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TREATMENT OF PULP AND PRODUCT OF SAME

No Drawing. Application filed August 5, 1927. Serial No. 210,999.

This invention relates to a treatment of cellulose pulp intended to permit optimum results and highest economic value to be realized from the use of such pulp as a raw material in the manufacture of paper, cellulose derivatives and other cellulosic products.

Pulp liberated from raw cellulosic material such as wood is frequently characterized in terms of average fiber length, but if the pulp is closely examined, it will be observed that it consists of fiber units of random sizes, some being above and some below the average. The long-fibered portion of pulp has characteristics quite distinct from its short-fibered portion. For instance, if wood pulp refined to high alpha cellulose content is separated or classified into, say, two equal portions, one containing the longer fibers and the other the shorter ones together with fiber fragments and cellulose in colloidal condition, these portions will have distinctly different characteristics. The long-fibered portion is very free and tough being comparable to high grade rags in stability, and, when made into paper, in strength, tear resistance, folding endurance, etc. Moreover, it yields derivatives of a stability and purity substantially equal to those producible from high grade cotton, even though the pulp from which it was separated is inferior to cotton. Hence, as disclosed in application, Serial No. 207,314, filed July 20, 1927, by Milton O. Schur and Robert A. Webber, when it is desired to produce high grade drivatives from wood pulp, it is advantageous to separate the long-fibered portion from the rest of the pulp and convert this portion alone. The short-fibered portion possesses only moderate strength, but is easy-beating, this latter characteristic being ascribable to the presence therein of most of the colloidal and hydrated cellulose in the original pulp.

One of the drawbacks to a process involving the classification of pulp into portions of different fiber lengths is that while the long-fibered portion is improved in quality by separation from the short-fibered portion, the remaining short-fibered portion is impaired in quality. Thus, most of the impurities present in the pulp, particularly specks and impurities of a resinous character including resins, gums, waxes and fats, remain in the short-fibered portion, so that it can be employed as a raw material only in the manufacture of comparatively inexpensive papers and derivatives. Even in the case of pulp refined to high alpha cellulose content, the short-fibered portion, if removed from the long-fibered portion, is unsuitable for the preparation of high grade derivatives, for most of the impurities present to the extent of, say, about 0.2% to 0.4% in the original pulp become concentrated in this portion. The retention of the impurities by this portion is apparently attributable to the high adsorptivity of cellulose fiber in finely divided condition, particularly in the form of fiber fragments and colloidal cellulose. It is hence not surprising that the short-fibered portion of pulp preferentially or selectively adsorbs the impurities, the long-fibered portion being far less contaminated.

While the percentage of impurities in the short-fibered portion of a pulp depends largely upon its size relative to the pulp as a whole, the chemical processing which the pulp has received, and upon the character of the original wood, nevertheless this portion, particularly when of small relative size, is rich in specks and refractory coloring matter, and high in ash content. It is also sensitive to heat when made into a sheet and dried on a steam drum under conditions simulating pulp and paper mill practice; it yields derivatives dark in color and comparatively unstable. Because of its instability and its short-fiber length, it can be used for the manufacture of only the poorer

grades of paper and derivatives. Nevertheless, where color or a high degree of purity in derivatives are of secondary consideration, low price being more important, as in the manufacture of cheap celluloid toys, advertising novelties, and the like, this short-fibered portion offers an attractive source of raw material. While the color may be brightened to a limited extent by the application of bleach, this tends to weaken the pulp, requires an extra bleachery, and at best is but a makeshift cure, for the pulp still retains an objectionable grayish cast, and is of inferior color stability.

It is the object of the present invention to produce from pulp long-fibered and short-fibered portions, each of which is better adapted to fill certain useful and valuable needs both in papermaking and in the preparation of cellulose derivatives than the original unclassified pulp, so that classification may increase not only the value of one portion, but of both portions. By removing these impurities, particularly those of a resinous character, before classification, or separation of the previously liberated pulp into its long and short fiber portions is effected, this object may be realized. More specifically, this object is attained by digesting the pulp in a saponaceous regent before classification into portions of different fiber lengths. Digestion of this character effects a dispersion or collodial solution of the resins, specks, and other impurities adsorbed mainly by the short-fibered portion, so that when the pulp is subsequently classified, this portion is substantially as white and stable as the long-fibered portion.

