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(54) METHOD FOR BLEACHING WOOD PULP USING HYDROGEN PEROXIDE

VERFAHREN ZUM BLEICHEN VON HOLZZELLSTOFF MITTELS WASSERSTOFFPEROXID

PROCEDE DE BLANCHIMENT DE PATE DE BOIS AU PEROXYDE D'HYDROGENE

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EP-A- 0 208 625
DE-C- 3 207 157
FR-A- 2 661 430

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Description

BACKGROUND OF THE INVENTION

This invention relates generally to wood pulp bleaching processes and more particularly to bleaching of medium consistency pulp using hydrogen peroxide solution in a two-phase bleaching stage.

Hydrogen peroxide is widely used in the brightening of mechanical, semi-mechanical, semi-chemical, and recycled pulps. More recently, it has also been used in chemical pulp bleaching to aid in its delignification. Oxidative extraction stages using peroxide in addition to oxygen are currently used to reduce the amount of chlorine necessary in the first stage of pulp bleaching. Hydrogen peroxide is also used in the final stages of pulp bleaching to achieve a high brightness, stable bleached pulp.

For mechanical, semi-mechanical, and semi-chemical pulps, hydrogen peroxide has been primarily used in high consistency systems, where the pulp slurry is dewatered to about 30% consistency and passed through a fluffer or high consistency mixer in which the peroxide solution is added. The pulp then falls by gravity to a reaction tower usually sized for several hours retention. The bleaching is performed in one stage such as described above or in two stages in series. In the latter case, one of those stages may be performed at medium consistency.

In chemical pulps, hydrogen peroxide has been primarily used in medium consistency systems, in which the pulp slurry, from a previous stage, is dewatered in a thickener or washer to about 10-14% consistency. The peroxide solution is added together with alkali at the repulper (discharge from the thickencr or washer) or before the medium consistency tower in medium consistency pump or mixer, usually in combination with other oxidative chemicals like oxygen.

A recent chemical pulp bleaching process is exemplified by EP-A-0 208 625 (corresponding to US-A-4 734 161) which discloses a method for bleaching chemical wood pulp with hydrogen peroxide at a temperature of from 90 to 100°C and at a consistency between 3 and 25% comprising:

consuming in a first step between 0,3 and 2,5 weight % of the peroxide at a pH of between 8,5 and 9,5 during less than 4 hours; and

consuming peroxide in a second step during between 2 to 5 hours to arrive at a total consumption of between 2 and 5 weight % peroxide, by adding an alkali in order to raise the pH to at least 11.

In FR-A-2 661 430 (corresponding to US-A-5 169 495) there is described a method for bleaching cellulosic mechanical pulps with hydrogen peroxide wherein peroxide is added only once at the beginning, and the alkalinity is adjusted just before the final step in a reaction tower. In FR-A-2 661 430, the reaction is carried out at 60°C and the minimum reaction time is 4 hours.

There are several ways to bleach mechanical pulps. Of these, the hot peroxide system is of interest because it pursues the same brightness development as the conventional high consistency systems, but does so at medium consistency (10-14%). This is achieved by increasing the temperature of the pulp to 85°C. and lowering the pH to about 9.5 to 10.5, which is differentiated from conventional high consistency peroxide system. Because of the faster reaction, the retention time is reduced from hours to minutes (15-30 min.) and no silicate is required to stabilize the peroxide solution. The peroxide charge remains about the same as that of the conventional systems.

Reactivation of residual peroxide has been proposed for use in the bleaching of mechanical pulps. This development allows reactivation of the non-consumed peroxide (after the first reaction stage tower) by increasing the alkalinity of the pulp suspension. The aim of this is to eliminate expensive dewatering equipment which is used after the bleaching tower to recover the residual peroxide by recirculating the filtrate from the dewatering equipment back to the point of addition of the fresh peroxide (usually at a mixer before the bleaching tower). This proposal becomes economically important when compared with a conventional two stage peroxide bleaching system which requires expensive dewatering equipment between stages.

High consistency systems are claimed to be the best way to develop highest brightness with lowest peroxide consumption. Its disadvantage resides in the large investment cost required because of the expensive dewatering equipment (to 30% consistency), the expensive mixer-fluffer, expense of long retention time tower and expensive high consistency tower discharge equipment. Furthermore, any attempt to recycle residual peroxide to reduce chemical consumption will require a second dewatering equipment after the tower, which is similar to the one used ahead of it.

