A-Recovery+ chemical recovery concept

ALLOWS MILLS TO SEE THE CHEMICAL CYCLE IN A NEW LIGHT

Over the years, chemical recovery technology suppliers have worked with pulp mills to "close" the chemical recovery loops in order to reduce emissions and effluent – and also to increase recovery efficiency. These loop closures have sometimes led to a build-up of certain chemicals and the creation of side streams that are either ignored or disposed of.

A major target of ANDRITZ's recent development work has been to innovate solutions for utilizing the side streams of a kraft pulp mill to unleash the hidden potential for generating profit, as what was once considered "waste" can be converted to valuable raw materials for commercial-grade bioproducts.

The objective continues to be operating chemical recovery systems as efficiently and environmentally sound as possible while minimizing capital investment and maximizing profits.

SEEING CHEMICAL RECOVERY IN A NEW LIGHT

ANDRITZ was inspired to take a fresh look at achieving this by shining a new light on the chemical cycle, with two targets in mind: 1) for environmental reasons, further closing of the chemical cycle, and 2) for business reasons, converting the side streams into something of value that could be used by the mill in place of purchased chemicals and energy, or sold for additional revenue. Today, with the increased knowledge and emphasis on biorefineries and bioproducts, this potentially presents a new source of profits.

This development work resulted in a technical solution called A-Recovery+, a modular chemical recovery concept that optimizes the sodium/sulfur (Na/S) balance in a mill to increase the revenue generated and/or to reduce costs significantly. A-Recovery+ also sets the stage for pulp mills to implement a fossil-free operation.

This two-pronged approach of A-Recovery+ – environmental soundness and commercial benefit – will please mills' process and production experts, and accountants as well. The first modules developed inside the A-Recovery+ concept generate economic value from the side streams in a traditional kraft pulp mill by adding value such as:

- Purifying raw methanol to commercial quality biomethanol
- Producing commercial quality concentrated sulfuric acid on-site
- Recovering high-quality lignin from black liquor

Development work continues to identify and unleash all the hidden potential in the side streams created during the kraft mill recovery process.

PURIFYING RAW METHANOL TO COMMERCIAL QUALITY BIOMETHANOL

Raw methanol originating from the kraft cooking process is often used in a mill as a support fuel – typically combusted in the recovery boiler, for example. However, with a patented extraction process, raw methanol can be purified into commercial-grade biomethanol, which can either be sold for additional revenue, or used in the chlorine dioxide (ClO_2) generation process. Methanol currently used in the ClO_2 generator is one of the last fossil-based chemicals prohibiting the establishment of a fossil-free pulp mill operation.

PRODUCING COMMERCIAL QUALITY SULFURIC ACID ON-SITE FROM CONCENTRATED NON-CONDENSABLE GASES (CNCG)

The traditional way mills have managed sulfur surplus has been by dumping recovery boiler fly ash. The ash consists mainly of sodium sulfate (Na_2SO_4) and sodium carbonate (Na_2CO_3) – meaning that, in addition to dumping sulfur, valuable sodium is lost. The lost sodium has to be made up by purchasing sodium hydroxide (NaOH).

An alternative way to control Na/S balance is to integrate Wet-gas Sulfuric Acid (WSA) technology in the mill. WSA produces sulfuric acid (H_2SO_4) from sulfur rich CNCG. The WSA combines catalytic conversion and condensation techniques to produce commercial-grade concentrated sulfuric acid that can be used even in demanding ClO_2 generation process.

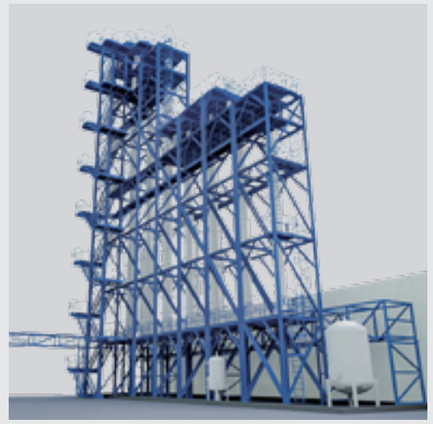
This is an economically and environmentally attractive way to manage and control the Na/S balance in the mill. The sulfur amount in the CNCG can be further adjusted to result in a better Na/S balance by extracting more sulfur out of black liquor with a Liquor Heat Treatment (LHT) system.

