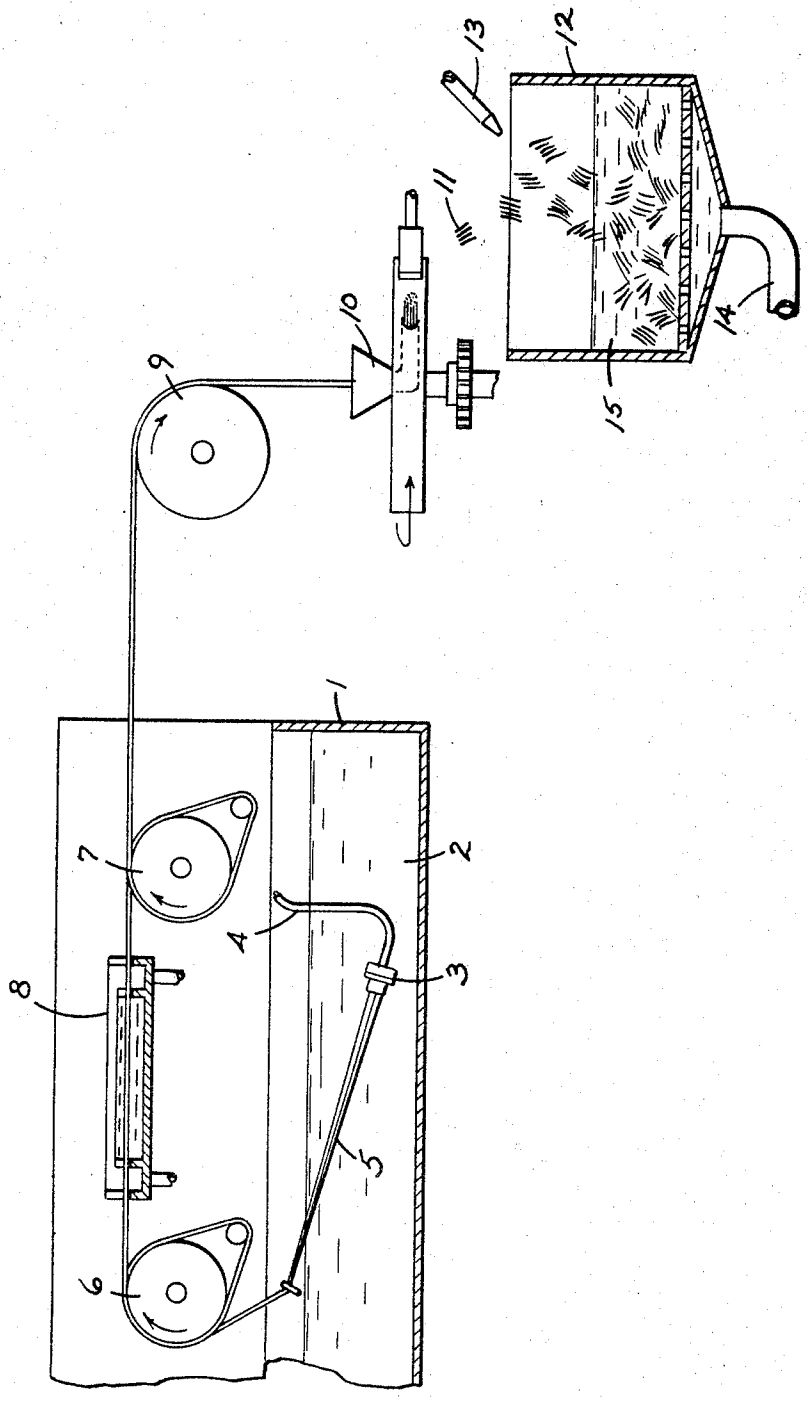
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VISCOSE RAYON FIBER AND METHOD OF MAKING SAME

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VISCOSE RAYON FIBER AND METHOD OF MAKING SAME

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ABSTRACT OF THE DISCLOSURE

High strength, high wet modulus, nonfibrillatable viscose rayon fibers and filaments having a very low alkali solubility are formed by spinning viscose having a limited composition into a low acid, low salt bath containing a small amount of formaldehyde, stretching the filaments in a second hot aqueous bath followed by completing the regeneration of the cellulose while the fibers or filaments are relaxed in a hot aqueous bath. Fabrics formed from these fibers exhibit about the same wet strengths as fabrics formed of cotton but exhibit substantially greater strengths in a conditioned state as compared to fabrics formed of cotton.

This invention relates to synthetic fibers, more particularly to a new and novel regenerated cellulose or viscose rayon fiber, to a process for producing such fiber and fabrics containing the fiber.

