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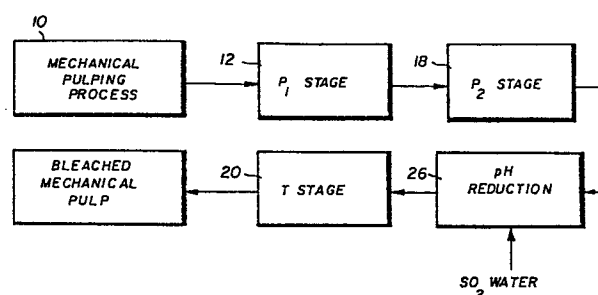
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Multi peroxide stage mechanical pulp bleaching.

Bleaching of a mechanical pulp, such as chemimechanical pulp (CMP), chemithermomechanical pulp (CTMP), and the like, achieves high brightness. A lignocellulose mechanical pulp is subjected to two different peroxide (P) stages (12, 18), and a hydrosulfite (dithionite) (T) stage (20). A P-P-T sequence is preferred (although a P-T-P sequence also produces good results). Bleaching is typically accomplished in all stages at a consistency of between about 8-30%. Between the peroxide stages, the pulp is preferably pressed (19). Between a peroxide stage and a subsequent hydrosulfite stage the pulp is preferably pressed (19'), and the pH reduced to between about 5.5-6.0 when diluting with SO₂ water (26). The P-P-T bleaching sequence results in pulp with unexpectedly high brightness, brightness levels of about 83% ISO, and greater, being possible.



MULTI-PEROXIDE STAGE MECHANICAL PULP BLEACHINGBACKGROUND AND SUMMARY OF THE INVENTION

Typical conventional bleaching sequences for the bleaching of mechanical pulps, such as mechanical pulp, chemimechanical pulp (CMP), thermomechanical pulp (TMP) and chemithermo-mechanical pulp (CTMP) comprise peroxide (P), hydrosulfite (T), or P-T sequences.

Conventional peroxide bleaching, with sodium or hydrogen peroxide, is typically accomplished at a consistency of about 12-30%. Single stage peroxide treatment is most common. However it has been known to use two stage peroxide bleaching (P-P) for medium brightness mechanical pulps, that is having a brightness of about 75-80% ISO.

Reductive bleaching with hydrosulfites (dithionites) is also commonly practiced in a single stage. However it has been known to use a P-T bleaching sequence, which gives brightness in the range of about 74-78% ISO. In a P-T sequence, the contribution to brightness of the final T stage is gradually reduced as the charge of peroxide is increased in order to boost final brightness.

According to the present invention it has been surprisingly found that where the peroxide treatment is split into two, or more, stages, the T stage does produce a substantial brightening effect, on the order of 2-4 ISO units. In a typical P-T sequence, the contribution from the hydrosulfite stage is very small (less than 2 ISO units) at the 80+ ISO level.

According to the present invention, there is provided a method of obtaining high brightness lignocellulose pulp, comprising the steps of (a) subjecting a mechanical lignocellulose pulp to a first peroxide bleaching; (b) subjecting the mechanical pulp to a second peroxide bleaching sequence; and (c) subjecting the mechanical pulp to a hydrosulfite bleaching sequence. More than two peroxide stages may be provided, and the steps (a)-(c) preferably practiced sequentially. Preferably the pulp is pressed between the stages to partially remove interstitial pulp liquor. This removed liquor (filtrate) is normally reused for dilution in preceeding stages, or for chemical recovery. During the practice of all of steps (a)-(c), the pulp maintains a consistency of between about 8-50%, although after pressing it is typically diluted (e.g. to between 8-15%). During each actual bleaching stage the consistency is between about 8-30%.

The invention also relates to a mechanical pulp having high brightness, and produced by the practice of steps (a) through (c). According to the invention, a mechanical pulp is produced having a brightness of about 83% ISO (or greater).

It is the primary object of the present invention to produce a high brightness mechanical pulp. This and other objects of the invention will become clear from a description of the detailed description of the invention, and from the appended claims.

