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PRODUCTION OF CELLULOSIC PRODUCTS

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This invention relates to the production of cellulosic products, and has for its general object the provision of certain improvements in carrying out one or more of the processing steps in the production of such products. The invention is of special advantage in the preparation and processing of viscose derived from chemically prepared wood pulp, and in this connection aims to improve the steps of shredding, filtering and spinning viscose. The invention further contemplates, as a new article of manufacture, a chemically prepared wood pulp product having polyethylene oxide incorporated therein.

Chemically prepared wood pulps are extensively used in the industrial arts for the production of such cellulosic products as rayon and other synthetic fibers, nitrocellulose, cellulose acetate, cellulose ethers, Cellophane and similar cellulosic films or sheets, etc. Wood pulp is commonly prepared and marketed in sheet form, and comminution or shredding is customarily one of the initial steps in its subsequent processing. When wood pulp is used in bulk form, either wet or dry, shredding or comminution is frequently a step involved in the subsequent processing. Since such subsequent processing usually involves the conversion of the cellulose of the wood pulp to some cellulose derivative and the solution of the derivative in a suitable solvent, the purpose of shredding is to break down the sheet into a fluffy mass or crumb in which the individual fibers will be suitably exposed to the action of the derivative-forming reagent or reagents. Thus, for example, in the production of viscose the wood pulp sheet is customarily steeped in a caustic soda solution to form alkali cellulose, and the alkali cellulose, after pressing and while still in sheet form, is shredded or comminuted to properly prepare the cellulose fibers for the xanthating reaction with carbon bisulfide. The resulting sodium cellulose xanthate is dissolved in dilute caustic soda to form the solution commonly known as viscose, which is opacified if desired, filtered, and spun into filaments.

Normal dissolving wood pulps in present use consist mainly of cellulose, but contain appreciable amounts of non-cellulosic impurities, such as hemi-celluloses, fats, resins, waxes, etc. One of the main objects in the manufacture of a highly refined dissolving pulp is to remove as much as possible of the non-cellulosic impurities, so that a whiter, purer pulp results, which is capable, in the manufacture of rayon, of producing a higher grade yarn.

We find, however, that not all of the non-cellu-

losic impurities which can be removed are undesirable, and in fact, certain of such impurities, normally present in small amounts, are highly beneficial in aiding the processing of the pulp into viscose, especially as regards the step of shredding the alkali cellulose. These beneficial impurities which aid the shredding operation are probably of the nature of fiber lubricants which permit the steeped and pressed pulp to be thoroughly shredded into a fluffy condition more readily and without mechanical damage to the alkali cellulose fibers which would cause them to react incompletely with carbon bisulphide. In a pulp which has not been highly refined, most of these beneficial impurities constitute a portion of the materials removable by organic solvents, as for example, ether, benzene, alcohol, etc. These beneficial impurities, often loosely termed "resins," are mainly of the nature of waxes, fats and resins, the latter often being present in a relatively small amount.

In theory, the problem of making a good pulp could be solved by removing all the undesirable impurities while retaining those impurities which facilitate the shredding operation by lubricating the fibers or otherwise. In practice, such a clean cut separation is difficult to accomplish directly. We have discovered that better results are obtainable by removing most or all of the impurities including those which serve beneficially as lubricants to the alkali cellulose fibers during shredding, and then adding to the pulp or to the alkali cellulose prior to the completion of shredding a sufficient amount of an agent capable of acting like, and actually being more effective than, the natural beneficial impurities.

White, highly purified or refined wood pulps are very advantageous for the production of high grade rayon yarns of superior strength and color, and for this reason, are highly esteemed by the trade. Such highly refined pulps are in general characterized by having an ether extract of about 0.15% or less where such values refer to the amount of natural ether extractable material left in the pulp after the purification processes. While our invention is particularly applicable to such highly refined pulps containing not more than about 0.15% of ether extractable material, it may be applied with certain advantages to the processing of normal dissolving pulps containing substantially more than 0.15% of ether extractable material, although such pulps do not generally yield the highest grade yarns and their processing into shredded alkali cellulose is not accompanied by any particular difficulty.

