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HIGH-CONSISTENCY PEROXIDE BLEACHING FOR GROUNDWOOD, TMP AND CTMP

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1. Introduction

The need to bleach mechanical fibrous materials,such as groundwood, refiner pulp and TMP, is on the increase as the demand grows for higher printability. So far, a brightness of 68 to 72 ISO has been sufficient for many illustration papers, but tha trend is towards higher brightness.

State of art of achieve higher brightness with mechanical pulp is the peroxide and hydrosulphite bleach process, however, a relatively large amount of peroxide is needed to bleach to such a high brightness.

The best way of achieving high brightnesses with a minimum amout of peroxide is to raise the stock density.The usual 17% achieved with standard machinery, has to be increased to 30% b.d. using the very latest equipment.

An excellent example of the latest technology is an installation in West Germany which went into service this year. We will report about this installation where groundwood pulp is bleached from 58 to 76 ISO in a 1-stage high-consistency peroxied bleach plant followed by a medium-consistency hydrosulphite stage.

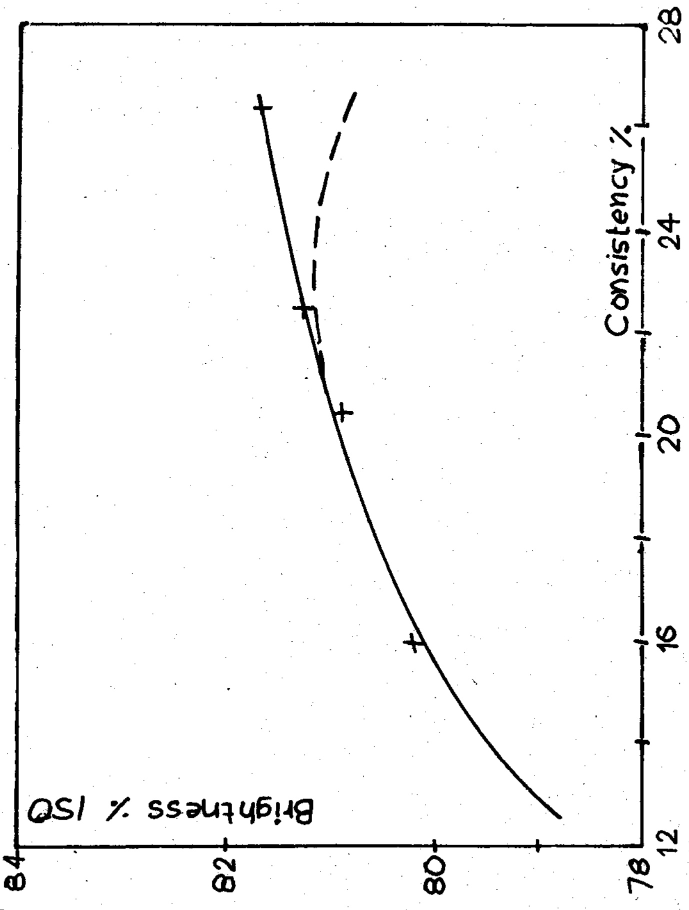

Fig. 1- Influence of the consistency during bleaching on the final brightness, t constant chemicals input.

2. Factors Affecting Peroxide Bleaching

In general, an increase in brightness of approximately 20% is obtained with peroxide bleaching. If the initial brightness is low, it is even possible to increase the brightness by up to 30 points. The main cost factor in the bleaching process is the peroxide itself, therefore attempts are being made to find ways of minimizing the amount of fresh peroxide needed.

Since peroxied bleaches very gently and is a very sensitive bleaching agent, care must be taken to provide optimum reaction. They are :

- -high consistency
- -good mixing
- -effective washing.

2.1 High pulp consistency (See Figure 1)

If the pulp consistency is increased, there is less water in the reacton, leading to a high concentration of H^2O^2 and chromophores. A series of tests has confirmed the improvement in the bleaching result as being a consequence of the higher consistency.

If the consistency is to be increased, it is especially important to mix the belaching chemicals in evenly, which, of course, becomes more and more difficult. An uneven, distribution of the chemicals could even overcompensate for the positive influence had by the high pulp consistency. In such a case, the diagram would show an apparent optimum consistency level caused by poor mixing.