FIRST A-RECOVERY+ REFERENCE

SÖDRA WILL BE THE FIRST TO PRODUCE COMMERCIAL-GRADE BIOMETHANOL AT A PULP MILL

ANDRITZ received an order from Södra, Sweden, to supply a biomethanol purification plant for the Mönsterås pulp mill. When completed, the plant will annually produce 5,000 tons of biomethanol from renewable raw materials. The biomethanol will be in compliance with IMPCA methanol quality reference specifications for merchantable methanol.

EU's target is to have 10% of the transport fuel coming from renewable sources, such as biofuels, by 2020. Södra has announced its own strategy to be totally fossil-free by 2030.



INTERVIEW WITH LEIF SJÖBLOM, SENIOR PROJECT MANAGER, SÖDRA INNOVATION & NEW BUSINESS

What were the motives to purify raw methanol? Södra decided that the technical, economical, and sustainable benefits of purifying methanol far outweighed the one of simply burning the chemical for energy. Methanol has many worthwhile commercial applications – including being used for making special chemicals – which brings added value to Södra, at the same time as fitting in with its sustainability goals.

Why was ANDRITZ chosen? The technology for purifying methanol was originally partly developed by Södra, so when ANDRITZ became the owner of it, it was a natural step to engage ANDRITZ for this project.

What are the expectations for the technology? We hope that the biomethanol will fulfil the IMPCA standard as guaranteed and to prove biomethanol is applicable anywhere fossil fuel-derived methanol is used today.

Leif Sjöblom, Senior Project Manager, Södra Innovation & New Business

How has the cooperation with ANDRITZ gone so far in the project? Even though both parties knew from the very beginning that this was a development project, we realized throughout the implementation that it is quite challenging and requires really good cooperation. Already from the start, we agreed on the importance of having a good cooperation in the project and this has been a key factor in order to solve any emerging issues.

Producing sulfuric acid on-site significantly reduces or even eliminates the need for recovery boiler fly ash dumping due to surplus sulfur.

The WSA can also create sulfur deficit by removing more sulfur from the cycle than what enters into the chemical recovery cycle. This free sulfur capacity may save money in the optimization of make-up chemicals – as internal Na_2SO_4 streams can be used as sodium make-up instead of purchased NaOH. The internal Na_2SO_4 can come from the ClO_2 generator as saltcake or from the bleaching plant (e.g., alkaline filtrates). Utilizing both of these sources will further reduce the volume of sulfate effluent or solid waste that the mill will have to landfill.

Up to 99.9% of the sulfur in CNCG can be converted to concentrated sulfuric acid with the WSA. All the sulfuric acid the mill requires can be produced on-site if the CNCG is co-combusted with elemental sulfur in the WSA.

Over 150 references for the WSA technology operate worldwide on a variety of sulfurous gas streams as well as for spent acid. It is a well-proven and robust technology developed by Haldor Topsoe A/S.

RECOVERING HIGH-QUALITY LIGNIN FROM BLACK LIQUOR

The lignin recovered from black liquor can be used either to replace fossil fuels in the lime kiln or to generate additional revenue by selling it externally as a raw material for advanced bioproducts.

The A-Lignin technology entails precipitating lignin from the black liquor with carbon dioxide, filtering the precipitated lignin, acid washing it with sulfuric acid, and drying it.

The negative impact of adding sulfur into the chemical recovery cycle by introducing H_2SO_4 at the lignin washing stage can be mitigated by on-site production of sulfuric acid that allows cost-efficient recovery of high-quality lignin without the negative environmental aspects of dumping large amounts of recovery boiler fly ash.