We have discovered a class of agents, namely, polyethylene oxides, which lubricate or protect the alkali cellulose fibers during shredding, and which are chemically entirely different from the beneficial impurities naturally present in the pulp. These agents are soluble in water. In general, they are much more effective in promoting shredding than the beneficial impurities naturally present in the pulp. Moreover, these agents exercise a beneficial influence upon certain subsequent steps in the preparation and processing of viscose into rayon which the natural beneficial impurities do not exercise. Based on these discoveries, our invention involves improving one or more of the processing steps in the production of cellulosic products from chemically prepared wood pulp by carrying out one or more of the processing steps in the presence of polyethylene oxide. When applied to the preparation and processing of viscose derived from chemically prepared wood pulp, the invention particularly involves carrying out the shredding of the alkali cellulose, or at least the final stage of shredding, and the spinning of the viscose in the presence of polyethylene oxide. Where the invention is practiced solely to improve the spinning of the viscose, it is immaterial from what cellulosic raw material the viscose is derived.

Polyethylene oxides are commonly prepared by polymerizing ethylene oxide with water in the presence of a suitable catalyst, such as sodium hydroxide, and as so prepared have the empirical formula $(C_2H_4O)_n \cdot H_2O$, where n is any number greater than 1. The polymerized products range from viscous liquids to hard waxes depending upon the degree of polymerization. As commonly prepared, the polymerized products are not homogeneous compounds, but are a mixture of various chain lengths or degrees of polymerization over a fairly narrow range. The polyoxyethylene glycols (sometimes termed polyethylene glycols) which can be prepared by condensation reactions so as to have a homogeneous nature are structurally identical with polyethylene oxides prepared in the presence of water and sodium hydroxide and are equally suitable for the practice of our invention and are intended to be included within the generic designation of polyethylene oxides. While polymerized products having the formula $(C_2H_4O)_n \cdot H_2O$ (or its expanded form $HO(C_2H_4O)_{n-1}CH_2CH_2OH$) are the preferred agents of our invention, the term polyethylene oxide is also generically intended to include any product which consists substantially of C_2H_4O groups, irrespective of any small terminal group or groups it may contain other than hydroxyl. With a long polyethylene oxide chain, substitution of any other small groups for the hydroxyl groups has a relatively small effect, and the resulting substitution product will still yield at least in part the advantages of the invention. Thus, the term polyethylene oxide is intended to also include products having a relatively long polyethylene oxide chain making up the greater part of the molecule and either one or two terminal groups consisting of halogen or any hydrocarbon group containing not more than seven carbon atoms and linked to the polyethylene oxide through either oxygen or sulfur.

We have found that all polyethylene oxides, including even diethylene glycol (the simplest polyethylene oxide), are suitable for the purposes of the invention. In practice, however, we find that the best results are obtained when using polyethylene oxides having a relatively high degree of

polymerization. With polyethylene oxides, as with most other polymers, increase in the degree of polymerization is accompanied by a rise in the melting point or freezing point. In characterizing polyethylene oxides, we prefer to use the freezing point rather than the melting point, since the former determination can be more conveniently and accurately carried out. In practicing the invention, we prefer to use those polyethylene oxides having a freezing point of at least $34^\circ C$, and exceptionally good results have been obtained with polyethylene oxides having a freezing point of $46-51^\circ C$.

Polyethylene oxides for use in practicing the invention may be prepared by any of the methods known to the art, such as treating ethylene oxide at an elevated temperature for a suitable length of time with caustic soda solution. We prefer to heat ethylene oxide with 48% caustic soda solution with agitation in a sealed vessel or autoclave at a temperature of $40-100^\circ C$ until the pressure drops substantially to zero. The smaller the proportion of 48% caustic soda to ethylene oxide, the higher will be the degree of polymerization, and the higher will be the freezing point. In preparing products with freezing points above $40^\circ C$, reaction temperatures of around $100^\circ C$ are suitable. In preparing products with freezing points below $40^\circ C$, due to the higher proportions of caustic soda, the reaction tends to proceed much more rapidly and it is advisable to work at lower temperatures to prevent the possibility of the reaction surging to completion within a few minutes with semi-explosive violence, resulting in an impure product. Also, in all cases, it is advisable to maintain continuous agitation to avoid the possibility of local overheating and the reaction surging too rapidly to completion even when maintaining the autoclave walls at temperatures well below $100^\circ C$. These precautions apply especially when all the ethylene oxide used is initially present in the autoclave. If, however, the ethylene oxide is introduced gradually in gaseous form, or by means of very small liquid additions as the reaction proceeds, the tendency for the reaction to "run away" will be greatly minimized, and it will even be possible to carry out the reaction at appreciably higher temperatures than those indicated.

