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3,116,353
SPINNING VISCOSE

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This invention relates to an improved cellulose xanthate spinning solution and to an improved method for producing high-tenacity regenerated cellulose products, especially yarn suitable for use in automobile tires, etc., from this improved spinning solution, and to the resulting products.

High-tenacity viscose rayon is usually produced by spinning viscose in an acid-salt bath containing, in addition to sodium sulfate and sometimes magnesium sulfate, a zinc salt (see U.S. Patents No. 2,312,152 and No. 2,324,437), and stretching the freshly coagulated thread in a second hot water bath containing small amounts of acid and salt as described in U.S. Patent No. 2,192,074. As is well-known in the art, viscose composition, viscose ripeness, spin bath composition, and spin bath temperature must each be adjusted and correlated with one another to yield yarn having the most favorable physical properties, i.e., tensile strength, elongation, fatigue, heat stability, etc. In tire yarn, fatigue and heat stability are even more important than tensile strength. The elongation value of tire yarn should be less than that usually desired in textile yarn, and the loss in strength in plying and cabling should be low.

In response to consumer demand the viscose rayon producers have searched constantly for methods for further improving the physical properties of high tenacity yarn. Increasing the zinc sulfate content of the spin bath gives an improved yarn, but eventually a point is reached where more zinc sulfate has but little further effect on the yarn properties. Another approach has been to add to the viscose, to the spin bath, or to both, various spinning modifiers.

Some investigators hold that the cellulose pulp (from cotton or wood) used in the production of high tenacity viscose rayon should contain only small amounts of very low molecular weight materials (d.p. 75 or less) and that the cellulose chains in the pulp should have a uniform molecular weight, rather than a high average molecular weight with some very high molecular weight chains and some low molecular weight chains (see, for example, TAPPI, volume 39, No. 1, pages 242–248, April 1956, and Paper Trade Journal, September 3, 1956, pages 21–25). A carefully prepared wood pulp, containing only a minimum amount of very low molecular weight material, is said to be just as satisfactory for the production of high tenacity viscose rayon as cotton pulp. The wood pulp sold by Rayonier, Inc., under the designation "Cordenier J" is an example of such a pulp. Others hold that when producing viscose for high tenacity yarn care should be taken that the cellulose chains in the "high quality" (high molecular weight) pulps, preferably cotton pulp, are broken down only as much as is necessary to obtain the optimum spinning viscosity, and that the amount of low molecular weight cellulose chains is not greatly increased. The importance of these latter factors in the production of high tenacity yarn has been brought out by recent disclosures in the patent art (see, for example, U.S. Patents No. 2,586,796, No. 2,592,355, and No. 2,732,279, and German Patent No. 838,936). Still others find it possible to produce high tenacity viscose rayon from wood pulp of comparatively low average molecular weight containing considerable very low molecular weight material. This is accomplished by reducing the alkali cellulose ageing time and/or temperature or by eliminating the ageing step completely, to avoid any considerable further degradation of the cellulose chains. Much of the very low molecular weight materials is removed from such pulps by the dip lye.

Yarn properties are also improved if "green" i.e., substantially unripened, viscose is spun at a high salt point (see, for example, U.S. Patents No. 2,581,835 and No. 2,598,834).

Despite the improvements resulting from these and other efforts, the consumers of high-tenacity yarn have demanded still further improvement.

I have found, unexpectedly, that high-tenacity viscose rayon having improved physical properties, especially tensile strength and fatigue, may be obtained by spinning viscose containing a small amount of a soluble viscose-coagulating salt of a strong base and a weak acid, in particular the soluble sulfides, but not excluding other such salts, such as sodium acetate, sodium phosphate, etc., in a zinc-containing acid-salt spin bath in the presence of small amounts of a polyalkylene glycol, or a derivative thereof, and one or more soluble hydroxy fatty acids, and preferably a hydroxy lower fatty acid having from 2 to about 6 carbon atoms, such as hydroxyacetic acid, lactic acid, etc. The hydroxy group is preferably but not necessarily in alpha position. Of the soluble viscose-coagulating salts of a strong base and a weak acid, metal salts are preferred and of the latter alkali metal salts are especially useful. For commercial purposes the sodium salts are highly advantageous. By "soluble" as applied to these salts, reference is intended to be made to their solubility in the environment of use irrespective of their solubility in water.