A process such as described finds important utility in the case of pulp which is being refined to high alpha cellulose content, for the product may be classified into two stocks of different fiber lengths, both of which are clean, white, and stable, possessing different characteristics and hence adapted for different uses. Thus, the long-fibered stock which is free and tough may be used as a rag fiber substitute in the manufacture of high grade writing bond, and ledger papers. It may also be used in the manufacture of high grade cellulose derivatives substantially equal to those producible from high grade cotton. The short-fibered portion is of good color and is easy-beating, and may be used to great advantage with difficultly beatable stocks, particularly rag stocks, to increase their beatability and hence enhance their suitability for papermaking. This portion is also well adapted for use as a raw material for the preparation of derivatives, as its short component fibers are of high reactivity and hence undergo quick reaction with converting chemicals.

The process of the present invention may be practised to advantage upon bleached sulphite or other wood pulp, but is particularly advantageous in the case of pulps refined to high alpha cellulose content and intended to supplant high grade cotton fiber as a raw material in the preparation of paper or derivatives. Soap-digestion in such case may be expediently performed while the pulp is undergoing a chemical refining which effects an increase in the alpha cellulose content of the pulp and its whitening. The pulp employed as a raw material may, for instance, be unbleached sulphite pulp containing resinous impurities to the extent of about 0.5% to 0.8%, or even higher, as determined by extraction from the fiber with organic solvents such as alcohol, ether, or chloroform. Such pulp may be refined by a series of chemical treatments, including a treatment with chlorine water, followed by alkaline digestion, and finally by bleaching. While we may soap-digest the pulp before or after any one of these treatments, such digestion may be expediently and economically performed while the pulp is being alkaline-digested and/or bleached, as this permits the stripping of resinous impurities and specks from the pulp without additional apparatus or time of treatment. If soap is added to the bleach liquor, it is preferable to use sodium base bleach, as the use of the usual calcium base bleach would result in the fixation of insoluble soaps on the fiber. The use of soap while the pulp is being hot-digested in an alkaline liquor has been found to be especially satisfactory, as this permits soap-forming substance to be used in lieu of previously prepared soap. In such case, sufficient alkali is used not only to effect the desired reaction on the pulp, but also to effect a saponification of the soap-forming substance. Moreover, under the influence of heat and the motion of the fibers, very effective deresinification and cleansing of the pulp is effected, as the resinous impurities are believed to exist in a softened or plastic condition quite amenable to the dispersing or solvent action of the soap solution. A specific series of chemical treatments may, for instance, be substantially as follows. Unbleached sulphite pulp is treated with about 2% to 4% of its weight of chlorine in the form of chlorine water, then is digested at a consistency of, say, 10% for five or six hours, at 212° F., in an alkaline liquor containing about 3% soap, saponifiable oil or fatty acid, sulphonated oil, rosin, or other soap-forming substance, and 8% caustic soda, based on fiber. The dark brown spent liquor of digestion containing the less-resistant beta and gamma celluloses, ligneous matter and the resinous impurities, is washed from the digested pulp, preferably with warm water. The pulp is then bleached at, say, 125° F. with

1% to 3% of its weight of calcium hypochlorite preferably in the presence of about 3/4% caustic soda, based on fiber. A bright white product results, high in alpha cellulose content, free from ligneous matter, low in copper number, and containing well under 0.1% of its weight of substance soluble in organic solvents.