The polymerized product so prepared will contain the original amount of alkali which will not be objectionable if the agent is to be added directly to the viscose. If, however, the agent is to be added to the pulp, it is advisable to eliminate the alkalinity of the polymerized product. This may readily be accomplished by adding 30% sulfuric acid or concentrated hydrochloric acid to the molten product removed from the autoclave until neutrality is obtained. The polymerized product so prepared will also contain water and an inorganic salt, but in most cases will be sufficiently pure for use in the practice of our invention in any of its aspects. In special cases, as for example when extreme lightness of color is desired or when it is desired to characterize the products accurately by their freezing points, additional purification may be necessary. Any of the known methods for purifying polyethylene oxide may be used. With products having higher freezing points, however, we find that an appropriate method consists in dissolving the neutralized product in benzene, removal of water by addition of sodium sulfate or other suitable drying agent, decolorizing with charcoal or activated carbon if desired, removal of the inorganic

salt from the water-free solution by filtration, and removal of the solvent by vacuum distillation. For products having low freezing points, the same method may be used though we prefer to substitute for the benzene, dioxane or methanol in which the products are more soluble.

A table is given below showing the freezing points of 5 polymerized products prepared as hereinbefore described, using varying amounts of 48% caustic soda with 50 grams of ethylene oxide. These products were neutralized, and were also subjected to subsequent purification as described to eliminate the inorganic salt and water in order to obtain accurate freezing points.

	Amount 48 per cent NaOH used	Reac- tion temp.	Time for pressure to drop to 0	Freezing point of product
	Cc.	°C.		°C.
1	1/4	93-100	8 hrs	51
2	1/2	95-100	5 1/2 hrs	49.5
3	3/4	98-100	3 hrs	46
4	2	98	Few minutes	34
5	4	50	10.5 hrs	29

While highly refined wood pulps are advantageous for the production of high grade rayon yarns of superior strength and color, the reaction of the shredded alkali cellulose from such pulps with carbon bisulfide is frequently incomplete. This impairment in the xanthating activity of the shredded alkali cellulose is due to some damage to the fibers during the shredding operation or to incomplete comminution or to formation of compressed fiber bundles. In the case of the conventional shredder having revolving blades co-acting with a stationary saddle bar, the tendency for such damage is especially great if the clearance between the revolving blades and the saddle bar is a little less than the correct value. In an extreme case, with a very highly refined pulp, shredding, even under optimum conditions, may produce a shredded pulp which xanthates less completely than if the alkali cellulose were not shredded at all. In other cases, it is possible to obtain reasonably satisfactory shredding of the alkali cellulose from highly refined pulps by adjusting the shredder clearance and by experimenting to find the optimum shredding time for the particular pulp and particular shredder. In this manner it is possible in some cases to obtain almost as complete a degree of xanthation of the shredded alkali cellulose from a highly refined pulp as would be obtained with the shredded alkali cellulose from a less pure pulp. But the necessity of constant supervision and adjustment to assure optimum shredding conditions makes the shredding of highly refined pulps too sensitive for satisfactory commercial practice. This sensitivity to damage during shredding of the alkali cellulose from highly refined pulps is overcome, in our invention, by carrying out the shredding operation in the presence of polyethylene oxide which may be added to the pulp prior to shredding or to the alkali cellulose prior to the completion of shredding. While the invention thus improves the shredding operation, the most note-worthy evidence of this improvement is in the subsequent filtration of the viscose. The improvement in shredding produces a shredded alkali cellulose which reacts substantially completely with carbon bisulfide, and the resulting viscose is comparatively free of unreacted fibers

and filtration proceeds more rapidly and economically.