The soluble salt modifier is added only to the viscose. The polyalkylene glycol or derivatives thereof and the hydroxy fatty acid modifiers may be added to the viscose, to the spin bath, or to both viscose and spin bath. Modifiers added to the viscose will gradually accumulate in the spin bath, and therefore the additions to such baths may be made taking that factor into account. The most favorable results are obtained if small amounts of the polyalkylene glycol and the hydroxy fatty acid modifiers are dispersed and/or dissolved in the salt modified viscose and also in the spin bath, though, if desired, the salt modified viscose may contain only the polyalkylene glycol modifier, while the spin bath contains sufficient amounts of both the polyalkylene glycol and the hydroxy fatty acid modifier, with particular reference to assuring the presence in the spin bath of sufficient hydroxy fatty acid to greatly retard the degradation of the polyalkylene glycol component as will be pointed out hereinafter.

While my modifiers are effective in the various conventional viscoses having different salt points or maturities, I have found that the greatest improvement is obtained by spinning viscose at a salt point of about 7.5 to about 9.0 or more (the salt point is the percent concentration of a sodium chloride solution which just coagulates a drop of the viscose; see, e.g., Charles Doree, "The Methods of Cellulose Chemistry," 1933, page 254) in an acid-salt bath containing about 4% to about 8% or more, of a soluble zinc salt. The viscose is preferably "green" or substantially unmatured. High salt point (high maturity) viscose may be obtained, as those skilled in the art will recognize, by various expedients, as by increasing the amount of carbon bisulfide used in xanthation, by reducing the ripening or maturing temperature, or by using both expedients, or by adding sodium sulfite to the viscose, etc. My modifiers are effective when used with viscose made from the various types of cotton pulps and wood pulps disclosed above.

I am aware that the viscose rayon spinning assistant art discloses the addition of polyalkylene oxides or glycols, or their ether or ester derivatives, to cellulose pulp or

to alkali cellulose (see U.S. Patents No. 2,362,217, No. 2,392,103, No. 2,393,817, No. 2,423,469, No. 2,481,693, No. 2,623,875, No. 2,710,861, etc.), to viscose (U.S. Patents No. 2,359,750, No. 2,397,338, No. 2,442,331, No. 2,519,227, No. 2,572,217, and No. 2,664,360 and British Patents No. 541,099, and No. 557,218, etc.), and to spin bath (see U.S. Patents No. 2,359,749, No. 2,442,331, No. 2,489,310, etc.). Also, I am aware that the prior art discloses the addition of water-soluble hydroxy fatty acids to viscose (see British Patent No. 309,147, German Patent No. 283,286, etc.) and to spin bath (see U.S. Patents No. 1,102,237, No. 1,376,672, and No. 1,393,199, and German Patent No. 283,286, etc.). I am also aware that the prior art discloses the addition of salts of strong bases and weak acids to viscose for various purposes (see, for example, U.S. Patents No. 896,715, No. 1,575,052, No. 1,773,923, No. 1,862,592, No. 2,064,356, No. 2,065,188, No. 2,086,309, No. 2,581,835, and No. 2,647,114, British Patents No. 242,242 and No. 272,939, and French Patents No. 728,682 and No. 899,905, etc.) but I am not aware of any disclosure of the use of small amounts of soluble salts of a strong base and a weak acid, together with a soluble hydroxy fatty acid, to enhance the beneficial effects of the polyalkylene glycols or their ether and ester derivatives, in viscose spinning. When the soluble viscose-coagulating salt selected as additive is one normally formed as a by-product of viscose production and maturation, then the amount of the addition is in excess of that produced as a by-product.

It is not entirely clear how soluble viscose-coagulating salts of strong bases and weak acids and hydroxy acids act to enhance the beneficial effects of the polyalkylene glycol-type modifiers in viscose spinning. While factors still unknown to me may also be responsible, I have established that the improved results are, in part, due to the fact that the hydroxy fatty acid acts as a preservative for the polyalkylene glycol polymer in the hot acid coagulating bath. The soluble strong base weak acid salt and the sodium salts formed when the hydroxy fatty acids are added to viscose exert a coagulating effect on the viscose and a buffering action against the strong acid of the spin bath. Both effects favor the improvement of the yarn properties.