2.2 Mixing

How can we achieve an intimate mixture? In an 'Andritz' HC mixer (see Figure 2) an intimate mixture is formed by breaking the fibre bundles down into their individual fibres. The shredded pulp and the bleaching chemicals enter this high-consistency mixer from above and are mixed between pneumatically supported discs. The mixer discharge unit is able to convey the pulp over a distance of several metres into the bleaching tower.

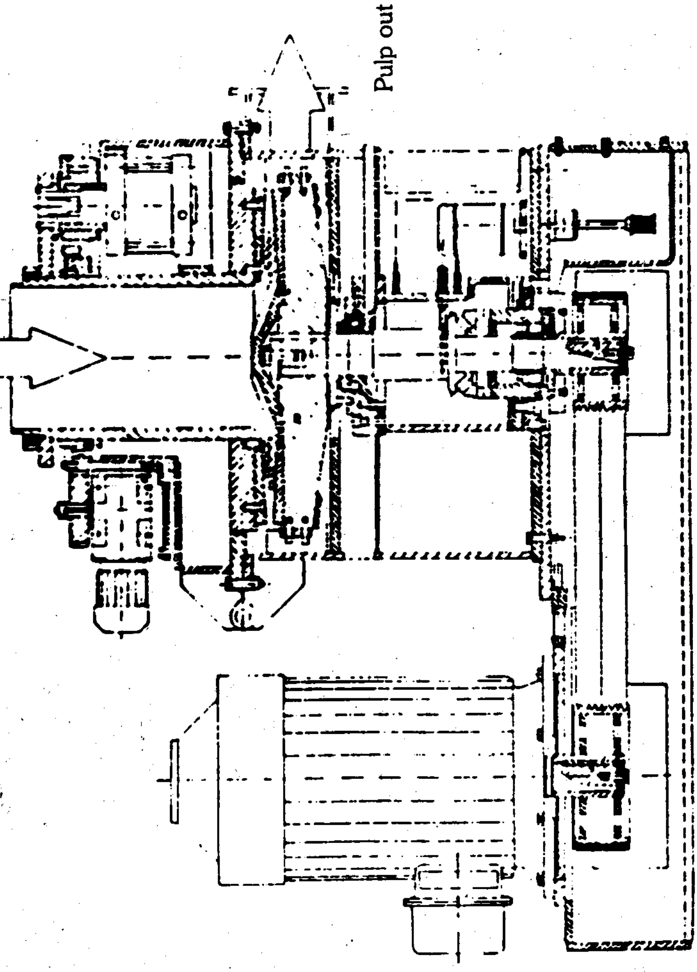

Fig. 2 - Andritz high-consistency mixer.

What is the benefit of the pneumatically supported discs and what do we want to avoid during mixing? We certainly do not want to have different pulp properties after the mixer. With the benefit of the pneumatically supported discs the fibre length distribution before and after the mixer does not change at all (see Figure 3).

Tests performed recently showed that the chemicals can be mixed in efficiently with this unit, even at consistencies of over 40%

2.3 Effective dewatering and washing

In high-consistency bleaching the fibre pulp must be dewatered to at least 35% befor the chemicals are mixed in. Additional washing is desirable to get rid of heavy metals resins and dissolved organic material.

These requirements have led to widespread use of the double wire press, especially with low freeness pulps (CSF level down to 45). The 'Andritz' double wire press can be equipped with a displacement or a low freeness washing unit as shown in Figure 4.

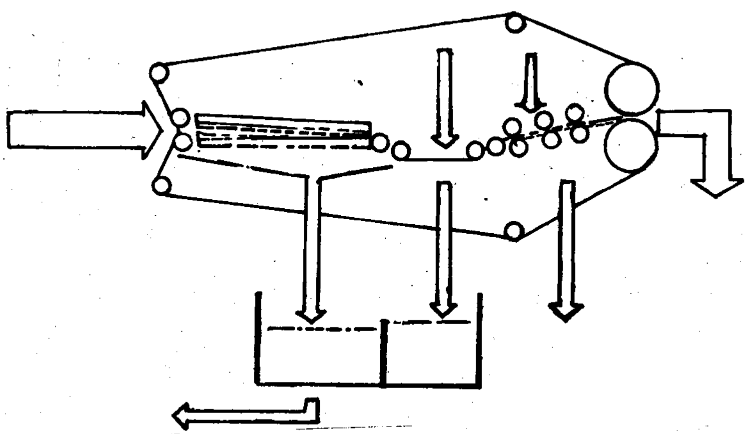

Fig 4 - Andritz low freeness washer.