In the spinning of viscose into acid spin baths containing certain metallic salts and especially a zinc salt, incrustations tend to form within the orifices of the spinneret, either partially or completely blocking the orifices. The partial blocking of the orifices causes objectionable irregularities in the thickness of the filaments and frequently causes breaking of the filaments which necessitates interruption of the spinning operation to change spinnerets. The formation of such incrustations is suppressed or minimized in the present invention by carrying out the spinning operation in the presence of polyethylene oxide. The polyethylene oxide may be added to the viscose or to the constituents entering into the production of the viscose, or may be added to the acid spin bath. While this aspect of our invention relates particularly to improving spinning conditions in the viscose process where viscose is normally extruded through spinnerets or other orifices into acid setting baths, it is to be understood that the invention is not limited to the viscose process, but is applicable to any process where cellulosic solutions are extruded through spinnerets or other orifices into aqueous setting baths, either acid, alkaline, or neutral, where incrustations tend to form within the extrusion orifices. In such cases, the invention is only subject to the limitations that the material be added in such a way as to be present in either the spinning solution or spin bath at the time of spinning.

When polyethylene oxide has been employed to improve shredding, in accordance with the invention, the polyethylene oxide will be present in the resulting viscose. Although, as hereinafter more particularly explained, the amount of polyethylene oxide required for securing the contemplated improvement in suppressing or minimizing the formation of incrustations during spinning is slightly greater than the amount required for securing the contemplated improvement in shredding and filtration, there is no objection to carrying out the shredding step in the presence of such amount of polyethylene oxide as is required in the spinning of the viscose. Indeed, the full advantages of our invention are best realized when polyethylene oxide is added to the alkali cellulose prior to the completion of shredding and in amount adequate for securing the contemplated improvement in spinning the viscose.

The most practical and economical manner of securing the desired presence of polyethylene oxide during the shredding of the alkali cellulose and during the spinning of the viscose is to incorporate polyethylene oxide in the wood pulp. This may be advantageously effected by adding polyethylene oxide to the pulp on the sheet-forming machine subsequent to sheet formation but prior to complete drying, by spraying the pulp sheet with an aqueous solution of polyethylene oxide or by means of a rotating roll partly immersed in such a solution. If desired, polyethylene oxide may be incorporated in the pulp prior to sheet formation, as, for example, by adding the agent to a suspension of pulp in water in a stock chest. In the latter case, the white water should be re-circulated in order to prevent considerable loss of the agent when eliminating water in sheet formation. In any case, there is produced a chemically prepared wood pulp product having polyethylene oxide incorporated therein. The production of this product,

as a new article of manufacture, is one of the aspects of the invention. When the agent is so incorporated in the wood pulp, by the manufacturer thereof, the pulp comes to the rayon manufacturer in a form calculated to secure the full advantages of the invention in the preparation and processing of the viscose into high grade rayon yarns.

All polyethylene oxides are soluble in the dilute sodium hydroxide concentrations normally present in viscose, e. g., 5 to 8%. The solubility of the polyethylene oxides in the sodium hydroxide concentrations present in steeping, e. g., about 18%, decreases as the degree of polymerization increases, and polyethylene oxides having freezing points about 34° C. or higher are relatively insoluble in 18% sodium hydroxide. Hence, the presence during steeping of a polyethylene oxide having a freezing point lower than 34° C. results in the solution of the agent in the sodium hydroxide steeping liquor, in amount varying with the agent's solubility therein. Since the steeping liquor is repeatedly reused, an equilibrium will soon be reached, and the loss of agent in steeping and pressing the sheets is thereby considerably minimized. However, more uniform and dependable results are attained by employing agents substantially insoluble in sodium hydroxide concentrations of around 18%. Moreover, polyethylene oxides having freezing points above 34° C. are more effective in bringing about the contemplated improvements in both the shredding and spinning steps than are the polyethylene oxides having lower freezing points. Accordingly, it is our preferred practice, especially when the agent is added prior to the completion of shredding, to employ in the practice of the invention polyethylene oxide having a freezing point of at least 34° C., and preferably around 46 to 51° C.