My polyalkylene glycol-type modifiers are effective only if their molecular weight is about 400 or more. These compounds are so sensitive to acid and to elevated spin bath temperature that in the absence of a hydroxy fatty acid in accordance with the present invention a polyalkylene glycol having an average molecular weight of about 3300 is quickly degraded by the hot acid of a conventional spin bath to an average molecular weight as low as about 350. It will be understood that a polyalkylene glycol becomes less effective, and finally completely ineffective as a spinning modifier, as its molecular weight drops. The addition of a small amount of a soluble hydroxy fatty acid in otherwise conventional viscose spinning retards this degradation so that the average molecular weight falls for example, from about 3300 no more than to about 900 to 1100. If a sufficient amount of hydroxy acid is not present in the spin bath, in an extended run the physical properties of the yarn decline steadily from the high values for yarn spun in fresh spin bath containing undegraded modifier. It appears that in order to derive the fullest possible benefit from the synergistic effect of the hydroxy fatty acid it is necessary to have present in a spin bath, either by direct addition or by carry-over from the viscose or both, a certain minimum amount thereof, as will be described more fully hereinafter.

"Carbowax 4000," a Carbide and Carbon Chemical Co. polyalkylene glycol having an average molecular weight of about 3300, is a preferred modifier. Lower molecular weight products can be used if the average molecular weight of the modifier in the spin bath does not fall below about 400, preferably not below about 1000,

and products having an average molecular weight of up to about 7,500 are effective. The very high molecular weight products (for example "Carbowax 20,000"), which should not be degraded to the potentially dangerous point of about 400 average molecular weight as rapidly as "Carbowax 4000," are not efficient modifiers, in part, at least, because these higher molecular weight compounds are removed from the spin bath by the yarn and the spin bath filter. The enhancing action of my hydroxy fatty acid modifier makes possible the efficient use of a medium molecular weight polyalkylene glycol polymer modifier in spin bath.

The manner in which a soluble salt of a strong base and a weak acid acts to improve the properties of yarn spun by my improved process is not clear. These salts, do, however, in addition to improving the spinning operation, enhance the beneficial effects of the other additives on the yarn properties.

My modifiers are most effective when the strong base-weak acid salt, the polyalkylene glycol, and the hydroxy fatty acids are dispersed and/or dissolved in the viscose and the polyalkylene glycol and the hydroxy fatty acid are dispersed and/or dissolved in the spin bath. If desired, the viscose may contain only the salt and the polyalkylene glycol modifiers, while the spin bath contains the polyalkylene glycol and the hydroxy fatty acid modifiers.

It is, therefore, an object of the present invention to provide an improved method for producing regenerated cellulose products, such as yarn, ribbon, film, etc., from viscose.

Another object is to provide an improved method for spinning high tenacity viscose rayon.

A further object is to provide an improved zinc acid-salt type coagulating bath for the production of high tenacity yarn from viscose.

Still another object is to provide an improved method for spinning high salt point viscose.

Yet another object is to provide an improved method for spinning "green" viscose.

Still other objects are to provide novel and improved viscose compositions as well as improved regenerated cellulose products having commercially more desirable physical properties, especially in regard to fatigue and strength characteristics.

Other objects of the invention will appear hereinafter.

The following examples illustrate various methods of applying the principles of the invention.

EXAMPLES 1–3

Conventional viscose spinning solutions containing about 7.0% cellulose and about 6.0% alkali, calculated as NaOH, were prepared by the well-known methods from a pulp blend containing 50% of a cotton linters pulp sold by Hercules Powder Co. under the designation "Hercules Cotton Grade 73," and 50% of a wood pulp sold by Industrial Cellulose Co., Ltd., under the designation "SK Tenacell," using 35½, CS_2, based on the cellulose present in alkali cellulose. When the cellulose xanthate crumbs were dissolved in lye to form the spinning solutions, varying amounts of "Carbowax 4000" (a Carbide and Carbon Chemical Co. polyethylene glycol having an average weight of about 3300), sodium sulfide flakes (about 63% Na_2S), and hydroxyacetic acid were added to the mixer. The percent modifier addition given in Table 1 is based on cellulose in alkali cellulose.

