Nalco BDP1309™ Chip Penetrant Improves Operations by $6.5 MM in a Eucalyptus Pulp Mill

NALCO Water
An Ecolab Company

CASE STUDY – PULP & PAPER
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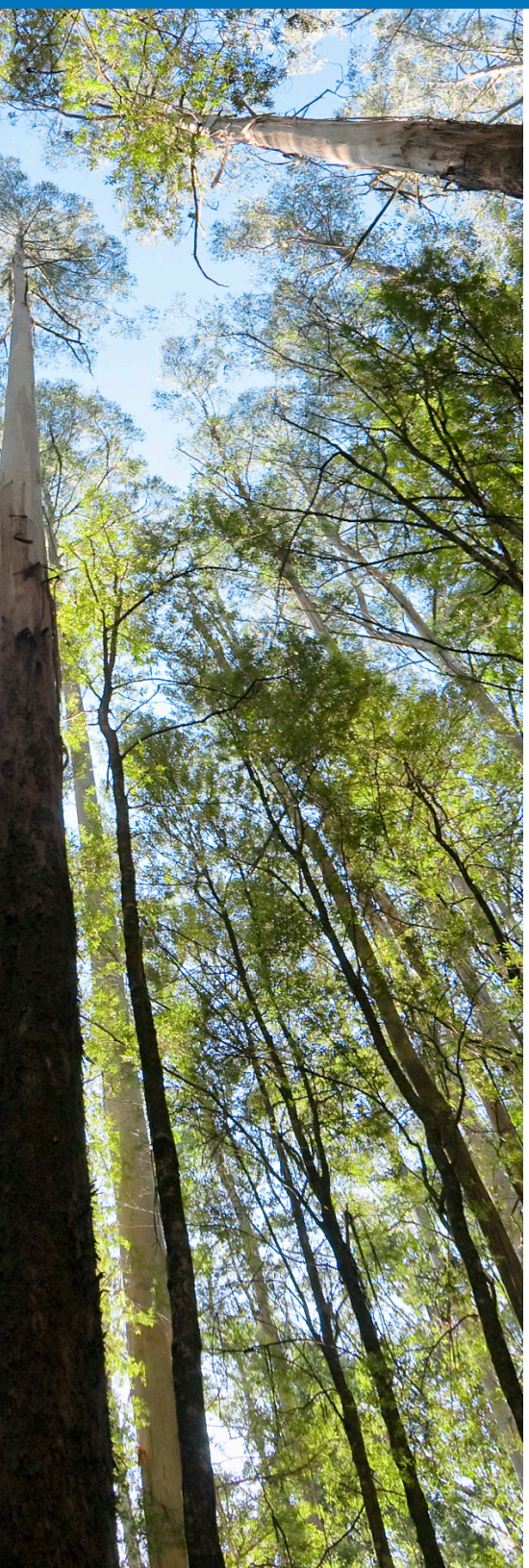

BUSINESS SITUATION

A Eucalyptus market pulp producer had seen a steadily increasing alkali charge requirement to produce pulp at target kappa levels due to the variety of species that were being utilized in the cooking process. In addition, these species contained large amounts of extractable material (as high as 8%), so the risk of producing off-grade pulp due to organic deposition was increasing simultaneously. The increased alkali demand had reached a point where periodic limitations on pulp production capacity were occurring due to low inventory levels of white liquor. Nalco determined that improving impregnation of the wood chips prior to cooking was necessary to reduce the alkalinity required, but older technology, conventional surfactant-based products would not be capable of restoring the cooking parameters to prior levels while also providing the capability to solubilize and remove the extractives from the wood to prevent deposition issues and off-quality pulp production. Nalco proposed a novel, newly-designed product instead which was developed to meet both needs determined by the mill. Prior to utilizing the product in the mill, laboratory trials were conducted at the University of Viscosa to confirm the capability of the product with excellent results. A complete plant audit utilizing the Mechanical, Operational and Chemical (MOC) approach was conducted that detailed the mill's operating parameters and specific chemical application points required to pro→vide an economical and complete solution.

CUSTOMER IMPACT	eROI℠	ECONOMIC RESULTS
Productivity increased by 21,500 tons per year	ASSETS	Increased profit by $6.5 MUSD/ year
Reduced Alkali Consumption at Digester by 2,800 tons/yr.	COSTS	Net savings of $0.14 MUSD/year
Reduced Chlorine Dioxide consumption by 1,500 tons/yr and Sulfuric Acid by 560 tons/year.	EARTH	Net Savings of $1.85 MUSD/year

eROI is our exponential value: the combined outcomes of improved performance, operational efficiency and sustainable impact delivered through our services and programs.

BACKGROUND

A large market pulp manufacturer utilizes a single bleached eucalyptus pulping line to make pulp for use in producing various grades including tissue/towel and printing and writing. The mill was interested in reducing the required alkaline charge to reach target kappa, reducing process variability, eliminate restrictions to production capacity, and meet customer demands for pulp characteristics and quality. Because of the unique characteristics of the wood being utilized in the cooking process, the uuse of a fairly powerful surfactant-based chip penetrant was required to fully maximize the impregnation of the wood chips in the Impregnation Vessel. This in turn would allow the cook to begin earlier in the digester vessel, maximizing the time available to completely process the wood to obtain the required kappa target using less total alkali charge without increasing temperature excessively, which would reduce the final pulp strength. In addition, the blend of surfactants provided the capability to maximize the removal of extractive material directly from the digester in the lower washing zone. The product utilized, BDP1309, is a novel blend of surfactants designed to fully maximize the impregnation of the wood chips and solubilize extractable material to meet both needs. In addition, the optimal impregnation of the wood had the potential to reduce the variability normally seen in the blown pulp, assisting the washing process and reducing the demand for commodity bleaching chemicals.

