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2,822,236

PROCESS OF MAINTAINING BRIGHTNESS IN HIGH DENSITY WOOD PULP HAVING A pH 6-10 BY ADDING HYDROGEN PEROXIDE AND COMPOSITION PRODUCED THEREBY

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This invention pertains to a method of making brightness-stable pulp and more particularly to a method of making bleached chemical pulps brightness-stable during storage.

In pulp and paper mill practice, paper making pulps are ordinarily dried or dewatered to a relatively high density to prepare them for storing or economical shipping. At this stage, the pulps have generally been bleached to the brightness level necessary to make them suitable for preparing a paper furnish. In other words, the pulps at this stage are ordinarily at the brightness level of at least 50 to 60 GE units and most often at the brightness level of about 70 to 85 GE units. Pulp brightness normally is defined in terms of GE units, a term which refers to units of reflectance as measured by a General Electric reflectance meter. Brightness values herein were determined according to TAPPI Standard Test Method T217m-48. At the same time the pulps will be at a relatively high density, generally in the range of 75% to 90%. Attainment of the necessary brightness level in bleaching chemical pulps is obviously connected with appreciable bleaching costs and it is very important that a brightness level once obtained in bleaching the pulp be preserved so that a pulp bleached, for example to a brightness of 80 GE units will show substantially the same brightness after prolonged shipping and storing periods preceding the time at which the bleached pulp is actually used in making up a paper furnish. Any loss of brightness during that period is objectionable and represents partly a wasted effort in bleaching and partly a serious inconvenience to the paper maker.

Overbleaching of the pulp to take care of brightness loss during storage or shipping is also objectionable, partly because of cost but mainly because overbleaching is apt to cause fiber damage.

It is, however, well known that bleached chemical pulps, dried or dewatered to a high density for storing and shipping purposes, will ordinarily suffer a brightness decrease. This brightness decrease is particularly pronounced in the case of semi- or fully-bleached chemical pulps in the brightness range of about 70 to 85 GE units. Another factor contributing to brightness loss is the heat retained in baled bleached pulp that has been dried on conventional equipment. The brightness loss in such pulp is still more pronounced than the brightness loss in bleached pulps which are either stored moist or partially dried at low drying temperatures prior to storage. All in all, the problem of preserving the obtained brightness during storage and shipping of such pulp is an important one to the pulp and paper-making industry.

We have now found that the bleached brightness of chemical pulps brought to a relatively high density after bleaching can be maintained if there is present in the bleached high density pulp a certain very small amount of hydrogen peroxide and if, moreover, the pulp at this stage is within a critical pH range. Neither the presence of hydrogen peroxide alone nor pH adjustment alone will

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maintain original bleach brightness of the bleached high density pulp. It is essential that both hydrogen peroxide content of the bleached high density pulp and its pH are at a certain critical level just prior to storage or shipment.

In accordance with the method of this invention, pulps will maintain their initial brightness for considerable periods of time if the pulp pH is between about 6 and 10 while approximately 0.02 to 0.25% H_2O_2 by weight is present in the pulp. Such pulps may be stored or shipped and after 4 to 6 weeks will be found to possess their original brightness level.

The particular pulp pH required will depend to an extent on the pulp type, pulp brightness and pulp purity. Pulps of higher brightness and higher purity will preferably be prepared to fall in the lower part of the pH range indicated; whereas pulps of lower brightness and lower purity, for instance pulps containing quantities of non-cellulosic matter, will preferably fall in the higher part of the pH range. The particular pH to be chosen within the range given will also be affected by the mode of treatment and the amount of hydrogen peroxide used. In the examples of the disclosure the pH values given have been determined by reslurrying the pulp to a density of about 1 to 3% and measuring the pH in that slurry by electro-metric means.

Ordinarily hydrogen peroxide will be used as the oxidizing agent in this method but other percompounds yielding hydrogen peroxide when dissolved in water may also be used. The amount of hydrogen peroxide which is required to maintain pulp brightness in the sense of this invention is approximately between 0.02 and 0.25% H_2O_2 by weight.

Ordinarily, an alkali will be required in addition to the hydrogen peroxide to adjust the pulp pH to the preferred range of 6 to 10. The nature of the alkali to be used is not critical and alkalies such as pyrophosphate, tri-polyphosphate, other phosphates, borates, sodium silicate, sodium carbonate, or sodium hydroxide may be used.

If desired, auxiliary agents such as sequestering agents, wetting agents or the like may be used in addition to the alkali.

Because of the wide variations in properties of bleached chemical pulps, preliminary tests will often be necessary to determine the hydrogen peroxide and alkali requirements sufficient to produce in a given bleached high density pulp the hydrogen peroxide and pH level suitable for preserving the initial bleached brightness. The various examples given later illustrate in detail the method of this invention but, although the H_2O_2 and pH requirements will always be within the range specified above, optimum results may be obtained for a given pulp only after preliminary testing.

The method of this invention is generally applicable to all commercial types of bleached chemical and bleached semi-chemical pulps such as kraft, soda, or sulfite pulps.

