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BLEACH PLANT MODERNIZATION OF CENIBRA'S LINE 01 IN BELO ORIENTE, MG, BRAZIL

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ABSTRACT

CENIBRA Celulose Nipo-Brasileira S.A., is a Bleached Eucalyptus Kraft Pulp producer located in Belo Oriente, MG, Brazil, with an annual capacity of 1.2 million ADt and includes two fiber lines. In order to modernize its existing Fiberline 01, inaugurated in 1977, a new bleach plant was installed with TwinRoll Press Evolution (TRPE™). With a challenging construction layout and tight startup schedule, the new compact bleach plant started up simultaneously with Line 1's permanent shutdown. Nominal capacity was achieved in less than one week, resulting in minimum production losses. With an ECF sequence $D_{HOT}EpD_1P$, the bleach plant provided a 10%-15% reduction in bleaching chemicals such as sodium hydroxide, chlorine dioxide and hydrogen peroxide, while sulfuric acid consumption dropped roughly 22%. Energy and steam had their consumptions reduced around 40% and 50%, respectively, while water consumption and effluent generation decreased 50%. As a result, the modernization project had an incredibly positive outcome, preserving product quality and continuous operation while improving operational and environmental results.

Keywords: *Eucalyptus Kraft Pulp, ECF Bleaching, Washing Machines.*

INTRODUCTION

CENIBRA (Celulose Nipo-Brasileira S.A.) has been producing bleached eucalyptus market pulp using two bleaching plants: Line 1, operating since the plant's startup in 1977, and Line 2, which has been operating since 1995. Each one was designed to use different washing systems. i.e., vacuum filter (Line 1) and atmospheric diffuser (Line 2). Maintenance costs, utilities and bleaching chemicals consumption increased over the years in Line 1, leading the company to study and approve a new bleaching plant investment (Line 3) in 2016.

Presenting a solution to rebuild the existing D_{Hot} Stage and three totally new bleaching stages (Ep, D_1 and P), taking advantage of compact layout and low chemical and utilities consumption, Valmet won the contract and started construction in the first quarter of 2017.

Composed of four (4) stages, including fifth-generation press washer (Twin Roll Press Evolution, TRPE), reaction towers and all MC Pumps, among other equipment, Valmet's solution was held within the schedule with minor interference in Line 1, which operated in parallel until the startup of Line 3. A controlled transition did not impact the annual production rate.

This report presents the details of the bleaching plant and improvement status of utilities and chemicals consumption rate with Line 3's implementation, which started up in April 2018.

Cenibra Pulp Mill

CENIBRA is a bleached eucalyptus kraft pulp producer based in Belo Oriente, Minas Gerais, Brazil. The company started operating in 1977 and today produces roughly 1.2 million ADt/y, with more than 90% being sold externally as market pulp.

NEW BLEACHING PLANT LINE 3

In planning the new bleaching plant's installation compared to Line 1, CENIBRA aimed to reduce maintenance costs, consumption of utilities, bleaching chemicals, water, and steam, while also improve product quality. For such, before starting to build Line 3, CENIBRA thoroughly examined the latest trends in bleaching technology and machine technical characteristics in order to have a new bleaching process equipped with the latest technologies.

Construction work was undertaken by Valmet under an EPCC contract that started in October 2016 (engineering phase), and scheduled to start up 18 months later, in April 2018.

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BLEACHING SEQUENCE

The Line 1 bleaching plant was designed in the 1970s to provide Standard market pulp using a 6-stage bleaching sequence (C E H D E D). The bleaching plant was later converted to ECF in the 1990s to (D Ep D P D). CENIBRA's intention, since the beginning of the concept, was to increase yield as much as possible, exploring cooking alternatives with the same Kappa number. The new bleaching plant, in the end, had to handle the desirable increase of HexA from digester. In the context of such strategy, the D_{Hot} stage was selected, combining a chlorine dioxide delignification property with a long hot-acid stage.