The medium consistency systems do not provide sufficient brightness increases and are said to consume more peroxide and require extremely long retention time for consumption of the peroxide. For more pronounced delignification or brightness effects peroxide must be applied in several towers, i.e., in chemical bleaching together with oxygen in the first extraction stage, alone or with other chemicals in the second extraction stage, and alone prior to the bleached high density tower. Residual peroxide is not recovered in these systems.

The foregoing illustrates limitations known to exist in present pulp bleaching processes, and it would be advantageous to provide an alternative directed to overcoming one or more of those limitations. Accordingly, a suitable alternative is provided including features more fully disclosed hereinafter.

SUMMARY OF THE INVENTION

According to the present invention as described in claim 1, a method of bleaching wood pulp using a hydrogen peroxide solution as a bleaching reagent, includes the steps of introducing pulp, at a consistency of 10%-18% (oven dried basis), to a mixer; heating the pulp to a temperature between 80 and 100 degrees Celsius; adding sufficient sodium hydroxide to bring the pulp to a pH of 9.5-11.5; adding sufficient hydrogen peroxide to assure that there will be a significant residual of peroxide after the first reaction tower; passing the pulp through a reactor column at a rate which provides a reaction time in the column of between 5 and 60 minutes; introducing the pulp to a mixer and reactivating residual hydrogen peroxide by adding sufficient sodium hydroxide to bring the pulp to a pH of at least 9; and depositing the pulp in a reaction tower and allowing the reaction to proceed for 1-4 hours until substantially all the residual hydrogen peroxide has been consumed.

The foregoing and other aspects of the invention will become apparent from the following detailed description, when considered in conjunction with the accompanying drawings.

BRIEF DESCRIPTION OF THE DRAWING

Fig. 1 is a schematic view illustrating a process sequence yielding a preferred embodiment of the method of the present invention.

DETAILED DESCRIPTION

Referring to the figure, pulp from a conventional washer or thickener is discharged through pipe 10 into mixer 100, where steam for heating the pulp and alkali for adjusting the pH of the pulp is added through pipes 16 and 15 respectively. The alkali may be sodium hydroxide, white liquor, or other alkali sources. The pulp is heated to more than the conventional 60°C., preferably to 85-95°C., and adjusted to a pH of greater than 8.5, preferably 9.5-10.5. The heated and pH adjusted pulp is discharged from mixer 100 through pipe 20 to a conventional medium consistency pump 200 which pumps the pulp through pipe 30 to a mixer 300. Hydrogen peroxide solution is added to the mixer 300 through pipe 35 in a quantity sufficient to assure substantial residual will be maintained at the end of the first phase of the reaction. As in conventional peroxide bleaching systems, the addition of magnesium compounds for protection of cellulose viscosity, as well as sequestrants (such as SiO_2 and/or chelants {such as EDTA or DTPA}) may also be added with the alkali solution through pipe 15, the peroxide solution through pipe 35, or separately through pipes 16 and 36.

The pulp, which has been heated to the desired reaction temperature, and adjusted to the desired pH, is pumped through pipe 40 into the upflow reaction column 400, which is sized for the retention time desired for the first phase of the reaction. According to the present invention, the upflow tube is sized to assure a pulp retention time of 5-55 minutes, preferably 10-20 minutes, after which retention, the pulp retains substantial residual peroxide. The pulp is discharged through pipe 50 to an appropriate mixing device 500, where additional alkali is added through pipe 55 to increase the pH of the pulp to 9.5-11.5, preferably 10.5-11.0. This alkali (sodium hydroxide) addition reactivates the residual hydrogen peroxide so that, when discharged through pipe 60 into reaction vessel 600, the pulp slurry will continue to brighten due to the peroxide reaction during retention in reaction vessel 600. Typical reaction vessels are sized for pulp retention times of 1-4 hours.

