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METHOD OF BLEACHING GROUNDWOOD

Robert L. McEwen, Williamsville, and Fred R. Sheldon, Buffalo, N. Y., assignors to Buffalo Electro-Chemical Company, Inc., Tonawanda, N. Y.

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1

The present invention relates to a method of bleaching or brightening a web or sheet of pulp or paper containing substantial proportions of ground wood fibers and therefore a substantial amount of natural wood incrustants or ligneous matter, and particularly to the bleaching of such webs or sheets by the employment of an alkaline solution containing a peroxide and a phosphate.

So-called chemical pulps, whether made by the soda, sulfate or sulfite methods, have been treated chemically to obtain relatively pure cellulose fibers from the original wood by the elimination of the non-cellulosic constituents designated incrustants and lignins. These substantially pure cellulose fibers, freed of the incrustants and lignins, may be readily bleached by hypochlorite or peroxide to excellent white. Furthermore, such bleached chemical wood fibers of pure cellulose retain their color and are not readily subject to reversion of color or yellowing.

In contrast to the chemical pulps there are many types of pulp mixtures which contain all or a portion of the incrustations, lignins and other non-cellulosic materials. Groundwood is the best known of this classification. Groundwood pulp and other pulps falling under this classification are herein described as pulps containing groundwood and the fibers of these pulps contain lignin in amounts greater than about 5-6% by weight.

Groundwood fibers contain all the natural incrustants and lignins of the original wood. Groundwood fibers therefore are not of such good initial white and furthermore are difficult to bleach by reason of the presence of the ligneous or other non-cellulosic matter of the original wood. Whereas it has been proposed to bleach chemical pulps, that is, those pulps substantially free of the natural incrustants and lignins, with alkaline peroxide solutions containing caustic soda and sodium silicate, as for instance by the methods described in Kauffmann and Wolfe U. S. Patent No. 2,150,926 and Heritage U. S. Patent No. 2,125,634, such operations possess little or no value in the treatment of pulps containing groundwood. Relatively good bleaching results can be obtained upon ground wood pulp by subjecting such pulp to special treatments with acid or hypochlorite under controlled pH conditions prior to an alkaline peroxide treatment, as more fully described in applications for patent by Robert L. McEwen, Serial No. 572,255, filed January 10, 1945, now Patent No. 2,465,327, and Serial No. 576,359, filed February 5, 1945 now abandoned.

When attempts are made to bleach ground

2

wood pulp with bleaching solutions of peroxide and silicate in the manner employed upon chemical pulp as in Heritage or Kauffmann and Wolfe, little or no bleaching is obtained except with enormous consumption of peroxide.

It is an object of the present invention to brighten pulp webs which contain ligneous or other non-cellulosic matter in considerable amounts by the employment of an alkaline peroxide solution.

It is therefore an object of the invention to obtain a relatively high degree of brightening efficiency upon webs containing relatively high proportions of ligneous matter or considerable ground wood pulp.

It is also an object of the invention to perform a brightening of webs containing ligneous matter on paper machines of conventional construction.

In accordance with the present invention, webs of pulp or paper sheets containing ground wood fibers, that is, matted or felted sheets of vegetable fiber which have been formed on a screen from a water suspension, are treated with an alkaline peroxide solution containing a phosphate and the sheet or web permitted to bleach or brighten by the subsequent conjoint action of the peroxide and phosphate. The solution may be applied to one or both sides of the web or sheet and in sufficient quantities to produce the degree of bleaching desired. The sheet after application of the aqueous solution of peroxide containing a phosphate should contain from about 12% to 250% of water based on the dry weight of the pulp whereby the sheet is still self-sustaining while the alkaline aqueous solution of the peroxide and phosphate should possess an initial pH of from 9.5 to 11.5. The phosphates employed should be such that the solutions fall within the alkaline pH range 9.5 to 11.5, and although trisodium phosphate is the preferred phosphate, it will be understood that disodium phosphate may be employed, as well as pyrophosphates, tetr phosphates, and various mixtures of these phosphates, the prime consideration being that the initial pH of the phosphate solutions used falls in the preferred pH limits. Although hydrogen peroxide as such is preferred as the addition peroxide in order to obtain the desired pH, it will be understood that aqueous peroxide solutions may be employed which were prepared by the use of alkali metal peroxides, alkaline earth metal peroxides and other percompounds which can be converted in aqueous solution to produce active oxygen (or hydrogen peroxide).

After the alkaline peroxide solution containing

a phosphate has been applied to the pulp web or paper sheet, the pH of the resulting sheet will be found to be about 9.5 to 10.5, and as bleaching proceeds, the pH of the sheet will have been found to drop to a point below about pH 8. The bleaching may be effected at room temperature or at elevated temperatures under conditions wherein the action of the peroxide solution is accelerated by evaporation of considerable moisture from the matted or felted sheet made of fibers containing groundwood. The method of applying the bleaching solution is any method providing even distribution of the solution over the surface of the sheet to be treated, and such application may be made by means of a spray or by padding rolls, although it will be found in practice that the latter method will generally be preferred.