In between the chlorine dioxide stages (D_{Hot} and D_1), an extraction stage was installed, considering that some of the quinone-type residual lignin formed in the previous stage is transformed into phenol-type and, to improve brightness, hydrogen peroxide is used. As such, chemical does not need high pressure to react, a downflow atmospheric vessel was installed, more cost efficient than pressurized vessel which need to use oxygen, for example.

The bleaching stage after the Ep stage was a chlorine dioxide bleaching stage (D_1) at moderate temperature, which easily reacts with lignin that changed its structure in the alkali treatment stage and, to reach the 90% ISO brightness desired, a final hydrogen peroxide bleaching stage (P) was selected.

As a result, after technical and economic analyses, the D_{Hot} Ep D_1 P bleaching sequence was defined as the most reliable for the project and a plant flowsheet was defined with the supplier as presented in figure 01.

WASHING STAGES

After comparing each type of washer, Valmet's fifth-generation press washer (TRPE) was adopted as the washing machine for each bleaching stage.

The TRPE™ press has presented, over the years, solid results in terms of costs, layout, and environmental aspects, which led CENIBRA to install two more washing presses in bleaching Line 2 (2019). For the equipment, it is possible to highlight the high washing efficiency due to residual liquid in lumen of pulp fiber can be squeezed out by having the high outlet consistency (around 30%) and the small amount of washing water used at same dilution factor (DF), reducing wastewater in the bleaching process.