The amount of polyethylene oxide used in the practice of the invention is relatively small, ranging from 0.01 to 0.5%, and preferably from 0.02 to 0.25%, by weight on the bone dry weight of the wood pulp used, when the agent is incorporated in or added to the pulp or to the viscose. So far as the objectives of the invention are concerned, there is little if any improvement by increasing the amount of polyethylene oxide above 0.5%, and such higher amounts give rise to certain disadvantages. These disadvantages include the causing of excessive softness in the sheet resulting in mechanical difficulties in steeping, excessive ball formation in xanthation, difficulties in the dissolving operation due both to the excessive ball formation in the xanthating step and due to excessive foaming in the viscose solution. Also there will be considerable difficulty in obtaining a completely de-aerated viscose which is absolutely necessary for satisfactory spinning. Higher concentrations of polyethylene oxide also unduly lower the surface tension of the viscose, thus changing the coagulating conditions so that the viscose cannot be satisfactorily spun by standard methods, causing the filaments to break and the thread to stick to the godet wheels or thread guides.

The amount of polyethylene oxide required for securing the contemplated improvement in shredding and filtration is generally slightly less than the amount required for securing the contemplated improvement in suppressing or minimizing the formation of incrustations during spinning. Thus, the contemplated improvement in shredding and filtration will generally be

brought about by from 0.02 to 0.05% of the polyethylene oxide, and rarely would more than 0.1% be required. For suppressing or minimizing the formation of incrustations, the polyethylene oxide should be present in the viscose in amount of 0.1% or even higher. These percentage figures are based on the bone-dry weight of the pulp used. When the polyethylene oxide is incorporated in the spin bath, the amount present in the spin bath may advantageously be 0.001 to 0.1% by weight on the weight of the bath.

While it is our preferred practice to incorporate the polyethylene oxide in the wood pulp product, which preferably is a highly refined pulp containing not more than about 0.15% of ether extractable material and is commonly marketed in sheet form, the presence of the agent during the processing steps of shredding, filtering and spinning may be secured in any other appropriate manner. Moreover, the agent need not be incorporated in every sheet of pulp, but may be incorporated in only alternate sheets, or may be otherwise added to only a portion of the pulp in whatever form it is marketed. Alternatively, the agent may be sprayed upon or otherwise suitably added to all or a portion of the alkali cellulose prior to shredding or prior to the completion of shredding. Finally, in those cases where the invention is not practiced in the shredding and filtering steps, the polyethylene oxide may be incorporated in the viscose or the spin bath, and in such cases the suppressing and minimizing of the formation of incrustations will be attained where the viscose is made of other cellulosic raw materials as well as wood pulp. However, we believe it will generally be found more advantageous to incorporate the polyethylene oxide in the initial wood pulp product, both as a matter of convenience and economy in preparing and processing the viscose, and because a very uniform distribution of the agent throughout the pulp is easily attained.

When the invention is practiced for effecting the hereinbefore mentioned improvements in shredding and filtering, certain further economies are effected in the subsequent steps of xanthating, dissolving and filtering. In viscose solutions there is usually a certain amount of undissolved fibers and gel-like material due to the incomplete reaction of the cellulose with the carbon bisulfide during xanthation. Prior to spinning, the viscose solutions are filtered several times to remove these gels and undissolved fibers. In the event that the viscose solutions contain excessive amounts of undissolved and partially dissolved fibers, filtration is an expensive operation. In such cases the filters become rapidly clogged and the filter media must be changed frequently in order that the viscose will pass through in a reasonable time. Frequent changing of the filter media is expensive not only as regards consumption of filter cloth but also in view of the very considerable amount of labor involved and also since a certain amount of viscose is lost every time the filter is opened up. Furthermore, when the viscose solutions contain very large proportions of gel-like material, filtration is usually not altogether satisfactory in that some of the smaller gel-like particles tend to pass through the pores of the cloth with adverse affect upon the spinning operation. It has heretofore been the practice in the viscose industry, when processing pulps which tend to yield viscose solutions high in undissolved material and having poor filtration properties, to minimize such difficulties

by carrying out the xanthation with amounts of carbon bisulfide considerably in excess of that normally required. Use of excess carbon bisulfide is expensive and in addition is technically undesirable in that it may adversely affect certain properties such as the ripening of the viscose and yarn characteristics. We have found that when processing highly purified pulps which would normally tend to give poorly filtering viscose solutions, the addition of minute amounts of polyethylene oxide so improves the shredding operation that the alkali cellulose subsequently reacts much more completely with carbon bisulfide and yields a viscose solution very free from undissolved and partially dissolved cellulose particles and having good filtration properties. This result can be accomplished not only without the use of excess carbon bisulfide, but in many cases satisfactory viscose solutions can be obtained using amounts of carbon bisulfide very substantially less than the amounts normally required.