These viscose spinning solutions were converted into 1650 denier tire yarn containing 720 filaments by extruding them at salt point about 8.0 and ball fall viscosity about 40 in a conventional continuous spinning process through spinnerettes having 60 mu holes into spin baths at about 65° C. containing about 100 g./l H_2SO_4, 215 g./l. Na_2SO_4, 100 g./l. $ZnSO_4$, 0.0050% "Carbowax 4000" and 0.0125% hydroxyacetic acid, using a separate hot

acid regenerating bath. The freshly extruded threads were drawn about 18 inches through the spin baths in a vertical direction, and were then subjected to a net stretch of about 83% and taken up at about 50 meters per minute. The yarns were washed, aftertreated and dried as is usual in the production of such yarn.

The conventional strength, elongation and fatigue tests were made on the singles yarns and on a 11.5/10 cable construction. (The 11.5/10 cable construction has 11.5 turns per inch **Z** ply twist, and 10 turns per inch **S** cable twist.) The data for the three yarns are given in Table 1. The expressions "conditioned strength" and "conditioned breaking elongation" refer to yarn having 12% moisture regain. The "oven-dry" cable strength value is determined on a cable dried overnight in an oven at 90° C. and tested while the moisture regain is still less than 1%.

Table 1

VISCOSE

Example No.	1	2	3
"Carbowax 4000," percent	0.275	0.275	0.275
Hydroxyacetic acid, percent		0.275	
Sodium sulfide flakes, percent (about 63% Na_2S)			5.52
SINGLES YARN			
Conditioned strength, g./d.	4.10	4.22	4.30
Wet strength, g./d.	2.85	2.97	3.00
Conditioned elongation, percent	11.9	12.3	12.0
Wet elongation, percent	23.6	22.6	22.3
Heat stability	95.0	95.9	96.1
Wet/dry ratio	0.694	0.704	0.699
11.5/10 CABLES			
Conditioned strength, g./d.	3.41	3.33	3.47
Oven dry strength, g./d.	3.66	3.74	4.02
Conditioned strength, lbs.	27.50	27.25	27.88
Oven dry strength, lbs.	29.50	29.94	32.31
Strength lost in cabling, percent	15.8	17.9	16.2
Fatigue	62.7	72.5	114.8

The yarn properties, in particular the tensile strengths and the fatigues, are greatly improved by spinning in the presence of all three modifiers, polyalkylene glycol, strong base-weak acid salt, and hydroxy fatty acid. There is but little further improvement in yarn properties when the hydroxy fatty acid is present in the viscose as well as in the spin bath.

EXAMPLES 4–6

Conventional viscose spinning solutions containing about 7.0% cellulose and about 6.75% alkali, calculated as NaOH, were prepared from "SK Tenacell" wood pulp, using about 35½% CS_2, based on cellulose in alkali cellulose. The viscose spinning solutions contained 0.275% "Carbowax 4000" and varying amounts of sodium sulfide flakes (about 63% Na_2S) and hydroxyacetic acid, all based on cellulose in alkali cellulose.

These viscoses were converted into 1650 denier, 720 filament yarn by spinning in a conventional continuous process through spinnerettes having 60 mu holes at ball fall viscosity about 45 and salt point about 8.0, in a 68° C. spin bath containing about 108 g./l. H_2SO_4, 220 g./l. Na_2SO_4, 95 g./l. $ZnSO_4$, 0.0050% "Carbowax 4000," and 0.015% hydroxyacetic acid, using a separate hot acid regenerating bath. The total stretch imposed upon the freshly formed threads was about 88% and the net stretch was about 81%. The take-up speed was about 52 meters per minute. The data for the singles yarns and the conventional 12.0/12.0 cable construction are given in Table 2.

Table 2

VISCOSE

Example No.	4	5	6
"Carbowax 4000," percent	0.275	0.275	0.275
Hydroxyacetic acid, percent		0.3	
Sodium Sulfide flakes (about 63% Na_2S), percent			3.0
SINGLES YARN			
Conditioned strength, g./d.	4.15	4.38	4.29
Wet strength, g./d.	2.88	2.92	2.89
Conditioned elongation, percent	11.3	11.7	11.1
Wet elongation, percent	22.4	21.7	22.1
Heat stability	94.1	94.8	96.3
12.0/12.0 CABLES			
Conditioned strength, g./d.	2.87	3.12	3.15
Oven-dry strength, g./d.	3.41	3.81	3.73
Conditioned strength, lbs.	23.95	26.09	26.27
Oven-dry strength, lbs.	28.50	31.84	31.19
Strength lost in cabling, percent	31.0	27.1	27.2
Fatigue	132.3	176	193.9

The yarn properties, in particular the very important cord strengths and fatigue values, are greatly improved by spinning in the presence of all three modifiers.