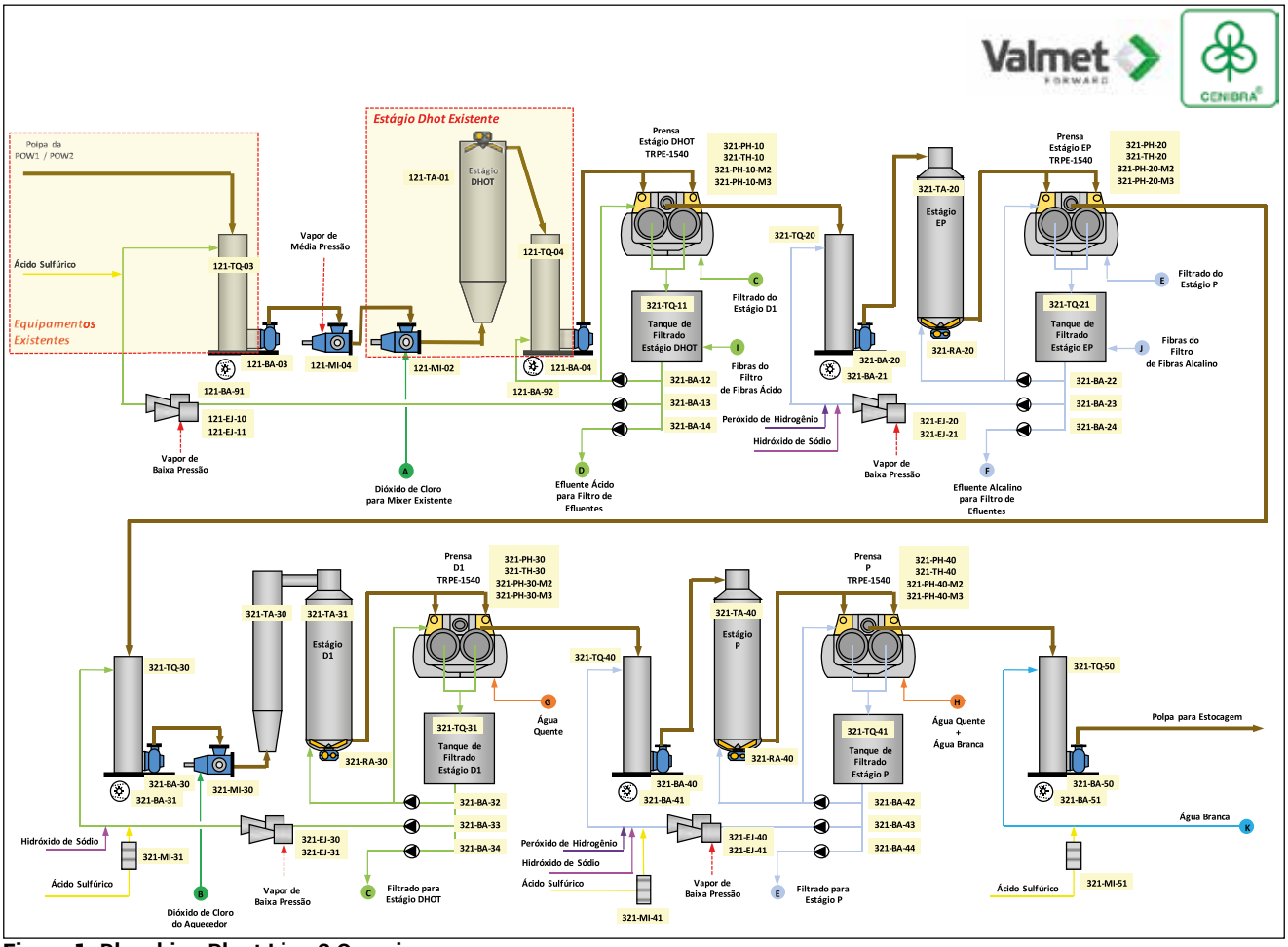

Figure 1. Bleaching Plant Line 3 Overview

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Figure 2: Bleaching Plant Line 3 Layout (Before and After Construction)

As the presses do not need a high inlet pressure on the pulp side, the Ep, D_1 and P press installed after the new towers have been fed by gravity, using only the towers level. It reduces the investment and allows the supplier to design an even tighter layout with the same efficiency.

INSTALLATION AND LAYOUT

Construction work of the Line 3 bleaching plant was necessary while the existing Line 1 bleaching plant continued to operate. In addition, the installation location had limited area because of the railway adjacent to the plant, as well as the access road to other process areas. This way, the bleaching plant had to fit on a ~650 m^2 site (Fig. 2).

The most important challenges faced by Valmet and subcontractors during the engineering and construction phase were to adjust the required layout to the existing area. Special attention was necessary to place an electrical room and four TRPE™ presses (which require space for cleaning and inspection) and underground interfaces.

The tight startup schedule (18 months) required synchronous cooperation from Valmet between Brazil and Sweden, which had a narrow window to start the assembly in the workshop and delivery at site in 10 months, giving 8 months for commissioning and startup procedures.

RESULTS AFTER STARTUP

As shown in Table 1, all utilities used to bleach the pulp had a significant reduction after the Line 3 startup. As the modern Line 3 uses press technology, the amount of water consumption, as well as effluent generation, had a significant reduction. It is a special feature considering that CENIBRA collects water from the Rio Doce, impacted after the collapse of a mine dam in Mariana (2015).

Table 1 Performance results of Line 3 after modernization

Inputs	Unit	Variation (%)
Power consumption	(kW/adt)	-49%
MP/LP Steam consumption	(kg/adt)	-49%
Water consumption / Effluent generation	(m^3/adt)	-38%
Chlorine dioxide (ClO_2)	(kg/adt)	-11%
Peroxide (H_2O_2)	(kg/adt)	-15%
Caustic Soda (NaOH)	(kg/adt)	-12%
Sulfuric acid (H_2SO_4)	(kg/adt)	-22%

The chemical consumption, new washing stages and good operation team, with experience in this kind of technology, led numbers to a new low and constant level. The closed filtrate system, which sends filtrate from last stages to previous ones, saves the chemicals used to adjust the pH.

CONCLUSIONS

The bleaching plant's modernization using efficient washing machines as presses allows the mill to use less water and generate less effluent, contributing to a sustainable environmental relationship.

Furthermore, CENIBRA achieved a significant reduction in operating costs in terms of bleaching chemical consumption, demonstrating that the investment achieved its planned objectives. ■