The particular manner in which the hydrogen peroxide and, if required, alkali or auxiliary chemicals, is incorporated into the bleached high density pulp are not critical and no particular method of incorporating these agents into the pulp is claimed here. The hydrogen peroxide and the alkali, if required, may be incorporated into the bleached pulp during or following mechanical dewatering or if the pulp is subjected to a drying operation, these chemicals may be incorporated before, during or after drying the pulp. The only critical requirement is that the bleached high density pulp contain the prescribed amount of H_2O_2 and have the proper pH before baling or otherwise readying the pulp for storage and/or shipment.

The chemicals required by the method of this invention will ordinarily be used in aqueous solutions. These

solutions may be introduced into the pulp by any conventional blending equipment by mechanical pressure rolls or by spraying. The chemicals can also be introduced into the pulp by exposing the pulp to a mist or vapor of those solutions. Wherever the presence of alkali is necessary for pH adjustment; that is to say, wherever more than one chemical is to be introduced into the pulp, the chemicals may be introduced in separate steps instead of being introduced jointly in form of a mixed solution.

The bleached pulp to be treated in accordance with this invention may be in sheet form or in crumb form and the mode of application of chemicals will obviously be dictated by the pulp form; that is, sheet or crumb. However, in either case the actual choice of mode of application of chemicals is not critical and any mode of application suitable or desirable under the particular operating conditions prevailing may be chosen.

As further illustrated by the examples, the process of this invention results in substantially maintaining the bleached brightness of the pulp particularly in the pulp brightness ranges considered here; namely, from about 50 GE units to 80 GE units. The method of invention will not appreciably, if at all, increase pulp brightness beyond the initial bleached brightness of the pulp but provides a simple, efficient and economical way substantially to preserve and maintain the brightness obtained in initial bleaching of the pulp regardless of the particular bleaching method employed and whether the bleachant was chlorine or peroxide or a combination of chlorine or peroxide bleaching steps.

Example 1

Bleached soda pulp of 81.4 GE units brightness was mechanically dewatered, passed through a pulp drying machine and then baled. After a storage period of 3 weeks, the brightness of this baled pulp had dropped to 78.5 GE units.

Another sample of the same bleached soda pulp of 81.4 brightness was mechanically dewatered. Hydrogen peroxide and sodium tripolyphosphate were then incorporated into the pulp which substantially was dried and at this point contained 0.025% H_2O_2 on an O. D. basis while the pulp pH was 6.7. After baling, the pulp was stored for three weeks at the end of which time the pulp brightness was 81.7 or substantially the same as the initial brightness.

Example 2

Another sample of the same soda pulp, as used in Example 1, with a bleached brightness of 81.4 was again mechanically dewatered. Hydrogen peroxide and sodium pyrophosphate were then incorporated into the pulp. The pulp was then dried to approximately 75% density and subjected to an accelerated aging test by being exposed for 16 hours in a closed container to a temperature of 60° C. Before aging, the pulp was at a pH 6.5 and contained 0.075% H_2O_2 on a dry pulp basis. After the aging test, the pulp brightness was 81.8, whereas a similar sample of the same bleached soda pulp aged without hydrogen peroxide treatment dropped in brightness upon aging to 77.7.

A sample of the same soda pulp containing, before aging, 0.075% H_2O_2 but having a pH of 5.5 showed brightness drop from an initial brightness of 81.4 to 77.3 during the accelerated aging test. This indicates the importance of proper pulp pH.

Example 3

Southern pine kraft pulp was bleached in a conventional manner to 84.1 GE units brightness and dewatered. It was then dried to approximately 75% density, baled and stored for 2 weeks. Due to the drying treatment, initial baled pulp temperature was approximately 60° C. and this temperature dropped to about 25° C. during the storage period. At the end of the

storage period, original pulp brightness had dropped from 84.1 to 79.8.

A sample of the same bleached kraft pulp was mechanically dewatered. Hydrogen peroxide, sodium triphosphate, and a sequestering agent (the sodium salt of ethylenediaminetetra-acetic acid) were then incorporated into the pulp. The pulp was then dried to approximately 75% density, baled, and stored for 2 weeks. The initial pulp temperature was again about 60° C. and dropped to about 25° C. during the storage period. The baled pulp contained 0.03% H_2O_2 and showed a pH of 7.4. Pulp brightness after storage was 84.2 or essentially the same as the original pulp brightness of 84.1.

Example 4

Kraft pulp bleached in a conventional manner was dried to approximately 80% density, at which time the brightness was 81.4. It was then baled and stored for 4 weeks. At that time the brightness had dropped to 79.2.

Another sample of the same kraft pulp was dried in a dryer to approximately 80% density. The pulp leaving the dryer was sprayed with an aqueous solution of hydrogen peroxide and thereafter contained 0.13% H_2O_2 on an O. D. basis while pulp pH was 8.2. After a 4 week storage period, pulp brightness was still 81.8.

Example 5

Kraft pulp bleached to 83.8 brightness was sheeted and passed through a conventional wet press and then pressed again to about 48% density. The sheet was passed through a dryer, baled, and stored for 26 days. At the end of this storage period, original brightness of 83.8 had dropped to 78.3.

