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PULPING OF LIGNOCELLULOSIC MATERIAL

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This invention relates to the pulping of lignocellulosic material to remove the lignin therefrom and relates more particularly to the pulping of lignocellulosic material with peracetic acid.

An important object of this invention is to provide a novel process for the pulping or bleaching of lignocellulosic material which will give a high yield of cellulose requiring little or no further purification.

Another object of this invention is to provide a process for pulping or bleaching lignocellulosic material with peracetic acid.

Other objects of this invention will be apparent from the following detailed description and claims.

According to the present invention, lignocellulosic materials, for example, wood are pulped with peracetic acid to produce a high yield of pulp that has a good white color and is substantially free from lignin. For many purposes, such as the manufacture of glassine, little or no additional purification of the said pulp is required because of its good color and high purity. For other purposes, such as the preparation of high quality and special purpose papers of which photographic paper is an example, it may be necessary to subject the pulp to a mild alkaline extraction with dilute aqueous caustic. In those cases where the specifications which the pulp must meet are quite stringent, as for pulp that is to be used in the manufacture of cellulose derivatives, it may be necessary to extract the pulp with aqueous caustic at elevated temperatures or in several stages in order to obtain a product having the desired properties. It may also be necessary, where pulps of exceptional brightness are not required. All these treatments subsequent to the pulping step itself may be quite mild as compared with the treatments to which pulp must be subjected when it has been prepared from lignocellulosic materials by conventional pulping processes such as the sulfite process. As a result, the cost of such subsequent treatments is held to a minimum as is the loss in yield and the further degradation of the cellulose molecules.

The pulp produced by the process of this invention beats up very readily so that it may advantageously be employed for the manufacture of parchment and glassine type of papers and will require only a minimum of beating time to prepare it for such use.

Lignocellulosic materials to which the process of this invention is applicable are primarily woods, including softwoods and hardwoods. It may also be applied to the pulping of other lignocellulosic materials such as straws, grasses and the like. In treating woods in accordance with this invention, there may be employed chips of the wood as is the general practice in the pulping of wood by other processes. However, it has been found that it is possible to obtain improved results if there are employed thin wafers of wood in which no portion of the wood is more than 0.015 inch from a surface thereof. When such thin wafers are employed, it is possible to complete the pulping of the wood in shorter periods of time, at lower temperatures and with reduced concentrations of reagents

as compared with the use of conventional chips. With the milder pulping conditions that are possible using thin wafers, there can be obtained a highly purified pulp, as measured by the permanganate number thereof, having a cupriethylenediamine viscosity twice as great as when conventional chips are pulped to the same purity showing that there is materially less degradation of the cellulose in the wafers. Extremely valuable results can also be achieved when the wood being pulped has been defibred to produce bundles of fibers by a suitable mechanical process. For example, there may be employed wood that has been defibred by the Asplund process in which wood chips are first heated with steam to an elevated temperature and are then passed between a pair of discs, one stationary and the other rotating where the chips are progressively broken to bundles of fibers, individual fibers and fiber fragments. Other processes that may be employed to defiber the wood include heating the wood in a pressure vessel to very high pressures in the neighborhood of 1000 pounds per square inch gage with steam and then exploding it from the vessel. The defibred wood responds very rapidly to the process of this invention so that it is possible to obtain therefrom a highly purified pulp in an extremely short period of time. Surprisingly enough, sawdust is not pulped rapidly with the process of this invention and requires a longer pulping period than wood chips.

The peracetic acid that is employed in carrying out the process of this invention should have a concentration of between about 10 and 40% by weight, calculated before dilution with the moisture contained in the lignocellulosic material. The lower concentrations of peracetic acid are especially useful in treating wood wafers or defibred wood. The liquid to lignocellulosic material ratio in carrying out the process should be between 8:1 and 20:1 calculated on a dry lignocellulosic material basis. The pulping may be carried out at temperatures between 60° C. and the boiling point of the peracetic acid at atmospheric pressure or, preferably, at temperatures between 60 and 100° C. One of the advantages of this process is that it may be carried out at atmospheric pressure, eliminating the need for the heavy, expensive pressure vessels that have previously been employed for the pulping of lignocellulosic materials. However, if desired, the pulping may be carried out at superatmospheric pressures. The time required for the pulping will depend on the physical state of the lignocellulosic material, the results desired and the precise conditions employed during the pulping and may range from as little as 6 minutes, or less, to 360 minutes, or more.

The process of this invention may be carried out on a batch basis. However, because it is possible to effect the pulping at atmospheric pressure and to complete the pulping in relatively short periods of time, this process lends itself especially well to being carried out in a continuous manner. In such case, the lignocellulosic material and the peracetic acid may be mixed in any suitable manner and then caused to move through a reactor for the desired period of time.

