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REFINED CELLULOSE PULP

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This invention relates to refined, cellulose pulps and more especially to refined, alkali-liberated pulps, such as sulphate of soda pulp. I have found that an alkali-liberated and alkali-refined pulp constitutes an advantageous raw material for making felts or webs which are to undergo impregnation with asphalt or other impregnants. This is particularly true when the raw pulp is refined or purified in a special way designed to develop the best physical as well as chemical properties therein.

This invention is centered about alkali-liberated and alkali-refined pulps to be used preferably in an unbleached condition. Aside from the fact that it is desirable for economical reasons to use the refined pulp in unbleached condition, when the felts made therefrom are to be impregnated with molten bitumen or asphalt as is done in the flooring and roofing industries, the unbleached condition of the pulp ensures greater stability against heating such as occurs during the treatment with the hot molten impregnant.

The pulp which I employ as the starting material is preliberated as ordinarily in a suitable alkaline cooking liquor, e. g., a so-called kraft liquor containing essentially caustic soda and sodium sulphide as the fiber-liberating chemicals or a so-called soda liquor containing essentially caustic soda as the fiber-liberating chemical. The raw cellulosic material, e. g., spruce wood, may be cooked in such liquors as ordinarily to accomplish the desired pulping or fiber-liberating action. Assuming that a kraft or soda pulp has thus been prepared, it will contain the various non-alpha cellulose components, including beta and gamma celluloses, pentosans, lignin, gums, resins, etc., which have survived the cooking operation and which detract from the stability and absorbency of the pulp sought in roofing, flooring, or similar felts to be fabricated from such pulp. Again, such raw pulps do not have those papermaking properties, especially tear resistance, prized in the flooring, roofing or analogous industries.

In accordance with the present invention, those physical and chemical properties sought in the pulp are attained by refining or purifying the preliberated pulp at about room or lower temperature conditions in a caustic soda or equivalent solution of alkali whose alkalinity is such that the desired refining or purifying action is secured without mercerizing the pulp fibers. Indeed, the alkalinity of the solution is maintained within two limits, namely, that at which mercerization of the pulp fibers takes place and that which does not comport with the desired purifying action on

the pulp. These limits will vary somewhat, depending upon the particular temperature at which the refining operation is conducted and upon the characteristics of the raw pulp. In any event, however, the refining liquor is used at a temperature not exceeding about 50° C., for it is only by operating below this temperature that one arrives at the desired kind of refined pulp. The fact is that when higher temperatures are used in the refining liquor, one does not realize as much removal of pentosans from the pulp or as great an increase in the tear resistance of the pulp. This is especially true of sulphate or kraft pulp which is of high tear resistance and pentosan content to begin with and which can undergo a vast appreciation in its tear resistance and reduction in its pentosan content provided that the refining liquor to which it is subjected is kept at temperatures below about 50° C. Sulphate or kraft pulp is thus the preferred kind of chemical wood pulp as the raw material because of its excellent physical characteristics at the very beginning and its potentialities for considerable improvement. It is, however, possible to use soda or other alkali-liberated pulp as raw material.

A specific example of procedure for producing the refined pulp of the present invention may be as follows. An alkali-liberated wood pulp is admixed with a caustic soda solution of about 5% to 8% strength in sufficient amount to yield a suspension of about 5% to 6% fiber content. The mixture is kept at about room temperature, say 30° C., for about 30 minutes to 2 hours, with slow stirring to ensure uniform reaction of the alkali on the non-alpha-cellulose components of the pulp. At the end of this time, the pulp has an alpha cellulose content of about 93% to 96% and can be washed free of refining liquor. The washed pulp may, if desired, be treated with a solution of sulphurous acid or other suitable acidic reagent for the purpose of neutralizing residual alkali present therein, whereupon the pulp may again be washed to remove reaction products of neutralization. The refined but unbleached pulp thus prepared may be formed into felts on the usual types of felt-forming machines. The felts thus fabricated are characterized by their ability to absorb comparatively large amounts of molten asphalt or other impregnants and to yield impregnated sheets of very high tear resistance.

In the event that the raw, alkali-liberated wood pulp has been undercooked and has a high residual lignin content, it may be desirable to treat such pulp with chlorine water or bleach liquor

before it undergoes the action of the alkaline refining liquor. In such case, the chlorine or bleach is not used in the amount to whiten the pulp significantly. On the contrary, it is used in a restricted amount for the purpose of chlorinating or otherwise reacting upon the lignin present in the pulp so as to produce water-soluble reaction products or ones easily soluble in the alkaline refining liquor. A raw sulphate or kraft pulp may, for example, be treated with a solution containing only about 1% to 2% chlorine or about 2% to 6% of 35% lime bleach (CaOCl_2), based on the weight of pulp, as the medium in which the stock is suspended at a density of about 5% until the chemical has been expended by reaction.

