on the development, commercialization and supply of established and novel processes. With its entrepreneurial culture, NORAM has a demonstrated track record of thinking outside the box to provide innovative solutions. Technologies can be evaluated and integrated into an advanced engineering solution based on first principles.

NORAM has made its mark internationally by supplying proprietary systems to various industries world-wide. NORAM can bring this expertise and innovative ideas to your projects.

NORAM has established strategic relationships with the following organizations:

- ◆ Bateman Engineering BV
- ◆ Canadian Hydrogen and Fuel Cell Association
- ◆ Eco-Tec
- ◆ First Chemical Corporation (A DuPont Company)
- ◆ FP Innovations
- ◆ Kemetco Research Inc.
- ◆ Membrane Reactor Technologies
- ◆ Ostara Nutrient Recovery Technologies Inc.
- ◆ Radient Technologies
- ◆ Siloxy Limited
- ◆ Simon Carves Limited (Punj Lloyd Group)
- ◆ The Electrosynthesis Company

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