When the pulping operation has been completed, the pulp is separated from the liquid and washed. For some purposes, the pulp may be used without further purification or bleaching. For other purposes, as pointed out more fully above, the pulp may be purified, bleached or both purified and bleached to prepare it for further use.

The following examples are given to illustrate this invention further:

Example 1

Hemlock chips containing 48.5% by weight of moisture are screened on a chip size classifier and those chips selected which pass through a 0.75 inch screen and are

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retained on a 0.5" screen. (The screen size is a measure of the diameter of the holes in the screen.) The chips are immersed in aqueous 26% by weight peracetic acid also containing 66% by weight of water plus acetic acid, 5.4% by weight of hydrogen peroxide and 2.5% by weight of sulfuric acid (total active oxygen 8.1%), employing a liquid to chip ratio of 9.8 to 1 (dry wood basis). The charge is brought to 100° C. at atmospheric pressure and held at this temperature for 2 hours. Then, the pulp is washed with water and dried. There is obtained a 44% by weight yield of a pulp having a good white color. The pulp has a viscosity in cupriethylenediamine of 20 (TAPPI T230), a permanganate number of 1.7 and an alpha cellulose content of 56%.

Example II

Hemlock wafers 0.02 to 0.03 inch thick and containing 41.9% by weight of moisture are immersed in aqueous 39% by weight peracetic acid also containing 34% by weight acetic acid, 13% by weight of water, 1% by weight of sulfuric acid and 6.3% by weight of hydrogen peroxide (total active oxygen 11.3%), employing a liquid to wafer ratio of 8.7 to 1 (dry wood basis). The charge is held at a temperature of 100° C. under atmospheric pressure for 6 minutes, washed with water and dried. There is obtained a 51% by weight yield of a pulp having a good white color. The pulp has a viscosity in cupriethylenediamine of 39, a permanganate number of 2.7 and an alpha cellulose content of 79%.

Example III

Asplund fibers containing 66.0% by weight of moisture prepared from Douglas fir chips are immersed in aqueous 25% by weight peracetic acid also containing 64% by weight of acetic acid plus water, 2.5% by weight of sulfuric acid, 8.3% by weight of hydrogen peroxide (total active oxygen 9.2%), employing a liquid to fiber ratio of 19.4 to 1 (dry wood basis). The charge is brought to 60° C. and held at this temperature under atmospheric pressure for 30 minutes, washed with water and dried. There is obtained a 56% by weight yield of a pulp having a good white color. The pulp has a viscosity in cupriethylenediamine of 5, a permanganate number of 2.6 and an alpha cellulose content of 61.1%.

Example IV

Hemlock chips containing 42.5% by moisture and screened as described in Example I are immersed in aqueous acetic acid, water, sulfuric acid, and hydrogen peroxide to give peracetic acid containing 8.8% total active oxygen employing a liquid to chip ratio of 16 to 1 (dry wood basis). The chips are digested for 4 hours under

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atmospheric pressure at a temperature between 90 and 100° C., washed with water and dried. There is obtained a 50.6% by weight yield of a pulp having a good white color. The pulp has a viscosity in cupriethylenediamine of 23, a permanganate number of 1.1 and an alpha cellulose content of 60.7%.

The pulp, without further treatment, has a Canadian Freeness of 505. When formed into a sheet it has a burst factor of 54.1, a tear factor of 65.8 and a folding endurance of 105.

It is to be understood that the foregoing detailed description is merely given by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention, what we desire to secure by Letters Patent is:

1. Process which comprises pulping wood particles selected from the group consisting of wood wafers in which no portion of the wood is more than 0.015 inch from a surface thereof and defibred wood with peracetic acid having a concentration of between about 10 and 40% by weight.

2. Process which comprises pulping wood wafers in which no portion of the wood is more than 0.015 inch from a surface thereof with peracetic acid having a concentration of between about 10 and 40% by weight at a temperature of between about 60 and 100° C.

3. Process which comprises pulping defibred wood with peracetic acid having a concentration of between about 10 and 40% by weight at a temperature of between about 60 and 100° C.

4. Process which comprises pulping wood with peracetic acid having a concentration of between about 10 and 40% by weight at a temperature of between about 60 and 100° C. employing a liquid to wood ratio of between 8 to 1 and 20 to 1.

5. Process which comprises pulping wood wafers in which no portion of the wood is more than 0.015 inch from a surface thereof with peracetic acid having a concentration of between about 10 and 40% by weight at a temperature of between about 60 and 100° C. employing a liquid to wood ratio of between 8 to 1 and 20 to 1.

6. Process which comprises pulping defibred wood with peracetic acid having a concentration of between about 10 and 40% by weight at a temperature of between about 60 and 100° C. employing a liquid to wood ratio of between 8 to 1 and 20 to 1.

References Cited in the file of this patent

UNITED STATES PATENTS

2,394,989	Dreyfus	Feb. 19, 1946
2,511,096	Bate	June 13, 1950

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