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PROCESSING OF CELLULOSE FIBER

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9 Claims. (Cl. 92—9)

This invention relates to the processing of cellulose fiber more particularly in the form of an aqueous pulp or fiber suspension to improve its suitability for use in various fields, including the papermaking and cellulose derivative industries. The cellulose fiber comprehended by the present invention is a preliberated pulp, for instance chemical wood pulp of the character of sulphite and kraft.

The various pulps which are liberated from raw cellulosic materials, notably wood, as by the sulphite, kraft or other chemical fiber-liberating process, are crude products in the sense that the pulp fibers have associated therewith a considerable amount of impurities, including lignin, resin, and beta and gamma celluloses, generally classified as non-alpha cellulose components. In order to realize best results through the use of such pulps as raw material in the papermaking and cellulose derivative industries, it is necessary to refine or purify the pulp fibers by dissolving out non-alpha cellulose components therefrom.

In my application Serial No. 480,198, filed September 6, 1930, (now Patent No. 1,880,046, dated September 27, 1932), I have described various processes of refining preliberated cellulose pulps involving the use of a wide variety or refining chemicals, including the borates, aluminates, and silicates. The present application is a division of the above-mentioned application and is intended to cover generically, as well as specifically, a refining process wherein any one or a combination of these three chemicals are employed to exert a refining action. As pointed out in my parent application, two important ends are realized when the aqueous pulp suspensions are digested at temperatures above about 150° C., for instance at 200° C. or at higher temperatures in the presence of such refining chemicals. In the first place, these chemicals bring about a sharp increase in the alpha cellulose content of fibers susceptible to refinement without, however, substantially injuring their papermaking or esterification characteristics. In the second place, they cause a lowering of the solution viscosity of the fiber, by which I mean that derivatives, such as nitrocellulose, prepared from the resulting fiber yield solutions of low viscosity in suitable solvent media. So, too, cuprammonium cellulose solutions or solutions of other cellulose derivatives prepared from the fiber have low viscosity. The effect of solution viscosity lowering is greater, the higher the temperature brought into play during the refinement of the pulp fibers. Thus, at temperatures of 200° C. or higher, a noteworthy reduction in the solution viscosity of the fibers is attained; and the aluminates are more effective in this respect than the borates or silicates.

The chemicals hereinbefore mentioned apparently have the common feature of generating a low hydroxyl ion concentration during the entire refining operation in the aqueous liquor in which the pulp fibers are suspended. It is evidently the hydroxyl ion which makes possible the purification of the fiber, for if the fiber is treated with water alone at about 200° C. or at higher temperature, the product is of relatively low alpha cellulose content. Evidently at about 200° C. or at higher temperatures, water hydrolizes the pentosans and less-resistant celluloses present in the fiber to form organic acids, which, if permitted to remain in the sphere of reaction, hydrolize the fiber. If, however, there is present in the sphere of reaction a borate, aluminate, or silicate, it serves as a buffer chemical to furnish progressively hydroxyl ions to neutralize the acids so as to promote the refinement of the fiber to high alpha cellulose content. The borates, aluminates, and silicates which I employ should be comparatively soluble and may conveniently and economically contain sodium as the basic or positive radical. In other words, I may employ the various sodium borates, sodium silicates, sodium aluminates, or other equivalents in the aqueous refining liquor.

An example of procedure falling within the purview of the present invention may be practised about as follows. A raw or unbleached sulphite pulp having an alpha cellulose content of 89%, a lignin content of 2%, a pentosan content of 3.5%, and a solution viscosity of 21.2 may be used as a raw material. The pulp may be digested for about two hours in a 1% to 2% solution of sodium tetraborate at about 200° C. The digested product, when washed free of digesting solution, will have an alpha cellulose content of about 96%, a lignin content of about 0.7%, a pentosan content of about 1.4%, and a solution viscosity of about 1.2. The washed pulp may then be bleached under conditions to preserve the alpha cellulose content at a maximum.

The same general procedure may be adopted when aluminates or silicates are used as the refining chemicals. These chemicals function much in the same way as the borates and, under a given set of conditions, conduce to refined fibers of lower solution viscosity. During the refining treatment, hydrolysis of the refining chemicals ensues, the aluminates, for instance, yielding aluminum hydroxide, which in itself acts as a

buffer to preclude undesirable action on the fibers. The refining chemicals of the present invention, especially the borates, are quite inexpensive. In fact, the borates are far less expensive than the stronger alkalies, such as caustic soda, heretofore used in refining pulps.

If desired, the pulp to be refined may be in partly or completely bleached condition. When a completely bleached or whitened pulp containing oxycelluloses is refined in accordance with the present invention, the refining liquor dissolves out oxycelluloses as well as other classes of non-alpha cellulose impurities.

In carrying out the high temperature digestions herein described, the digesters employed must be constructed to withstand pressures of about 200 to 230 pounds. The heating of the refining liquor may be accomplished by providing a digester with a circulating system such as is employed in the so-called indirect cook in making pulp, in which case the liquor is drawn from the bottom of the digester through a screen, is passed through a heater, and returned to the top of the digester. Or, if desired, screened liquor may be removed from the top of the digester, passed through a heater, and introduced into the bottom of the digester in order to induce a more positive circulation within the digester. If desired, however, both the pulp and liquor may be passed through a heater so as to dispense with a screening. When high pressure steam is unavailable for the heater, it may be desirable to bring the digester charge to as high a temperature as is possible with the available steam, and then to raise the charge to the highest temperature by a suitable electric heating unit, for instance an electric heater strapped about the digester.

Because of the lack of a generic term which embraces the three specific refining chemicals of the present invention, I am forced to adopt an indirect definition, which has been done heretofore in similar situations, to the effect that the refining chemical is one selected from a group consisting of the borates, aluminates, and silicates.

I claim:

1. A process which comprises digesting preliberated cellulose pulp at temperatures above about 150° C. in a solution of a chemical selected from a group consisting of the soluble borates, aluminates, and silicates.

2. A process which comprises digesting preliberated chemical wood pulp of the character of sulphite and kraft at temperatures above about 150° C. in a solution of a chemical selected from a group consisting of sodium borate, sodium aluminate, and sodium silicate.

3. A process which comprises digesting preliberated cellulose pulp at elevated temperature in water containing borates.

4. A process which comprises digesting preliberated but unrefined wood pulp at temperatures above about 150° C. in water containing borates.

5. A process which comprises digesting preliberated chemical wood pulp at temperatures above about 150° C. in a solution of sodium borate.

6. A process which comprises digesting preliberated cellulose pulp at elevated temperature in water containing aluminates.

7. A process which comprises digesting preliberated chemical wood pulp at temperatures above about 150° C. in a solution of sodium aluminate.

8. A process which comprises digesting preliberated cellulose pulp at temperatures above about 150° C. in water containing silicates.

9. A process which comprises digesting preliberated chemical wood pulp at temperatures above about 150° C. in a solution of sodium silicate.

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