Although sodium silicate is preferred as an addition agent generally when employing hydrogen peroxide for the bleaching of cellulosic materials, it is quite surprising that when such solutions are employed to brighten unified webs or sheets of lignin containing materials and the solution dried into the sheet, little or no increase in brightness of the sheet results and in some instances the color of the paper is actually lower. It is also very surprising and not fully understood, that radically different results are obtained on the same types of materials containing lignin when silicate of soda is used in conventional pulp bleaching methods as contrasted to the web bleaching method. It was just as unexpected that phosphates used in conventional pulp bleaching methods produced very poor results whereas extremely good results were obtained when used for the web bleaching method. Other alkalies such as caustic soda, soda ash, behaved very similarly to silicate of soda when used in the bleaching of lignin containing webs. Where sheets containing substantially no lignin are treated with peroxide solutions containing silicate, excellent brightening action results.

The following examples are given as merely illustrative of the invention and are not to be deemed limitative thereof, as it will be understood that departures in concentration, time of treatment, speed of operation, etc., may be varied considerably without departing from the scope of the invention:

Example I

A pulp furnish containing 60% unbleached groundwood, 40% unbleached sulfite along with clay, size and alum was formed into a sheet on the wire of a paper machine, passed through presses and at 35% consistency impregnated with the bleaching solution prior to passage of the sheet over the driers. The solution consisted of hydrogen peroxide and trisodium phosphate in a concentration which resulted in the application to the sheet of 2.0% hydrogen peroxide (27.5%) and 2.0% trisodium phosphate, both based on the dry weight of the pulp. The sheet was run at 200 feet per minute and was on the driers for a period of 1 minute. After passage over the driers, brightness determinations were made on the paper sheet and were found to be an average of 65.3 units as measured on a Hunter photoelectric colorimeter. Brightnesses made on paper prepared in the same way from the same lot of pulp which had not been impregnated with the bleaching chemicals was found to average 55.8 units when measured on the same instrument.

Thus a brightness increase of 9.5 brightness units was obtained by this treatment.

Example II

As an example of the inefficiency of previous known formulations when carried out in the same manner as above described is shown in the following example: A pulp sheet prepared from the same lot of pulp as described above and formed in the same manner, was impregnated with a solution of hydrogen peroxide and silicate of soda at a concentration which permitted the impregnation of the sheet with 2% hydrogen peroxide (27.5%) and 0.7% silicate of soda (42° Bé.). After this sheet was impregnated and passed over the driers as in Example I, the dried sheet was measured for brightness in the same manner as in the former example. This sheet was found to have a brightness of 56.3 units whereas the untreated sheet had a brightness of 55.8, thus a brightness increase of only 0.5 brightness units was obtained.

In order to show the unusual effect of peroxide solutions containing phosphates when dried in the pulp sheet, Example III is given which will contrast with alkalies other than phosphates used in the similar manner (as shown in Examples IV and V).

Example III

A pulp sheet containing 70% unbleached sulfite and 30% groundwood was formed on a paper machine and impregnated with a peroxide solution of such concentration that 1% hydrogen peroxide (27.5%) and 1% trisodium phosphate were applied to the sheet on a dry basis. Application was made to one surface, and the sheet was dried after impregnation. The brightness of the bleached sheet was found to be 65.5 as measured on a photoelectric colorimeter, whereas the untreated sheet had a brightness of 55.5, thus a brightness increment of 10.3 units was obtained.

Example IV

A pulp sheet, as in Example III, was impregnated on one surface with a solution of such a concentration that 1% hydrogen peroxide (27.5%) and 1% caustic NaOH were applied to the sheet on a dry basis. After drying, the sheet was measured for brightness and was found to be 53.7. Thus a loss of 1.5 points resulted.

Example V

A pulp sheet, as in Examples III and IV, was treated with a solution of suitable concentration such that 1% hydrogen peroxide (27.5%) and 0.45% sodium carbonate were added, based on the weight of the sheet. After drying, the sheet was measured for brightness in the same way as described heretofore and was found to be 56.6 or a brightness increment of only 1.4 brightness units.

From the foregoing, it will be apparent that the conjoint action of peroxide and phosphate is unique in its effect upon webs or sheets containing fibers made from lignin containing pulp, such as groundwood and therefore which contain substantial proportions of the natural in-crustants of the wood. In general, the lignin content is above about 5 to 6% by weight based on the dry fiber content of the sheet.

What is claimed is:

1. The method of bleaching ground wood fibers which comprises felting the fibers into a web from a water suspension containing such fibers,

2,510,595

5

dewatering the web to a water content of less than about 250% on an oven dry pulp basis whereby the web is self-sustaining and thereafter applying to at least one face of the pulp web sufficient of an aqueous alkaline bleaching solution to produce the desired degree of bleaching in the web, said solution consisting of hydrogen peroxide and a soluble phosphate of an alkali metal as the essential ingredients, the latter compound producing a pH therein in the range pH 9.5 to 11.5.

2. The method of bleaching ground wood fibers which comprises felting the fibers into a web from a water suspension containing such fibers, dewatering the web to a water content of less than about 250% on an oven dried pulp basis whereby the web is self-sustaining and thereafter applying to at least one face of the pulp web sufficient of an aqueous alkaline bleaching solution to produce the desired degree of bleaching in the web, said solution consisting of hydrogen peroxide and a soluble phosphate of an alkali metal as the essential ingredients, the latter compound producing a pH therein in the range pH 9.5 to 11.5 and subsequent to such application removing additional water from the web by evaporation.

ROBERT L. McEWEN.
FRED R. SHELDON.

6

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