ECONOMIC FEASIBILITY

In the accounting world, the terms "opportunity cost" and "avoidable cost" are well established. In the chemical recovery world, both of these terms are in play with the A-Recovery+ chemical recovery concept. On the opportunity side, additional revenue is gained from the production and sale of commercial-grade biochemicals and bioproducts that might have been traditionally disposed of or ignored. On the avoidable side, savings result from not having to purchase make-up chemicals for the pulp mill.

A NEW LIGHT: A-RECOVERY+ CHEMICAL CONCEPT

The A-Recovery+ chemical recovery concept provides environmental solutions for further closure of the chemical recovery loops PLUS commercial solutions for generating revenue and reducing costs.

The first A-Recovery+ modules are for sulfuric acid production, methanol purification, and lignin recovery, but the work continues to identify and unleash all the hidden potential in the kraft mill by utilizing side streams more efficiently.

In total, these interesting and attractive options for next-generation chemical recovery will reduce effluents and water consumption, reduce the need for make-up chemicals, and convert side streams into valuable bioproducts.

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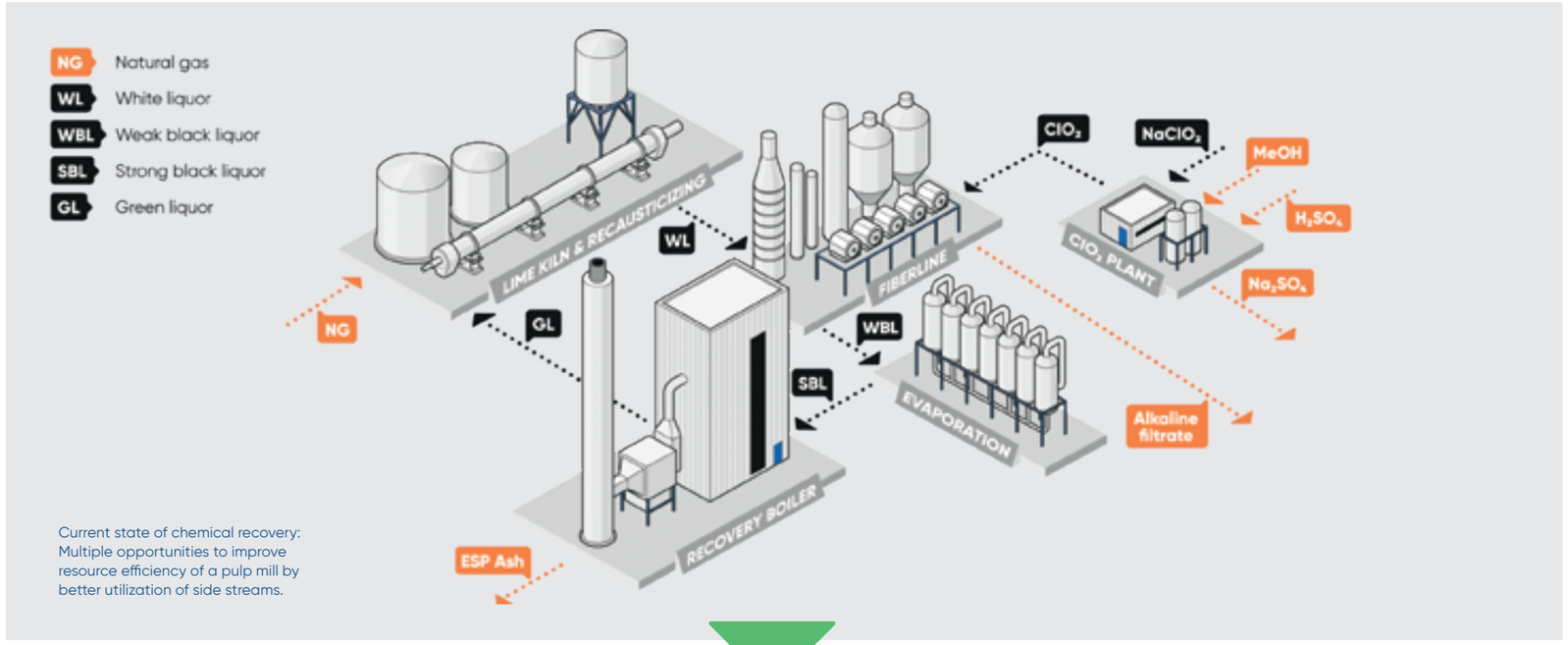
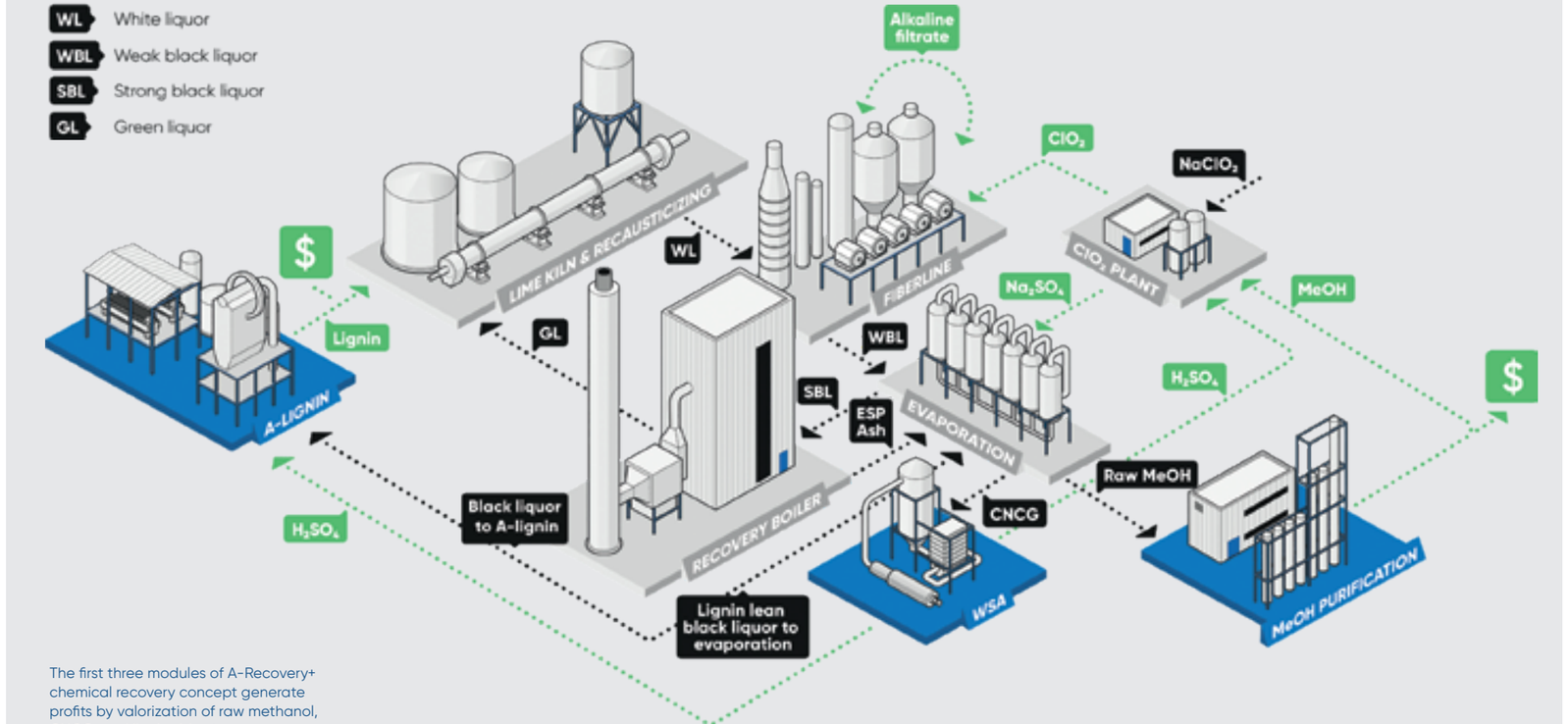


Current state of chemical recovery: Multiple opportunities to improve resource efficiency of a pulp mill by better utilization of side streams.



The first three modules of A-Recovery+ chemical recovery concept generate profits by valorization of raw methanol, CNCG, and lignin side streams.