When the product is classified after bleaching, the short-fibered portion is found to have a bright, pleasing white appearance, and to be of high color stability. Classification may be effected as by washing the pulp as a thin layer on fine mesh screen, say, 50-mesh Fourdrinier wire, or on plate having fine perforations, for instance, of .02 inches in diameter, as is more fully disclosed in application, Serial No. 755,730, filed December 13, 1924, by George A. Richter and Elwood Ebie. The long-fibered portion remains on the screen or plate, while the short-fibered portion passes through and may be recovered from the wash water on a thickener or other suitable means. Or the washing may be performed by repeatedly diluting the pulp with fresh filtered water and flowing it over wire or perforated plate maintained in an inclined position. Or it may be more expedient to effect a classification by removing the long-fibered portion by passing edge-presenting members capable of picking up the long fibers, through the pulp, and washing and recovering these fibers, the short fibers remaining in the residual pulp. This method is fully disclosed in application, Serial No. 206,477, filed July 18, 1927, by Robert A. Webber, and permits the removal of long-fibered stock from pulp in predetermined controlled amount.

Having thus described certain embodiments of this invention, it should be obvious to those skilled in the art that these are capable of change and modification without departing from the spirit or scope of invention as defined in the appended claims.

We do not herein claim features generic to our application, Serial No. 202,454, filed June 29, 1927, which discloses the soap-digestion of pulp to effect a removal of resins therefrom. Nor do we herein claim the subject matter of our application Serial No. 210,998, filed August 5, 1927, which discloses the separation or removal of fine and broken fibers from pulp, followed by the deresinification of the removed material in a saponaceous reagent.

What we claim is:

1. A process which comprises deresinifying previously liberated cellulose pulp, and then classifying the deresinified pulp into portions of different fiber lengths.

2. A process which comprises preparing a bleached and substantially deresinified wood pulp of high alpha cellulose content, and then separating the bleached pulp into long-fibered and short-fibered portions.

3. A process which comprises digesting pulp in a saponaceous reagent, washing the reagent from the pulp, and separating the washed product into portions of different fiber lengths.

4. A process which comprises digesting wood pulp in an alkaline liquor containing soap, washing the digested pulp, and classifying the washed product into long-fibered and short-fibered portions.

5. A process which comprises digesting wood pulp at elevated temperature in an alkaline liquor containing soap, bleaching the digested pulp, and classifying the bleached product into long-fibered and short-fibered portions.

6. A process which comprises digesting pulp in an alkaline liquor containing soap, bleaching the digested pulp in bleach liquor containing soap, and separating the bleached product into portions of different fiber lengths.

7. A process which comprises bleaching pulp in bleach liquor containing soap, and separating the bleached product into portions of different fiber lengths.

8. A process which comprises bleaching pulp in sodium base bleach liquor containing soap, and classifying the bleached product into long-fibered and short-fibered portions.

9. A process which comprises chlorinating unbleached pulp, alkaline-digesting the chlorinated pulp in a liquor containing soap, bleaching the digested pulp, and classifying the bleached product into long-fibered and short-fibered portions.

10. A process which comprises treating unbleached sulphite pulp with chlorine water, digesting the treated pulp at elevated temperature in caustic soda liquor containing soap, washing the digested pulp, bleaching the washed pulp, and classifying the bleached product into long-fibered and short-fibered products.

11. A process which comprises subjecting previously liberated wood pulp to the action of a reagent capable of deresinifying such pulp, and then separating the deresinified pulp into portions of different fiber lengths.

12. A process which comprises digesting pulp at elevated temperature in a liquor containing soap-forming substance and alkali in excess of that necessary to saponify said substance, and separating the digested pulp into long-fibered and short-fibered portions.

13. A product consisting of white, cellulose pulp containing well under 0.1% of its weight of substance soluble in organic solvents, said pulp being substantially free from fine, short and broken fibers.

14. A product consisting of a bright-

white, wood pulp refined to high alpha cellulose content and containing well under 0.1% of its weight of substance soluble in organic solvents, said pulp being substantially free from fine, short and broken fibers and being convertible into papers comparable in stability, strength, tear resistance and fold endurance to those made from high grade rags.

In testimony whereof we have affixed our signatures.

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