EXAMPLES 7–8

Conventional viscose spinning solutions containing about 7.0% cellulose and about 6.5% alkali, calculated as NaOH, were prepared from "SK Tenacell" wood pulp, using about 35½% CS_2, based on cellulose in alkali cellulose. The viscose spinning solutions contained "Carbowax 4000," technical grade sodium sulfide flakes (about 65% Na_2S), and hydroxyacetic acid in the amounts, based on cellulose in alkali cellulose, given in Table 3.

These viscoses were converted into 1650 denier, 720 filament yarn by spinning in a conventional pot spinning process through spinnerettes having 60 mu holes in a 68° C. spin bath containing about 108 g./l. H_2SO_4, 220 g./l. Na_2SO_4, 95 g./l. $Zn.SO_4$, 0.05 g./l. "Carbowax 4000" and about 0.20 g./l. hydroxyacetic acid. The stretch imposed upon the freshly formed threads was about 87%. The data for the singles yarns and the conventional 12.0/12.0 cable construction are given in Table 3.

Table 3

VISCOSE

Example	7	8
"Carbowax 4000," percent	0.275	0.275
Sodium sulfide flakes (about 63% Na_2S), percent	3.0	3.0
Hydroxyacetic acid, percent		0.3
SINGLES YARN		
Conditioned strength, g./d.	4.06	3.81
Wet strength, g./d.	2.64	2.56
Wet/dry ratio	0.651	0.672
Dry elongation, percent	13.3	13.4
Wet elongation, percent	24.2	24.0
Heat stability	98.0	98.9
12.0/12.0 CABLES		
Conditioned strength, g./d.	2.93	2.95
Oven-dry strength, g./d.	3.65	3.58
Conditioned strength, lbs.	24.84	25.20
Oven-dry strength, lbs.	30.98	30.60
Strength lost in cabling, percent	25.5	22.1
Fatigue	157	243

The yarn properties are improved where the viscose contains all three modifiers.

I have found that to obtain the best yarn properties there should preferably be present in the viscose from about 0.1–1.0% of the polyalkylene glycol component, based on cellulose in alkali cellulose. Especially good results are obtained when the polyalkylene glycol component is present in the viscose to the extent of about 0.2–0.35% With regard to the hydroxy fatty acid component I have found that from about 0.1–1.0%, based on cellulose in alkali cellulose, may be usefully employed in the viscose, especially good results being obtained when about 0.20–0.40% of the hydroxy fatty acid component is present in the viscose, although as pointed out above all of this component may, if desired, be added directly to the spin bath. In addition to the polyalkylene glycol the viscose should contain from about 2–5.5% of the soluble viscose coagulating salt such as technical grade sodium sulfide in the form of sodium sulfide flakes (about 63% Na_2S), preferably about 3–4% sodium sulfide flakes (about 63% Na_2S) based on cellulose in alkali cellulose.

From about 0.002–0.050% of more of polyalkylene glycol based on the weight of the spin bath should be present in the spin bath, irrespectively of whether by direct addition or by carry-over from the viscose, or both. Particularly desirable results are obtained where this range is about 0.003–0.010%. The hydroxy fatty acid additive is preferably present to the extent of about 0.0125–0.050% or more, and preferably about 0.0125–0.020% based on the weight of the spin bath.

The physical properties of high tenacity yarn, in particular the tensile strength and fatigue, are improved by increasing the alkali content of the viscose, as from 6.0% NaOH to 6.75% NaOH, or more, in the approximately 7.0% cellulose viscose disclosed in the examples, as may be seen in Examples 4–6. However, these high alkali viscoses do not spin well unless modifiers are used. The use of the modifiers thus makes it possible to obtain the further advantages resulting from the use of high alkali viscose.

While a polyethylene glycol having an average molecular weight of about 3,300, such as Carbide and Carbon Chemical Company's "Carbowax 4000," is preferred for the practice of this invention lower molecular weight products may be employed if the average molecular weight of the modifier in the spin bath does not fall below about 400, preferably not below about 1000, and products having an average molecular weight of up to about 7,500 are useful. Ether and ester derivatives of fatty acids having a polyoxyethylene chain containing at least about 25 ethylene oxide and/or propylene oxide groups are suitable modifiers. The various polyoxyethylene compounds disclosed in U.S. Patents No. 2,359,749, No. 2,359,750 and No. 2,519,227 are useful modifiers. Where the terms polyalkylene glycol are used in the specification or the claims it is intended to include their ether and ester derivatives, including the hydroxy fatty acid esters, as well as the corresponding polypropylene oxide and mixed polyethylene-polypropylene oxide derivatives.