Claims

1. A method for bleaching wood pulp (10) using a hydrogen peroxide solution (35) as a bleaching reagent, comprising the steps of:

   introducing pulp (10), at a consistency of 10% - 18%, oven dried basis, to a mixer (100);
   heating said pulp (10) to a temperature between 80 and 100 degrees Celsius;
   adding sufficient alkali (15) to bring said pulp (10) to a pH of greater than 8.5;
   adding sufficient hydrogen peroxide (35) in a mixer (300) to assure that there will be a significant residual of peroxide after the first reactor column (400);
   passing said pulp (10) through a reactor column (400) at a rate which provides a reaction time in said column less than 60 minutes;
   introducing said pulp (10) to a mixing means (500) and reactivating residual hydrogen peroxide by adding sufficient alkali (55) to bring the pulp (10) to a pH of at least 9; and
   depositing said pulp (10) in a reactor tower (600) and allowing the reaction to proceed for 1-4 hours until a substantial portion of the residual hydrogen peroxide has been consumed.

2. The method of claim 1, wherein sufficient alkali (55) is added to bring said pulp to a pH of 9.5 - 10.5.

3. The method of claim 1, wherein said pulp (10) is passed through a reactor column (400) at a rate which provides a reaction time in said column between 10 and 15 minutes.

Patentansprüche

1. Verfahren zum Bleichen von Zellstoff (10) unter Verwendung einer Wasserstoffperoxidlösung (35) als

einem Bleichreagens, beinhaltend die Schritte:

Einleiten des Zellstoffes (10) mit einer Konsistenz von 10%-18% auf ofengetrockneter Basis in einen Mischer (100),
Erwärmen des Zellstoffes (10) auf eine Temperatur zwischen 80 und 100 Grad Celsius;
Zusetzen von ausreichend Alkali (15), um den Zellstoff (10) auf einen pH-Wert von größer als 8,5 zu bringen;
Zusetzen von ausreichend Wasserstoffperoxid (35) in einem Mischer (300), um zu gewährleisten, daß es einen beträchtlichen Rest an Peroxid nach der ersten Reaktorsäule (400) geben wird;
Hindurchleiten des Zellstoffes (10) durch eine Reaktorsäule (400) mit einer Geschwindigkeit, die eine Reaktionszeit in der Säule von weniger als 60 Minuten ergibt;
Einleiten des Zellstoffes (10) in eine Mischeinrichtung (500) und Reaktivieren von restlichem Wasserstoffperoxid durch Zusetzen von ausreichend Alkali (55), um den Zellstoff (10) auf einen pH-Wert von wenigstens 9 zu bringen; und
Einbringen des Zellstoffes (10) in einen Reaktorturm (600) und Erlauben, daß die Reaktion für 1-4 Stunden von
statten geht, bis ein wesentlicher Teil des restlichen Wasserstoffperoxids verbraucht worden ist.

2. Verfahren nach Anspruch 1, wobei ausreichend Alkali (55) zugesetzt wird, um den Zellstoff auf einen pH-Wert von 9,5-10,5 zu bringen.

3. Verfahren nach Anspruch 1, wobei der Zellstoff (10) durch eine Reaktorsäule (400) mit einer Geschwindigkeit hindurchgeleitet wird, die eine Reaktionszeit in der Säule zwischen 10 und 15 Minuten ergibt.

Revendications

1. Procédé pour le blanchiment d'une pâte cellulosique (10) en utilisant une solution de peroxyde d'hydrogène (35) à titre de réactif de blanchiment, comprenant les étapes consistant à:

introduire la pâte (10) en une concentration de 10%-18%, à l'état séché à l'étuve, dans un mélangeur (100);
chauffer ladite pâte (10) à une température entre 80 et 100 degrés Celsius;
ajouter une quantité d'alcalis (15) suffisante pour amener ladite pâte (10) à un pH supérieur à 8,5;
ajouter une quantité de peroxyde d'hydrogène (35) dans un mélangeur (300) suffisante pour garantir la présence d'une quantité résiduelle importante de peroxyde après la première colonne à réaction (400);
faire passer ladite pâte (10) à travers une colonne à réaction (400) à un débit qui permet d'obtenir un temps de réaction dans ladite colonne inférieur à 60 minutes;
introduire ladite pâte (10) dans un moyen de mélange (500) et réactiver le peroxyde d'hydrogène résiduel en ajoutant une quantité d'alcalis (55) suffisante pour amener la pâte (10) à un pH d'au moins 9; et
déposer ladite pâte (10) dans une colonne à réaction (600) et laisser la réaction se dérouler pendant un laps de temps de 1 à 4 heures jusqu'à ce qu'une portion importante du peroxyde d'hydrogène résiduel ait été consommée.

2. Procédé selon la revendication 1, dans lequel on ajoute une quantité d'alcalis (55) suffisante pour amener ladite pâte à un pH de 9,5-10,5.