We claim:

1. The method of improving a processing step in the production of regenerated cellulosic products from chemically prepared wood pulp which comprises adding prior to the completion of shredding the alkali cellulose a polymerized compound having the formula $A(C_2H_4O)_n-1CH_2CH_2B$, where n is an integer greater than 1 and where A and B are radicals selected from the group consisting of OH, halogen, OR and SR, R representing an alkyl group having up to 7 carbon atoms.

2. The method of improving a processing step in the production of regenerated cellulosic products from chemically prepared wood pulp which comprises adding prior to the completion of shredding the alkali cellulose a polymerized compound having the formula $A(C_2H_4O)_n-1CH_2CH_2B$, where n is an integer greater than 1 and where A and B are radicals selected from the group consisting of OH, halogen, OR and SR, R representing an alkyl group having up to 7 carbon atoms, said compound having a freezing point of at least 34° C.

3. The method of improving a processing step in the production of regenerated cellulosic products from chemically prepared wood pulp which comprises adding prior to the completion of shredding the alkali cellulose a polymerized compound having the formula $A(C_2H_4O)_n-1CH_2CH_2B$, where n is an integer greater than 1 and where A and B are radicals selected from the group consisting of OH, halogen, OR and SR, R representing an alkyl group having up to 7 carbon atoms, said compound having a freezing point around 46-51° C.

4. The method of improving a processing step in the production of regenerated cellulosic products from chemically prepared wood pulp which comprises adding prior to the completion of shredding the alkali cellulose a polymerized compound having the formula $A(C_2H_4O)_n-1CH_2CH_2B$, where n is an integer greater than 1 and where A and B are radicals selected from the group consisting of OH, halogen, OR and SR, R representing an alkyl group having up to 7 carbon atoms, the amount of the compound present being from 0.01 to 0.5% by weight on the bone dry weight of the pulp.

5. The method of improving a processing step in the production of regenerated cellulosic products from chemically prepared wood pulp which comprises adding prior to the completion of shredding the alkali cellulose a polymerized com-

pound having the formula $A(C_2H_4O)_n-1CH_2CH_2B$, where n is an integer greater than 1 and where A and B are radicals selected from the group consisting of OH, halogen, OR and SR, R representing an alkyl group having up to 7 carbon atoms, said compound having a freezing point of at least 34° C., the amount of the compound present being from 0.01 to 0.5% by weight on the bone dry weight of the pulp.

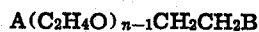
6. The method of improving a processing step in the production of regenerated cellulosic products from chemically prepared wood pulp containing not more than about 0.15% ether extractable material which comprises adding prior to the completion of shredding the alkali cellulose a polymerized compound having the formula $A(C_2H_4O)_n-1CH_2CH_2B$, where n is an integer greater than 1 and where A and B are radicals selected from the group consisting of OH, halogen, OR and SR, R representing an alkyl group having up to 7 carbon atoms, said compound having a freezing point of at least 34° C., the amount of the compound present being from 0.01 to 0.5% by weight on the bone dry weight of the pulp.

7. The method of improving a processing step in the production of regenerated cellulosic products from chemically prepared wood pulp containing not more than about 0.15% ether extractable material which comprises adding prior to the completion of shredding the alkali cellulose, a polymerized compound having the formula $A(C_2H_4O)_n-1CH_2CH_2B$, where n is an integer greater than 1 and where A and B are radicals selected from the group consisting of OH, halogen, OR and SR, R representing an alkyl group having up to 7 carbon atoms, said compound having a freezing point around 46-51° C., the amount of the compound present being from 0.01 to 0.5% by weight on the bone dry weight of the pulp.