My viscose modifiers may be incorporated, separately if desired, in the viscose at any time prior to spinning. This may be accomplished by adding them to the viscose or by incorporating them in the pulp, or in the alkali cellulose, etc. A uniform dispersion of the modifiers in the spinning solution is most readily obtained by adding them to the mixer when the cellulose xanthate is dissolved in the lye to form the viscose.

I have disclosed the use of my improved spinning process in pot spinning and continuous spinning processes but it is also useful in spool spinning. It is especially useful in a continuous spinning process, using, for example, the method and the apparatus described in copending application, Serial No. 389,421, filed October 30, 1953, now U.S. Patent No. 2,898,627.

The process may obviously be modified without departing from the spirit and scope of the invention as set forth in the appended claims.

What is claimed is:

1. A process for the production of improved cellulosic products which comprises modifying a viscose by adding thereto a soluble-viscose-coagulating salt of a strong base and a weak acid, and extruding the resultant viscose into an acid spin bath in the presence of a polyalkylene glycol having an average molecular weight of at least about 400 and an hydroxy fatty acid.

2. A process for the production of improved cellulosic products which comprises modifying a high maturity viscose by adding thereto a soluble viscose-coagulating salt of a strong base and a weak acid, and extruding the resultant viscose into an acid spin bath in the presence of a polyalkylene glycol having an average molecular weight of at least about 400 and an hydroxy fatty acid.

3. A process as defined in claim 2 in which the polyalkylene glycol is selected from the group consisting of polyethylene glycol, polypropylene glycol and mixed polyethylene-polypropylene glycols having an average molecular weight of from about 400 to about 9,000.

4. A process as defined in claim 3 in which the soluble viscose-coagulating salt, the polyalkylene glycol, and the hydroxy fatty acid are present in the viscose in an amount from about 2–5.5%, 0.1–1.0%, and 0.1–1% respectively, based on cellulose in alkali cellulose, and the polyalkylene glycol and the hydroxy fatty acid are present in the spin bath in an amount from about 0.002–0.050% and 0.0125–0.050%, respectively, based on the weight of the spin bath.

5. A process as defined in claim 3 in which the soluble viscose-coagulating salt, the polyalkylene glycol, and the hydroxy fatty acid are present in the viscose in an amount from about 3–4%, 0.2–0.35%, and 0.20–0.40%, respectively, based on cellulose in alkali cellulose, and the polyalkylene glycol and the hydroxy fatty acid are present in the spin bath in an amount from about 0.003–0.010% and 0.0125–0.020%, respectively, based on the weight of the spin bath.

6. A process as defined in claim 3 in which the hydroxy fatty acid contains from 2 to about 6 carbon atoms per molecule.

7. A process as defined in claim 3 in which the viscose has a salt point of about 7.5 to about 9.0.

8. In a process for the production of improved cellulosic products by extruding viscose to which sodium sulfide has been added into an acid spin bath, the improvement which comprises carrying out the extrusion in the presence of further additives comprising a polyalkylene glycol having an average molecular weight of at least about 400 and a hydroxy fatty acid.

9. A process as defined in claim 8 in which at least one of said further additives is incorporated in the viscose prior to extrusion.

10. A process as defined in claim 8 in which at least one of said further additives is incorporated in the spin bath.

11. A viscose solution containing a soluble viscose-coagulating salt of a strong base and a weak acid, a polyalkylene glycol having an average molecular weight of from about 400 to about 9,000, and a hydroxy fatty acid.

12. A high maturity viscose solution containing a soluble viscose-coagulating metal salt, a polyalkylene glycol having an average molecular weight of from about 400 to about 9,000, and a hydroxy fatty acid.

13. A high maturity viscose solution having a salt point of about 7.5 to about 9.0 and containing as additives at least 2% sodium sulfide, from about 0.1–1.0% of polyalkylene glycol having an average molecular weight of from about 1000 to about 7500, and from about 0.1–1.0% of a hydroxy fatty acid, each based on cellulose in alkali cellulose.

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