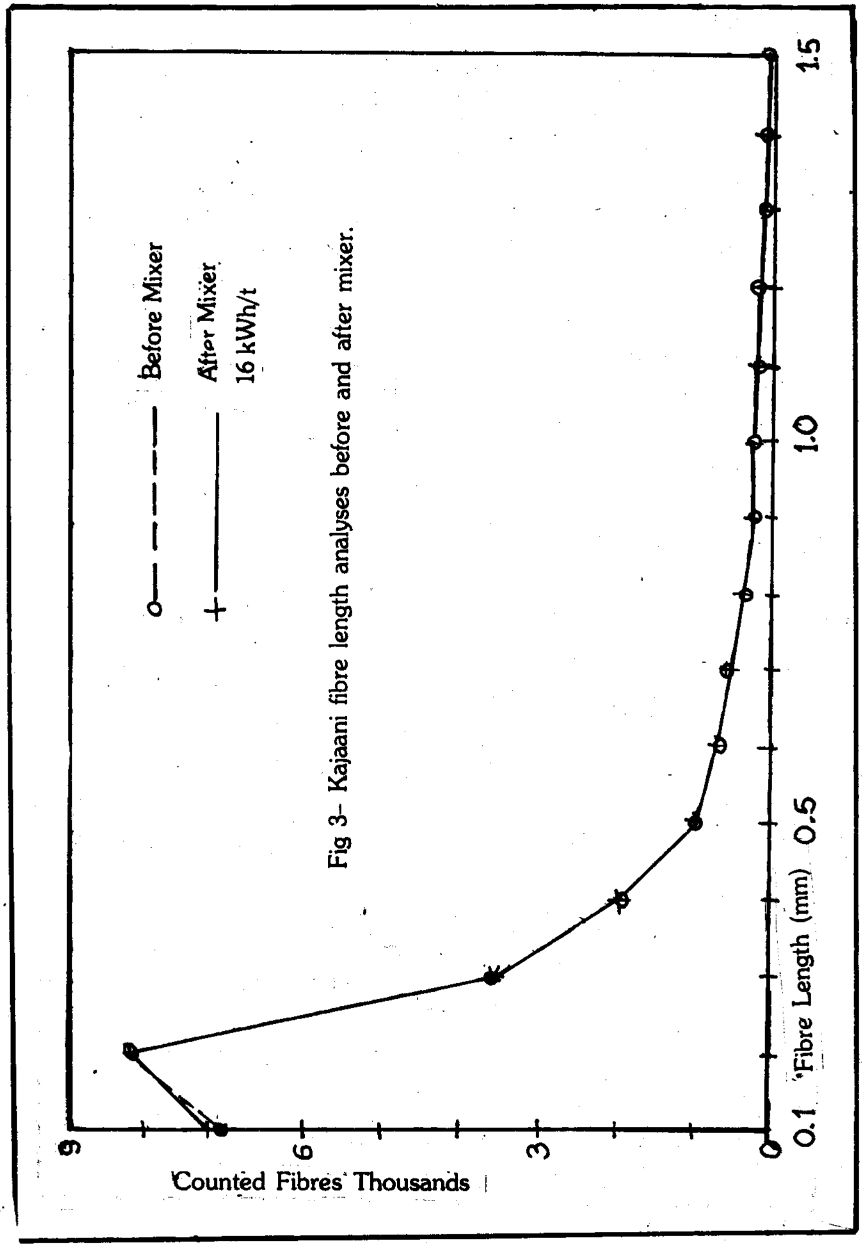

Fig 3– Kajaani fibre length analyses before and after mixer.

On a double wire press the pulp is pre-dewatered to12-15% in a plate-supported wedge zone. In the subsequent wash zone the pulp is re-wetted in the wash module and reaches its required final consistency in the last zone, the ascending press section.

