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METHOD OF BLEACHING KRAFT PULP SHEET

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ABSTRACT OF THE DISCLOSURE

A rapid process for the brightening of kraft wood pulp which comprises bleaching the kraft pulp by contacting it, in sheet form, with an aqueous hypochlorite bleaching solution at a temperature of from 100 to about 250° C. for a period of time of at least about 1 minute, said hypochlorite solution having a pH from about 9 to about 13 and a concentration of from about 6% to about 10% available chlorine based on the oven dry weight of the pulp. As a further step, the bleached kraft pulp sheet is rinsed and dried and optionally contacted with an aqueous sodium peroxide bleaching solution at a pH of from about 10 to about 12 to further brighten the pulp.

This invention relates to bleaching wood pulp, and more particularly relates to a new and novel high speed, single step process for bleaching kraft pulp in sheet form.

A primary object of the invention is to provide a new and unique method for rapidly bleaching kraft pulp sheet.

Another object of the invention is to provide a one step, rapid, high temperature method of rapidly bleaching kraft pulp in sheet form wherein the pulp is bleached within the period of only a few minutes.

A further object of the invention is to provide a high speed, single stage process for bleaching high density kraft pulp sheet with only a minimum or even no degradation in the strength of the sheet.

Another object of the invention is to provide a novel method for bleaching kraft pulp sheet to obtain unusually high increases in brightness.

These and other objects and advantages of the present invention will become apparent from the detailed description presented hereinafter.

The novel bleaching process of the present invention for increasing the brightness of kraft pulp comprises: contacting a kraft pulp in sheet form with an aqueous hypochlorite bleaching solution at a temperature of from about 100 to about 250° C. for a period of time of at least about 1 minute, said hypochlorite solution having a pH of from about 9 to about 13 and a concentration of from about 6 percent to about 10 percent available chlorine, based on the oven dry weight of the pulp. Ordinarily, a contact time of from 1 to 8 minutes of the bleach with the kraft pulp sheet is employed, depending on the temperature employed.

Usually, in the practice of the invention, the resulting bleached kraft pulp sheet is rinsed of residual hypochlorite and chlorinated residues. This latter operation provides an additional advantage in that it further enhances the brightness of the pulp.

It is preferable in heating to the operating temperature the pulp sheet which has been contacted with the bleach that the heat transfer to the sheet be as rapid as possible. Accordingly, a massive heat block means in contact with the pulp sheet ordinarily is used since such a heating means transfers heat more rapidly than does hot air of the same temperature. Alternatively, an oven or any other suitable heating means which provides the requisite temperature within the disclosed period can be used.

The pulp density of the damp kraft pulp sheet which is processed by the present novel process usually varies from about 35 to about 80 percent. The term "pulp density" or "density" as used herein refers to the percent by weight of pulp solids present in a damp pulp sheet formed from a pulp slurry. The brightness of the bleached paper is related to the pulp density of the paper. For example, at a temperature of about 100° C. the optimum brightness occurs at densities of about 70 to 75 percent; at about 150° C. the optimum densities for maximum brightness are about 60 to 70 percent, and at about 200° C. the optimum pulp densities are about 50 to 60 percent; at about 250° C. optimum brightness occurs at densities of about 40 to 50 percent.

The actual operating times to achieve optimum brightness increases for a given pulp density at a predetermined temperature vary in an inverse manner with the temperature of operation. To illustrate, to obtain optimum brightness in a higher density pulp paper within the aforesaid broad range, a lower temperature but longer heating time is employed than with a lower density pulp paper wherein higher temperatures but shorter heating times are employed for approximately the same degree of brightness increase.

Preferably, the concentration of the hypochlorite bleaching solution used will be from about 7 percent to about 9 percent available chlorine based on the oven dry weight of the pulp, the pH thereof being preferably from about 11 to 13. A preferred temperature during bleaching within the temperature range of from about 100 to 250° C. and a preferred pulp paper density within the disclosed range of from about 35 percent to about 80 percent will be determined for a given operation by the operating process conditions employed in an installation as is understood by one skilled in the art.