BRIEF DESCRIPTION OF THE DRAWINGS

FIGURE 1 is a schematic view illustrating the steps in the practice of an exemplary method according to the present invention;

5 FIGURE 2 is a schematic indicating a preferred modification of the method of FIGURE 1;

FIGURE 3 is a schematic representation of exemplary apparatus utilized in the practice of one of the peroxide stages in the method of FIGURE 1;

10 FIGURE 4 is a schematic representation of exemplary equipment utilizable in the practice of the hydrosulfite bleaching stage of FIGURE 1; and

FIGURE 5 is a schematic representation of a modification of the method of FIGURE 1 wherein the T
15 stage is between two P stages.

DETAILED DESCRIPTION OF THE DRAWINGS

The invention is useful in increasing the brightness of all types of mechanical pulps. The term "a mechanical lignocellulose pulp" as used in
20 the specification and claims is intended to encompass conventional mechanical pulps, such as ground wood and refiner pulps, e.g. CMP, CTMP, and TMP. FIGURE 1 illustrates the production of a mechanical pulp in a typical mechanical pulping
25 process station 10, which includes the use of refiners, and other pulping process stages as desired.

After a mechanical lignocellulose pulp is produced in station 10, it is subjected to a first sodium or hydrogen peroxide bleaching P_1 , as indicated by reference numeral 12 in FIGURE 1.

5 Peroxide bleaching is accomplished utilizing conventional equipment, and conventional bleaching conditions for peroxide bleaching of mechanical pulps (e.g. 45-90°C, 15-240 minutes) A typical form
10 such equipment can take is illustrated schematically in FIGURE 3 wherein the pulp is fed to a mixer 14, the peroxide, sodium hydroxide, and buffering and stabilizing agents or the like (such as sodium silicate and $MgSO_4$) are added. If desired after
15 mixing in mixer 14, the consistency of the pulp may be increased in screw press 15, and ultimately the pulp is fed to bleaching tower 16. Bleaching would typically be accomplished at a consistency of about 8-30%, preferably about 12-25%.

20 In the present embodiment after treatment in stage P_1 , the pulp is passed to the second peroxide stage P_2 , indicated by reference numeral 18 in FIGURE 1. There it is subjected to another typical peroxide bleaching sequence. Other peroxide
25 bleaching sequences after stage 12 (e.g. P_3 , P_4 , etc.) may be provided.

In the preferred embodiment of the invention, between the P_1 and P_2 stages the mechanical pulp is pressed. This is illustrated
30 schematically in FIGURE 2 wherein a press station 19 is disposed between the peroxide bleaching sequence stages 12, 18. In press station 19, the pulp is pressed to a high consistency (e.g. on the order of 30-50%) before the bleach liquid for the subsequent
35 peroxide stage 18 is added. Also as indicated in

FIGURE 2, pressing in press station 19' preferably is practiced after stage 18.

After the second (or subsequent, i.e. last) peroxide bleaching sequence, the pulp is subjected to a hydrosulfite bleaching, as illustrated schematically by reference numeral 20 in FIGURE 1. The conditions in the hydrosulfite bleaching stage 20 are conventional (e.g. 45-90°C, 10-60 min.) except that it is preferred that the bleaching be practiced with a pulp consistency of between about 8-30%, preferably between about 8-15%. Hydrosulfite bleaching of medium consistency mechanical pulps is illustrated in copending U.S. patent application Serial No. 589,938 filed March 5, 1984, and the equipment and processes illustrated therein may be utilized in the practice of bleaching 20. FIGURE 4 schematically illustrates one form of the typical equipment that could be utilized in the practice of stage 20, wherein the pulp, after having been pressed and diluted to about 8-15% consistency, is mixed with hydrosulfite and other chemicals, such as buffering, chelating, and sequestering agents. The pulp is fluidized by the mixer 22, and then passes to conventional upflow tower 24.

Between stations 18, 20, it is also desirable to reduce the pH (e.g. to between 5.5-6.0) of the mechanical pulp. This is typically accomplished by the introduction of SO₂ water. Where the addition of the SO₂ water will dilute pulp consistency below the desired level for station 20, pressing of the pulp can be practiced between the stations 18, 20, preferably before the pH reduction station 26 -- see press station 191 illustrated in FIGURE 2.