PROGRAM DESIGN

Following the process audit and discussions with the mill's Operations and Research and Development (R&D) personnel, it was determined that feeding the Nalco BDP1309 at various rates between 0.4 to 0.5 kg/air-dry ton (ADT) of blown pulp leaving the digester vessel should provide the desired operational improvements that the mill was requesting. The production line had excellent data visibility for the trial to allow the mill to determine the full range of benefits of this new technology.

The trial plan incorporated a gradual ramping of the dosage over a period of time to allow the mill's automated control system to make all necessary changes to maintain maximum stability of the process.

As agreed with the customer, the first indicator that would be monitored after initiation of the trial would be the blown pulp kappa. Once a reduction in the kappa was observed, the primary adjustment that would be made would be to the alkalinity profile to help reduce the total % Applied Alkali (%AA) target. In addition to these variables, baseline data was also gathered on all key process variables for the Chip Feed, Impregnation Vessel, Digester, Washing, O2 Delignification, Bleaching and Liquor processing areas. The impact of the product on all areas of the mill would be observed and documented to determine a total return to the mill.

RESULTS

The trial results were reviewed with operational leadership upon completion of the three week trial. Overall, the results of the trials were extremely positive, with all of the goals of the trial being met. These results allowed for a minimum 3:1 payback as compared to program cost. During the trial, the following results were identified:

- The key result of the trial was that the alkali charge to the digester was significantly reduced. The charge was reduced from an average of 21.6% to as low as 19.5% before additional experiments in cooking profile and wood supply were made. Throughout the trial, the total alkalinity charge was reduced by 8 tons per day. This allowed the mill to maximize production, reaching as high as 3550 tons per day.

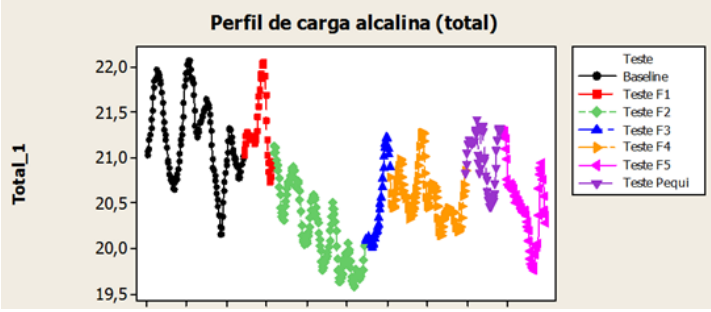

Figure 1. Reduced alkali charge per ton of wood produced

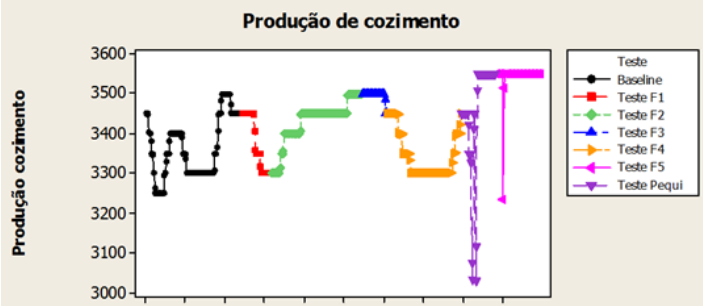

Figure 2. Production Rate - Cooking

- The uniformity of the blown pulp improved significantly as evidenced by a major reduction in shives in the blown pulp. This uniformity translated into washing improvements and a reduction in commodity bleaching chemicals, including a 12% reduction in sulfuric acid and a 6% reduction in chlorine dioxide to obtain the same brightness targets.

Figure 3. Blown Pulp Prior to Trial and During Trial

- Throughout the trial, the monitoring of extractable material was conducted at various points, including in the blown pulp and in the final bleached pulp. Despite the wood containing between 4-8% extractable material throughout the trial, pulp being blown from the digester remained in the 0.2 – 0.3% extractives range, while final bleached pulp in all samples was found to be <0.1% extractable material, both outstanding results. No quality issues were noted at any time during the trial.

The summary of key results and value delivered are described in Table 1.

Process Variable	Acheivement	Value Obtained
Pulp Production Improvement	1.9% Production Increase	$6,500,000
Applied Alkali to Digester/ton	8 tons per day alkali reduction	$130,000
Reduced Commodity Bleaching Chemicals	12% reduction in sulfuric acid and 6% reduction in chlorine dioxide	$1,800,000
	Total Annual Savings	**$8,430,000**
	Program Cost:	**$1,950,000**
	Return on Investment:	**432%**

Table 1. Summary of process improvements & value obtained

CONCLUSION

As a result of using Nalco's BDP1309 surfactant-based chip penetrant technology and total process expertise, the customer's operations were significantly optimized with net annual savings and profitability generation estimated at $6.5 MM US. The utilization of BDP1309 technology accelerated the liquor impregnation process to allow the cooking process to be completed earlier and in more uniform fashion to reduce alkali demand and make the pulp easier to wash and bleach. The customer is now able to improve the sustainability of operations through optimized raw material and energy usage, improved cleanliness and significantly reduced total cost of operation.

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