I present herewith a table giving important physical and chemical characteristics of an ordinary kraft pulp before and after it has undergone the special refining operation hereinbefore described, the values representing such characteristics being obtained by making tests on different batches of pulp:

	Kraft pulp	Refined but unbleached pulp
Mullen strength (beaten).....	155-160	120-142
Tear resistance.....	220-245	350-400
Alpha cellulose %.....	88-89	93-96
Pentosans %.....	7-10	3-5
Folding endurance.....	1800-2400	3000-4000
Yield of process %.....		double folds 92-95

From the foregoing table, it will be seen that by the special refining operation hereinbefore described the tear resistance of the raw kraft pulp has been increased by more than 50% and that its alpha cellulose content has been markedly increased and its pentosan content greatly reduced, despite the fact that the raw pulp itself has a tear resistance almost twice as great as raw sulphite pulp derived from the same wood. It is by virtue of this pronounced improvement in both the physical and chemical properties of the pulp that felts made therefrom are eminently adapted for impregnation purposes, for instance, impregnation with molten bitumen or asphalt to yield sheets of high value in the flooring and roofing industries. The tear resistance values in the foregoing table apply to sheets prepared from pulps which were beaten or hydrated to the same extent. The ratio between the tear resistance values of the two pulps, as appears from the tables, exists more or less at different stages of their beating or hydration and extends even to felts made from the substantially unbeaten pulps and impregnated with asphalt, pitch or other bituminous binder.

The refining operation conducive to the pulps of the present invention may be performed with solutions whose alkalinity is afforded by alkalies other than caustic soda, so long as the alkalinity is such as to cause the desired purification at temperatures below about 50° C. without mercerizing or otherwise injuring the papermaking characteristics of the pulp fibers. Thus, part or

all of the caustic soda may be replaced by sodium sulphide which is effective as a refining chemical under the appropriate temperature conditions. The use of a refining liquor containing sodium sulphide as well as caustic soda fits well into the refinement of kraft pulp, as in such case the refining liquor may be prepared from the chemicals recovered in the kraft cooking cycle and the spent refining liquor may be subjected along with the spent kraft cooking liquor to recovery operations.

It is possible to bleach the refined pulps of the present invention to whiteness without appreciably affecting their physical or chemical properties.

In fact, they can be bleached far more easily than the raw, alkali-liberated pulps from which they are derived and with much lower bleach consumption. As already indicated, however, I prefer to keep the pulps in an unbleached condition when they are to serve for making flooring, roofing, or analogous felts or impregnating papers.

The pulp of the present invention is generally suitable for papermaking purposes and is especially satisfactory for making papers wherein it is desired that such qualities as high softness, absorbency, flexibility, tear resistance, and fold endurance be present. Such pulp yields, for example, an excellent paper base for the production of so-called coated or filled papers, as well as one eminently suited for impregnation purposes.

So far as subject matter is concerned, this is a division of my application Serial No. 73,193, filed December 4, 1925, which in turn is a continuation-in-part of my application Serial No. 52,232, filed August 24, 1925, which issued on April 28, 1931 as Patent No. 1,802,575.

I claim:

1. An alkali-liberated and alkali-refined cellulose pulp having an alpha cellulose content of at least 93% and whose tear resistance is at least about 50% greater than that of the unrefined pulp from which it is derived.

2. A substantially unbleached, alkali-refined kraft wood pulp having an alpha cellulose content of at least 93% and a pentosan content not exceeding 5% and whose tear resistance is at least 50% greater than that of the unrefined kraft pulp from which it is derived.

3. An alkali-liberated and alkali-refined cellulose pulp whose alpha cellulose content is at least 93% and whose alpha cellulose content has been reached by the reaction of a non-mercerizing, alkaline liquor at a temperature not exceeding about 50° C. on the unbleached, alkali-liberated pulp.

4. A substantially unbleached, alkali-refined kraft wood pulp whose alpha cellulose content is at least 93% and whose alpha cellulose content has been reached by the reaction of a non-mercerizing, alkaline liquor at a temperature not exceeding about 50° C. on the unbleached, kraft wood pulp.

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