The bleached mechanical pulp produced according to the sequence illustrated in FIGURE 1 has high brightness; brightness on the order of about 83% ISO units, or more, can be achieved.

5 Almost as high a brightness can be achieved if a peroxide stage is utilized both before and after a hydrosulfite stage. This is shown schematically in FIGURE 5 wherein T stage 20' is between P₁ stage 12' and P₂ stage 18'. The following examples illustrate

10 the enhanced brightness that can be achieved by the practice of the method of the invention.

Example 1 - Prior Art

A P-T sequence was practiced on unbleached CTMP pulp having 53.5% ISO, 160/110 (cold/hot) ml

15 C.S.F. (millimeters, Canadian Standard Freeness) containing 0.4% DCM-extract (a measure of the amount of resin), 92 ppm manganese, and 9 ppm iron. For the peroxide stage, the pulp was pretreated with 0.2% DTPA on bone dry (BD) pulp at 3% consistency

20 and 60°C. The temperature in both the P and T stages was 80°C, and the pulp consistency was 15% in both stages. The treatment time in the peroxide stage was 180 minutes using 3% sodium silicate and 0.2% MgSO₄ for buffering and stabilizing the

25 peroxide liquid. In the T stage the reaction time was 30 minutes, using 1% hydrosulfite which was all consumed. The following results were obtained:

<u>PEROXIDE STAGE</u>		
	CHARGE H ₂ O ₂ , %	5.0
30	CONSUMPTION H ₂ O ₂ , %	3.3
	CHARGE NaOH, %	3.5
	END-pH	9.3
	BRIGHTNESS, % ISO	77.8

HYDROSULFITE STAGE

END pH	5.5
BRIGHTNESS, % ISO	78.7

Example 2

5 Practicing the present invention utilizing
the same pulp as described in Example 1, pretreated
in the same way, with the same buffering and
stabilizing agents, with the same temperatures (i.e.
80°C) and consistency (i.e. 15% in all stages), and
10 with a reaction time of 180 minutes in each peroxide
stage and 30 min. in the hydrosulfite stage (1%,
which was all consumed), the following results were
obtained:

PEROXIDE STAGE 1

15	CHARGE H_2O_2 , %	3.0
	CONSUMPTION H_2O_2 , %	2.3
	CHARGE NaOH, %	3.0
	END-pH	9.5
	BRIGHTNESS, % ISO	75.4

PEROXIDE STAGE 2

20	CHARGE H_2O_2 , %	5.0
	CONSUMPTION H_2O_2 , %	2.9
	CHARGE NaOH, %	3.5
	END-pH	10.5
25	BRIGHTNESS, % ISO	80.7

HYDROSULFITE STAGE

END pH	6.1
BRIGHTNESS, % ISO	83.5

30 Between the second peroxide stage and the
hydrosulfite stage the pulp was pressed and the pH

was reduced by the addition of SO_2 water, the reduction practiced so that the pH was about 5.5-6.0 just prior to the hydrosulfite stage, and the pulp was diluted as necessary in order to maintain the consistency throughout the actual bleaching stages at about 15%.

Example 3

In this example the hydrosulfite stage was between two peroxide stages (see FIG. 5). The pulp, and general conditions, were the same as for Example 2, with the following results:

	<u>PEROXIDE STAGE 1</u>	
	CHARGE H_2O_2 , %	3.0
	CONSUMPTION H_2O_2 , %	2.5
15	CHARGE NaOH, %	3.0
	END-pH	9.3
	BRIGHTNESS, % ISO	75.4
	<u>HYDROSULFITE STAGE</u>	
	END pH	6.3
20	BRIGHTNESS, % ISO	77.7
	<u>PEROXIDE STAGE 2</u>	
	CHARGE H_2O_2 %	5.0
	CONSUMPTION H_2O_2 %	3.2
	CHARGE NaOH, %	3.5
25	END-pH	10.2
	BRIGHTNESS, % ISO	82.6

The final pulp brightness of almost 83 ISO (82.6) was suprisingly high, although not quite as high as the one for the sequence in Example 2.