8. The method of improving chemically prepared wood pulp which comprises incorporating in the wood pulp a polymerized compound having the formula $A(C_2H_4O)_n-1CH_2CH_2B$, where n is an integer greater than 1 and where A and B are radicals selected from the group consisting of OH, halogen, OR and SR, R representing an alkyl group having up to 7 carbon atoms.

9. The method of improving the shredding and filtering steps in the manufacture of products by the viscose process from chemically prepared wood pulp which comprises carrying out said steps in the presence of a polymerized compound having the formula $A(C_2H_4O)_n-1CH_2CH_2B$, where n is an integer greater than 1 and where A and B are radicals selected from the group consisting of OH, halogen, OR and SR, R representing an alkyl group having up to 7 carbon atoms, said compound having a freezing point of at least 34° C.

10. The method of improving the shredding, filtering and spinning steps in the manufacture of products by the viscose process from chemically prepared wood pulp which comprises carrying out said steps in the presence of a polymerized compound having the formula



where n is an integer greater than 1 and where A and B are radicals selected from the group consisting of OH, halogen, OR and SR, R representing an alkyl group having up to 7 carbon atoms, said compound having a freezing point of at least 34° C., the amount of the compound present during each of said steps being from 0.01

to 0.5% by weight on the bone dry weight of the pulp used for preparing the viscose.

11. As a new article of manufacture, a wood pulp product having incorporated therein from 0.01 to 0.5% of a polymerized compound having the formula $A(C_2H_4O)_{n-1}CH_2CH_2B$, where n is an integer greater than 1 and where A and B are radicals selected from the group consisting of OH, halogen, OR and SR, R representing an alkyl group having up to 7 carbon atoms based on the bone dry weight of the pulp.

12. As a new article of manufacture, a chemically prepared wood pulp product containing not more than about 0.15% of natural ether extractable material and having incorporated therein from 0.01 to 0.5% of a polymerized compound having the formula $A(C_2H_4O)_{n-1}CH_2CH_2B$, where n is an integer greater than 1 and where A and B are radicals selected from the group consisting of OH, halogen, OR and SR, R representing an alkyl group having up to 7 carbon atoms based on the bone dry weight of the pulp.

13. As a new article of manufacture, a wood pulp product having incorporated therein a relatively small amount of a polymerized compound having the formula $A(C_2H_4O)_{n-1}CH_2CH_2B$, where n is an integer greater than 1 and where A and B are radicals selected from the group consisting of OH, halogen, OR and SR, R representing an alkyl group having up to 7 carbon atoms, said compound having a freezing point of at least 34° C.

14. As a new article of manufacture, a wood pulp product having incorporated therein a relatively small amount of a polymerized compound having the formula $A(C_2H_4O)_{n-1}CH_2CH_2B$,

where n is an integer greater than 1 and where A and B are radicals selected from the group consisting of OH, halogen, OR and SR, R representing an alkyl group having up to 7 carbon atoms, said compound having a freezing point around 46-51° C.

15. As a new article of manufacture, a chemically prepared wood pulp product containing not more than about 0.15% of natural ether extractable material and having incorporated therein a polymerized compound having the formula $A(C_2H_4O)_{n-1}CH_2CH_2B$, where n is an integer greater than 1 and where A and B are radicals selected from the group consisting of OH, halogen, OR and SR, R representing an alkyl group having up to 7 carbon atoms, said compound having a freezing point of at least 34° C., the amount of the incorporated compound being from 0.01 to 0.5% by weight on the bone dry weight of the pulp.

16. As a new article of manufacture, a chemically prepared wood pulp product containing not more than about 0.15% of natural ether extractable material and having incorporated therein a polymerized compound having the formula $A(C_2H_4O)_{n-1}CH_2CH_2B$, where n is an integer greater than 1 and where A and B are radicals selected from the group consisting of OH, halogen, OR and SR, R representing an alkyl group having up to 7 carbon atoms, said compound having a freezing point around 46-51° C., the amount of the incorporated compound being from 0.01 to 0.5% by weight on the bone dry weight of the pulp.

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