3. Procédé selon la revendication 1, dans lequel on fait passer ladite pâte (10) à travers une colonne à réaction (400) à un débit qui permet d'obtenir un temps de réaction dans ladite colonne entre 10 et 15 minutes.

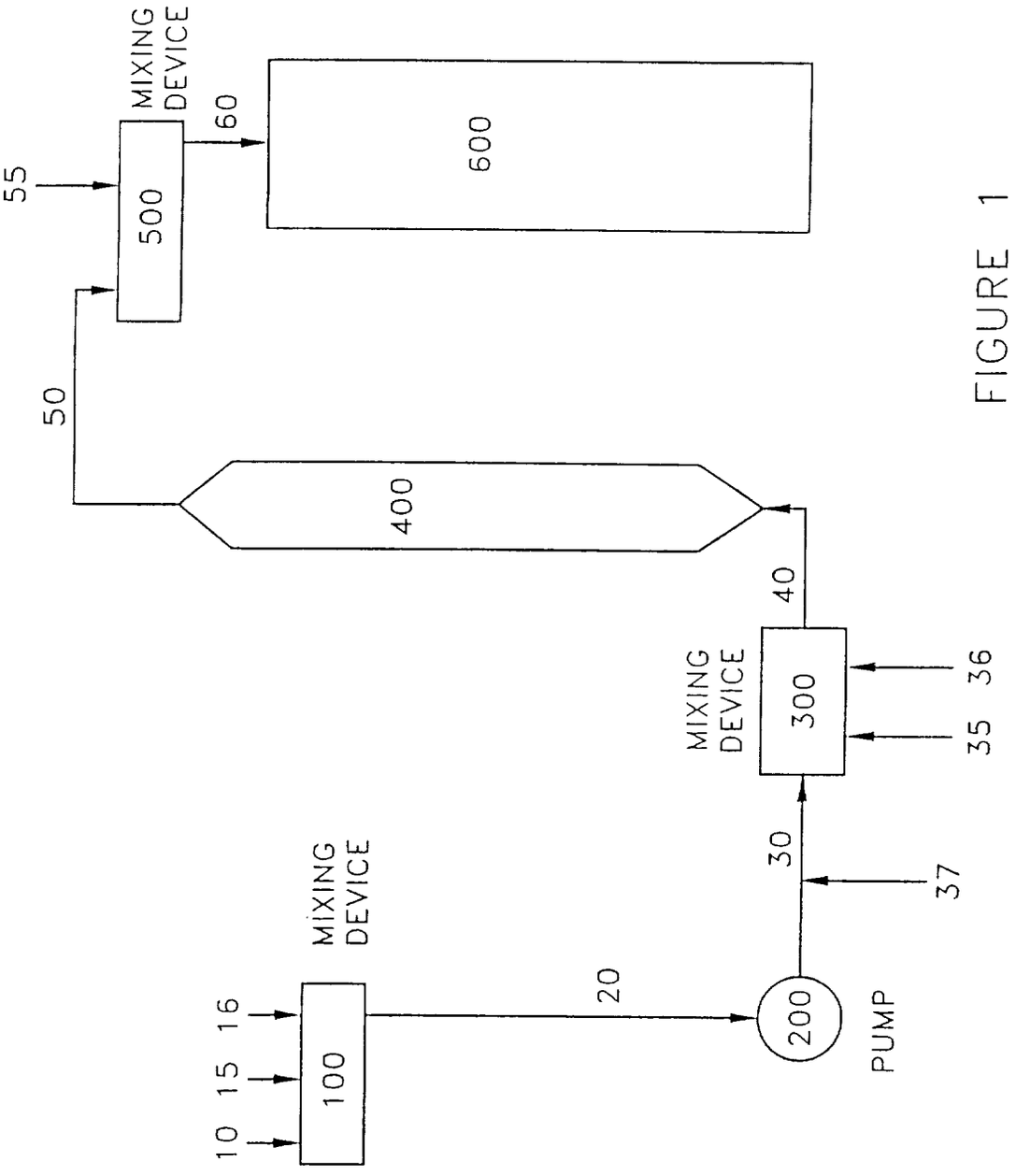

MIXING DEVICE
500
55
60
600
50
400
40
MIXING DEVICE
300
35 36
30
37
MIXING DEVICE
100
10 15 16
20
200
PUMP

FIGURE 1