If a double wire press washer is used, it is possible to improve the washing efficiency or reduce the amount of fresh water by 30 to 50% while retaining the same washing efficiency.

3. High-Consistency Bleach Plant

A 2-stage bleach plant for mechanical pulp with 50 ml CSF was planned, built and commissioned for a GWP-mill. The raw material used here is 90% spruce and 10% pine, ground continuously. The belaching agents ar peroxide for high-cionsistency pulp and then dithionite for medium-consistency. This plant has output of 320 b.d. mt per day; 2 dewatering lines handle 160 b.d. mt each per day.

The main plant data are shown in Table 1.

TABLE 1

DESIGN DATA

Pulp	90% spruce 10% pine
Freeness	80' SR (50 ml CSF)
Brightness	58 to 59% ISO
Production	320 tpd
Max. H_2O_2 charge	1.8 %
Max. dithionile charge	0.8 %
Brightness after P-stage	72% ISO
Brightness after R-stage	76% ISO
Max. el.energy consumption	510 KWh (38.25 KWh/t)

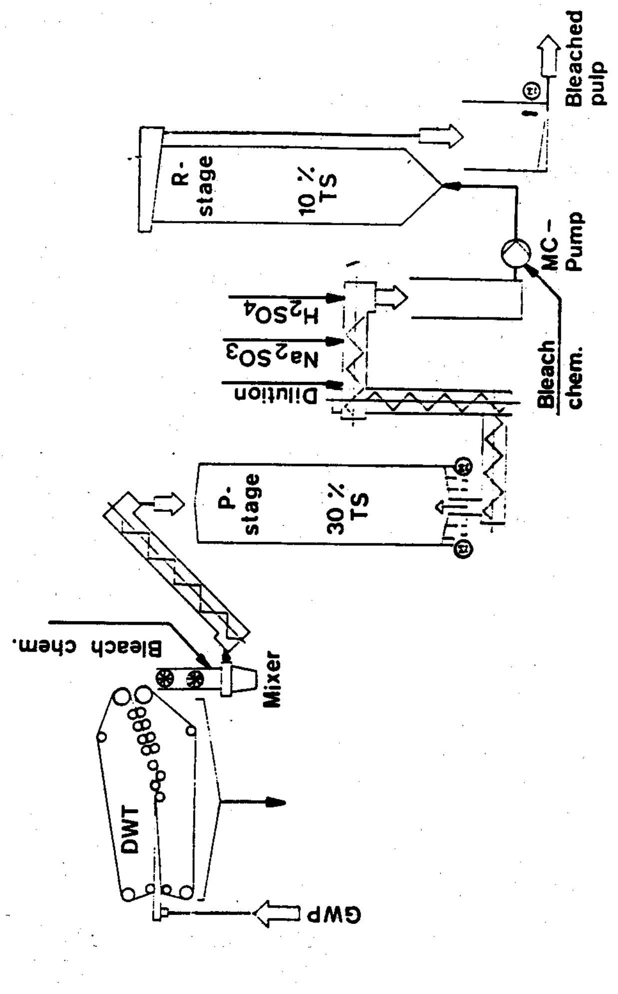

Fig 5– Flow sheet of a 2-stage bleach plant.

3.1 Plant layout

The wood supplied is debarked in dry barking drums and ground in continuous grinders. After screeing, cleaning and pre-thickening, the pulp enters the mixing chest. After the mixing chest, the pulp is fed to the 'Andritz' double wire presses (Fig. 5). Shredders are connected directly to the presses, followed by screw conveyors which bring the pulp to the high-consistency mixers. The bleaching chemicals for peroxide bleaching (peroxide, silicate, caustic soda) are mixed into the stock here. The chemicals are added in the mixer fall shaft itself through a chemicals pipe. A system of screw conveyors then brings the stock with added chemicals to the high-consistency bleaching tower (peroxide tower). After a retention time f approximately 2 hours the pulp is discharged with a consistency of 30% (belaching consistency) nd then diluted to 10% in the screw channel. When it has been diluted the pulp bleached in the first stage enters the stand pipe. The chemicals for the second bleaching stage are fed to the medium-consistency pump and mixed into the pulp.