Further increases in brightness of kraft pulp may be obtained by subsequent treatment of the hypochlorite bleached sheet with a conventional formulated aqueous sodium peroxide bleaching solution at a pH of from about 10 to 12. For example, treatment of kraft pulp with a 2 percent sodium peroxide aqueous bleach at a pH of about 11 increases the brightness of the pulp by approximately 14 G.E. points over the brightness obtained by the aforesaid hypochlorite bleach.

Kraft pulps in general may be employed in the present process. Specific examples of usable pulps include western hemlock kraft pulp and southern pine kraft pulp. The present invention provides a rapid simple means of obtaining unusual brightness increases of kraft wood pulp upon bleaching with a hypochlorite solution and differs from the prior art primarily in that only a single high speed, high temperature step is required in comparison with the five or more steps conventionally required to obtain similar brightness increases.

The following examples serve to illustrate the novel process of the present invention but are not to be construed as limiting the invention thereto.

EXAMPLE I

Western hemlock kraft pulp was slurried with water such that the resultant damp paper sheet (squeezed or blotted dry) formed therefrom contained about 70 percent pulp (as calculated on an oven dried basis). The damp sheet weighed one gram and comprised 0.7 gram of pulp and 0.3 gram of water. The sheet was next treated with 2 cc. of sodium hypochlorite solution at pH 11 (10 percent NaOCl based on the weight of the pulp). Thereafter the sheet was dried in an oven at 200° C. for 2¼ minutes. Upon removal from the oven the sheet was rinsed with 125 cc. of water, blotted, and air-dried overnight. The brightness of the pulp sheet prior to contact

with the hypochlorite was measured at 25.3 G.E. points of brightness using a General Electric spectrophotometer. Upon measuring the brightness of the sheet after being treated the brightness was found to be 77.5 G.E. points; i.e. an increase of 52.2 G.E. points.

EXAMPLE II

Southern pine kraft pulp was slurried with water such as to provide a damp paper sheet formed therefrom containing about 1.2 grams of pulp (oven dry basis) and about 1.6 grams of H_2O. This sheet was treated with 3 cc. of sodium hypochlorite solution at pH 12 (10 percent NaOCl based on the weight of the pulp). The sheet was then placed in a drying oven at 100° C. for 7.5 minutes. Upon removal from the oven the sheet was rinsed with 100 cc. of water, blotted, and air-dried overnight. The treated sheet had a brightness of 71.4 G.E. units with no strength degradation (as measured by an Instron Tensile Tester). The brightness of the untreated sheet was recorded as in Example I at 27.5 G.E. points.

EXAMPLE III

Southern pine kraft pulp was slurried with water such that the resultant damp paper sheet formed therefrom comprised 1.0 gram of pulp (dry weight) and 0.5 gram of water. This sheet was treated with 3 cc. of sodium hypochlorite at pH 12 (8 percent NaOCl based on the weight of the pulp). The sheet was then placed in a 150° C. drying oven for 2 minutes. Upon removal from the oven the sheet was rinsed with 100 cc. of H_2O, blotter, and air-dried overnight. The brightness of the sheet was measured as in the above examples and found to have increased by 45.8 G.E. points over the untreated sheet with little degradation in strength (as measured by an Instron Tensile Tester).

Unusually high increases in brightness can also be obtained similarly as in the foregoing examples by employing other kraft pulps, and hypochlorite bleaching concentration and pH's in accordance with the present novel process.

I claim:

1. A method for brightening kraft pulp which comprises:
   (a) impregnating the pulp in sheet form with an aqueous hypochlorite bleaching solution having a pH of from about 9 to about 13, said pulp sheet having a pulp solids content of from about 35 to about 80 percent by weight prior to being impregnated, and
   (b) heating said impregnated pulp sheet at a temperature of from about 100 to about 250° C. for a period of time of from about 1 minute to about 8 minutes to dry said sheet.

2. The method of claim 1 and including the steps of impregnating the hypochlorite-treated sheet with an aqueous solution to rinse said sheet, and impregnating said sheet with an aqueous sodium peroxide bleaching solution having a pH from about 10 to about 12.

3. The method of claim 1 wherein the pH of the hypochlorite solution is from about 11 to about 13.

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