It will thus be seen that according to the present invention a mechanical pulp having high brightness is produced, with a synergistic effect being achieved in pulp brightness by utilizing multi-peroxide stages prior to a hydrosulfite stage. While the invention has been herein shown and described in what is presently conceived to be the most practical and preferred embodiment thereof, it will be apparent to those of ordinary skill in the art that many modifications may be made thereof within the scope of the invention, which scope is to be accorded the broadest interpretation of the appended claims so as to encompass all equivalent methods and products.

Claims:

1. A method of obtaining high brightness
lignocellulose pulp comprising the steps of
subjecting a mechanical lignocellulose pulp to
5 peroxide bleaching, and a hydrosulfite
bleaching sequence (20), characterized by:

subjecting the mechanical pulp to a first
peroxide bleaching (12) and a second peroxide
bleaching (18), to produce a bleached
10 mechanical pulp.

2. A method as recited in claim 1
further characterized in that the peroxide and
hydrosulfite bleaching steps are practiced in
15 the following sequence: first peroxide
bleaching; second peroxide bleaching; and
hydrosulfite bleaching.

3. A method as recited in claim 1
20 further characterized in that the peroxide and
hydrosulfite bleaching steps are practiced in
the following sequence; first peroxide
bleaching; hydrosulfite bleaching; and second
peroxide bleaching.

25 4. A method as recited in claim 1
further characterized in that the consistency
of the pulp during the practice of each of the
steps is within the range of about 8-30%.

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5. A method as recited in claim 4 further characterized in that the consistency of the pulp during the hydrosulfite bleaching sequence is within the range of about 8-15%.

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6. A method as recited in claim 5 comprising the further step of prior to the hydrosulfite bleaching sequence, reducing the pH of the mechanical pulp to between about 5.5-6.0 (26).

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7. A method as recited in claim 2 comprising the further step, between the peroxide bleaching steps, of pressing the mechanical pulp (19).

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8. A method as recited in claim 1 wherein the first and second peroxide bleaching steps and the hydrosulfite bleaching sequence are the only bleaching steps practiced in the treatment of the mechanical pulp.