3.2 Operating results

With the 'Andritz' double wire press it was possible to dewater the pulp with 50 ml CSF from an inlet consistency of 4% to 36% right away in the start-up phase on a 2.6 m wide machine and with an output of 180 b.d. mt per day. A washing efficiency level of 92% was achieved thanks to the dewatering process. The chemicals are mixed into the pulp in the 'Andritz' high consistency mixer at 36% b.d. mt. The chemicals addeed reduce the consistency to 30% b.d. (bleaching consistency). Good mixing can be achieved with only 16 Kwh per mt of pulp. This low energy requirement for mixing is not only favourable in its effect on the operating costs, it also ensures that any changes in the fibre properties are negligible. Figure 6 hows the influence the specific mixer energy has on the brightness. This diagram also charts the freeness as a function of the mixing energy.

A mere 18 kw of electricity are required to discharge the pulp from the bleach tower with the 'Andritz' high consistency discharge system at an output of 320 b.d. mt per day. Energy consumption for dilution in the screw conveyor after the tower is also minimal.

The amount of pulp discharged could be adjusted between 140 and 360 mt per day by varying the speed.

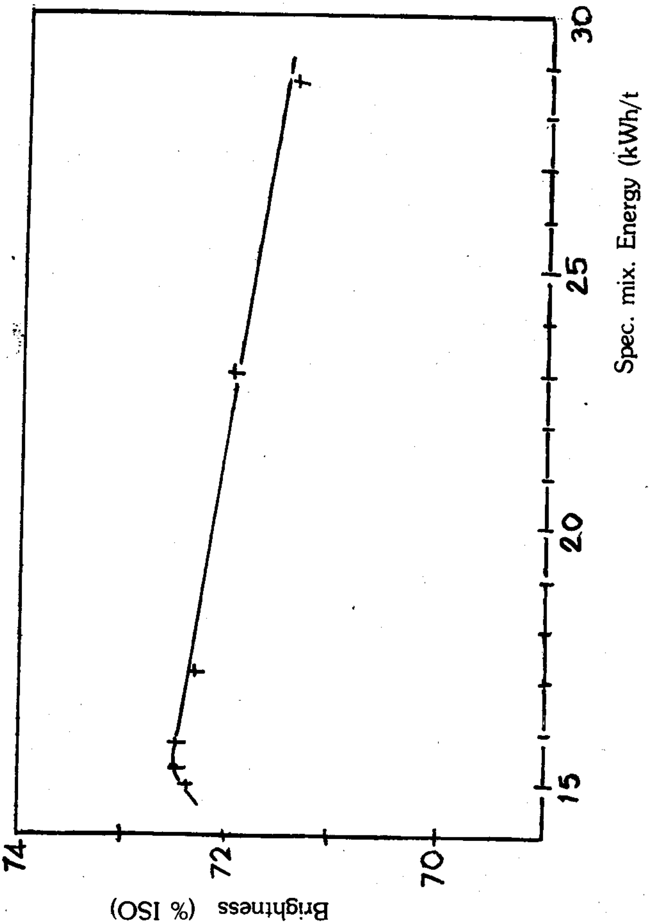

Fig 6– Influence of specific mixing energy on brightness.

TABLE 2

Comparison	Design data	Operation data
Brightness% ISO	58-59	60-62
Production% tpd	320	340
Max. H2O2 charge %	1.8	1.2
Max.dilhionite charge %	0.8	1.0
Brightness after P—stage% ISO	72	72.3
Brightness after after R—stage% ISO	76	77.7
Max. el. energy consumption kWh/t	38.25	34.2

Table 2 provides a comparison of the design values and the data measured, showing that consumption levels were all well below those expected, and the maximum capacity and final brightness better than anticipted.

4. Summary

For a high-consistency peroxide bleach plant the equipment used must be of a high technical standard. Of prime importance are good pulp washing, intimate chemicals mixing at high consistency without damaging fibres, and a means of also handling this high pulp consistency at the bleach tower discharge. The 'Andritz' components can meet these requirements.

Taking an existing plant as an example, it was shown that mechanical pulp can be bleached to brightness of 73% ISO using 1.2% H2o2. The subsequent dithionite stage boosted the brightness to 78% ISO. Sepcific energy consumption for the entire belach plant was 34.2 KWh per mt.