A sample of the same kraft pulp was dewatered by pressing to form a sheet of about 40% density. Into this sheet were then incorporated sodium silicate, sodium hydroxide and a sequestering agent (the sodium salt of ethylenediaminetetra-acetic acid). Then the pulp was passed through a wet press which further increased pulp density to about 48% and at this stage, hydrogen peroxide was incorporated in the pulp sheet which was then passed through a conventional dryer. At this point, the pulp contained 0.07% H_2O_2 and had a pH of 8.7. After baling, the pulp was stored for 26 days at the end of which period pulp brightness was found to be 84.8 or substantially the same as the initial pulp brightness.

Example 6

Sulfite pulp bleached in a conventional manner to a brightness of 85.8 and pressed and dried to approximately 80% density was stored for 8 days. At this time, original pulp brightness of 85.8 had dropped to 79.9.

A sample of the same bleached sulfite pulp was pressed and hydrogen peroxide and sodium tripolyphosphate were incorporated into the pulp which was then dried to approximately 80% density. The pulp before storage contained about 0.1% H_2O_2 and had a pH of about 7.3. After 8 days' storage the pulp brightness was found to be 85.8, the same as the initial pulp brightness.

Example 7

Northern hardwood kraft pulp bleached in the conventional manner to about 84 brightness was dewatered and dried to about 75% density, then baled and stored. After storage for 24 days, pulp brightness had dropped from an original 84 to 78.7.

Another sample of the same bleached kraft pulp was dewatered. Hydrogen peroxide, sodium silicate, and sodium hydroxide were incorporated into the pulp before drying to about 75% density. At this point the pulp contained 0.07% H_2O_2 and showed a pH of 9.7. After baling and storing for 24 days, the pulp showed a brightness of 85.6 indicating that original brightness had remained substantially unchanged.

Example 8

A sample of sulfite pulp of 60 brightness was dewatered to about 35% density and then dried at 120° C. to 75% density. Immediately after drying, the pulp was subjected to an accelerated aging test by being exposed in a closed container for 32 hours to a temperature of 50° C. The original brightness of 60 dropped during that aging test to 57.9.

Another sample of the same pulp was dewatered to about 35% density and hydrogen peroxide, sodium silicate, and sodium hydroxide were incorporated before drying the pulp at 120° C. to about 75% density. At this point the pulp contained 0.15% H₂O₂ and had a pH of 8.9. After subjecting this pulp to the same aging test, a brightness of 61.1 was found indicating that original brightness had been maintained.

Example 9

A sample of neutral sulfite semichemical pulp of about 50 brightness was dewatered to 35% density and then dried at 120° C. to result in a density of approximately 75%. This pulp was then subjected to an accelerated aging test by being exposed in a closed container for 16 hours to a temperature of 60° C. The brightness was found to have dropped to 47.

Another sample of the same pulp was also dewatered to 35% density and then hydrogen peroxide and sodium tripolyphosphate were incorporated into the pulp prior to drying at 120° C. to about 75% density. At this time, the pulp contained 0.12% H₂O₂ and showed a pH of 6.7. This pulp was also subjected to the aging test. After aging, the pulp brightness was found to be 50.5 indicating that original brightness had been well maintained.

What is claimed is:

1. The method of maintaining during storage the brightness level in a bleached wood pulp from the group consisting of bleached chemical and bleached semi-chemical wood pulps, said pulp having been bleached with an

amount of a bleach from the group consisting of chlorine bleaches, peroxide bleaches and combinations of chlorine and peroxide bleaches, to provide in said pulp a brightness level of 50 to 85 GE units which comprises dewatering said pulp to a density of 75% to 95%, incorporating in said pulp prior to storage, 0.02% to 0.25% hydrogen peroxide on a dry pulp weight basis and adjusting the pH in said pulp to a pH in the range 6 to 10.

2. The method of maintaining during storage the brightness level in a bleached wood pulp from the group consisting of bleached chemical and bleached semichemical wood pulps, said pulp having been bleached with an amount of a bleach from the group consisting of chlorine bleaches, peroxide bleaches and combinations of chlorine and peroxide bleaches, to provide in said pulp a brightness level of 50 to 85 GE units which comprises dewatering said pulp to a density in the neighborhood of 35%, incorporating in said dewatered pulp, from 0.02% to 0.25% hydrogen peroxide on a dry pulp weight basis and adjusting the pH of said pulp to a pH in the range pH 6 to pH 10 and then, prior to storage, drying said pulp to 75% to 95% density.

3. A new composition of matter, a bleached wood pulp from the group consisting of bleached chemical and bleached semi-chemical wood pulps, said pulp having been bleached with an amount of a bleach from the group consisting of chlorine bleaches, peroxide bleaches and combinations of chlorine and peroxide bleaches to provide in said pulp a GE brightness of 50-85, said pulp having a density of 75% to 95%, a pH in the range pH 6 to pH 10 and having 0.02% to 0.25% hydrogen peroxide on a dry pulp basis whereby the brightness of said pulp is maintained during storage.

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