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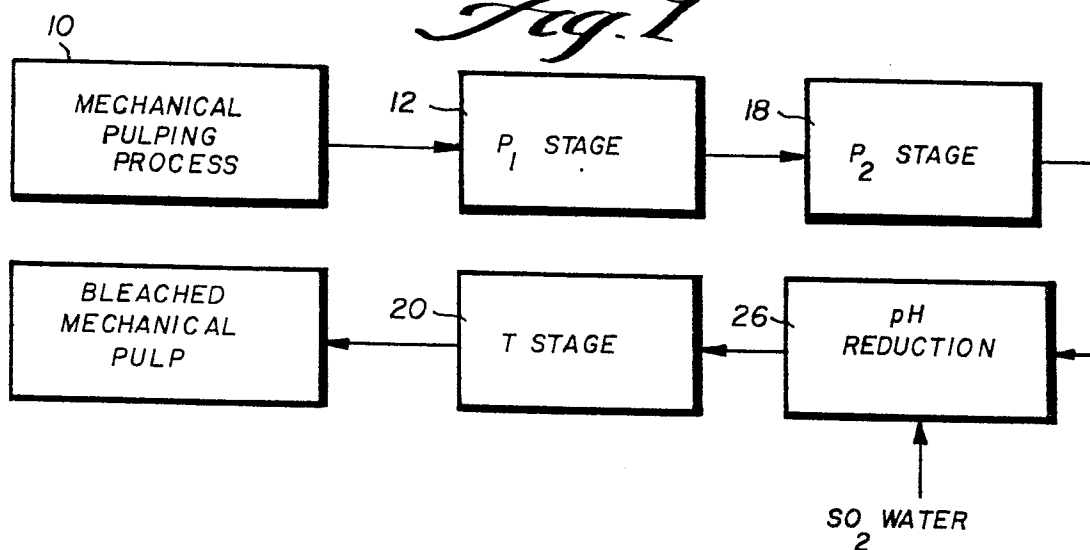
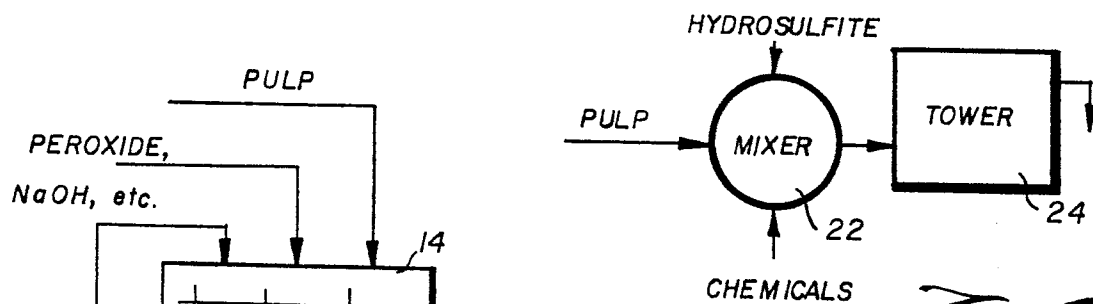
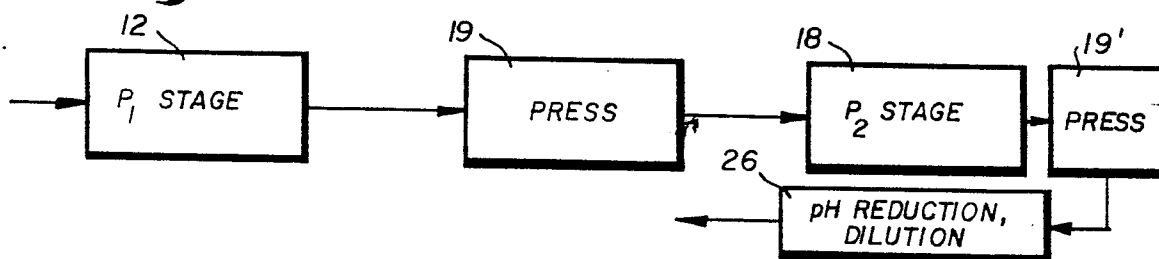
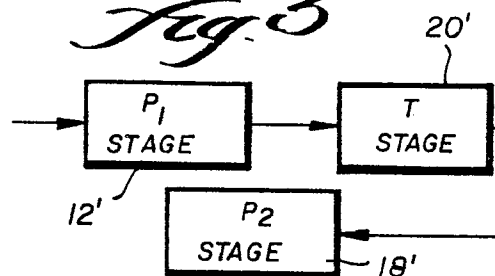
9. A high brightness mechanical lignocellulose pulp characterized in that it is produced by the steps comprising: (a) subjecting a mechanical lignocellulose pulp to a first peroxide bleaching sequence (12); (b) subjecting the mechanical pulp to a second peroxide bleaching sequence (18); and (c) subjecting the mechanical pulp to a hydrosulfite bleaching sequence (20).

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10. A high brightness pulp as recited in claim 9 further characterized in that it has a brightness of about 83% ISO.

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Fig. 1*Fig. 2**Fig. 3**Fig. 4**Fig. 5*



European Patent
Office

EUROPEAN SEARCH REPORT

0191756

Application number

EP 86 89 0030

DOCUMENTS CONSIDERED TO BE RELEVANT			
Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.4)
A	TAPPI, vol. 53, no. 12, December 1970, pages 2275-2277, Atlanta, GA, US; C.A. RICHARDSON et al.: "Two-stage bleaching of high-yield pulp at blandin" * Whole article *	1,9	D 21 C 9/10
A	--- US-A-2 862 784 (M.A. KISE et al.) * Whole document *	1,6,9	
A	--- US-A-2 290 601 (J.S. REICHERT et al.) * Whole document *	1,9	
A	--- US-A-1 820 502 (J. SCHUBER) * Page 1, line 1 - page 3, line 67 *	1,3,9	TECHNICAL FIELDS SEARCHED (Int. Cl.4)
			D 21 C
The present search report has been drawn up for all claims			
Place of search THE HAGUE		Date of completion of the search 20-05-1986	Examiner NESTBY K.
CATEGORY OF CITED DOCUMENTS			
X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document		T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons & : member of the same patent family, corresponding document	