While many forms of regenerated cellulose fibers have been produced and they have attained widespread use and acceptance because of their strength, luster, softness and hand, they have had certain physical characteristics that have limited their use in some fields in place of cotton or in blends with cotton. Desirable properties of cotton fiber are its high elastic modulus and low extensibility when wet or conditioned and the relatively reduced shrinkage of fabrics when wet and then dried. Regenerated cellulose fibers of the prior art that were not too brittle or did not fibrillate were characterized by excessive shrinkage when wet and then dried and a relatively low elastic modulus both wet and conditioned. Fabric woven of the prior art regenerated cellulose could not be stabilized by physical stabilizing processes but required relatively expensive chemical or resin treatment for this purpose.

Regenerated cellulose or viscose rayon fibers are, in effect, "tailor-made" for specific end uses. The specific end use determines the method employed in producing the fibers and the specific composition of the viscose solution and the spinning bath or baths and the specific conditions employed in the methods of production. Slight changes in the composition of the viscose and spinning baths and slight alterations in the methods of production result in fibers having an extremely wide range of properties. In general, in the production of viscose rayon fibers having a high wet modulus, it has been necessary to utilize viscose solutions having a low cellulose content and spinning the filaments at a very low speed.

One of the principal objects of the present invention is to provide a viscose rayon fibers having high strength characteristics and a high wet modulus without being excessively brittle or fibrillatable.

A further object of the invention is to provide viscose rayon fibers having a high wet modulus and a low water pick-up and low shrinkage characteristics.

Another object of the invention is to provide viscose rayon fibers having a high wet and conditioned modulus and high wet and dry or conditioned strengths.

Still another object of is to provide a method of forming fibers of the foregoing characteristics at a reasonably high spinning speed.

A further object of the invention is to provide a woven fabric containing viscose rayon fibers that may be stabilized against excessive shrinkage by physically compressing the fabric in the direction of its warp.

Other objects and advantages of the invention will become apparent from the following description and claims.

The drawing is a diagrammatic illustration of apparatus for the production of the fibers and for the practice of the present invention.

The present invention contemplates the production of an improved high strength, high wet modulus viscose rayon fiber at a commercially feasible rate of speed by utilizing viscose and a spinning bath both having composition ranges within rather narrow limits, and spinning the viscose under a limited range of conditions.

The invention is applicable to the production of continuous filaments or staple fibers in a wide range of deniers, for example, the denier may be from 1.0 to 3.0 or greater in accordance with conventional practice relating to viscose rayon filaments and yarns. It is well known that in the production of synthetic staple fibers, the viscose is converted into a continuous filament and the staple fibers are produced by cutting the continuous filaments to a desired length. In the discussion which follows, the term "fiber" will be used, and it is to be understood that this term is being used to designate both continuous filament and staple fiber.

One of the unique characteristics of the present fiber is its high tenacity or tensile strength in both the wet and dry or conditioned state. The tenacity in the wet state is at least about 4.0 grams per denier. In the conditioned state, that is, after the fiber has been initially dried and then allowed to remain in an atmosphere having a relative humidity of 58% and a temperature of 75° F. for twenty-four hours, the fiber has a tenacity of at least 5.5 grams per denier. In general, the wet tenacity will vary from about 4.0 to about 4.8 grams per denier and the conditioned tenacity will vary from about 5.5 to about 6.5 grams per denier. Another particularly unique characteristic of the present fiber is that it resembles cotton very closely in its wet modulus, shrinkage characteristics and ultimate extensibility or elongation in both the wet and conditioned states. Because of these characteristics, the fiber may replace cotton for many textile purposes or may be blended with cotton. It also possesses the desirable characteristics of other viscose rayon textile fibers with respect to luster, softness and hand. Fabrics formed of the fiber may be stabilized by physically compressing the fabric in a warpwise direction by well known methods such as the process associated with the trademark Sanforize as disclosed in the patent to Cluett 1,861,422, May 31, 1932.

Another of the very unique and surprisingly unexpected characteristics of the fiber of this invention is its low alkali solubility. The alkali solubility is measured by determining the weight loss of a fiber sample after the sample is subjected to the action of a 6% caustic soda solution at room temperature for 10 minutes. Conventional grades of tire cord type rayon exhibit a loss in weight of about 13%. Conventional grades of rayon for textile purposes exhibit a weight loss of from about 15% to 17%. Prior types of high strength, high wet modulus viscose rayon fibers exhibit a weight loss of 8%. Cotton fiber exhibits a weight loss of about 2%. The fibers of the present invention exhibit a weight loss of from 3% to 4%.

One of the factors which has greatly limited the blending of textile grades of rayon fibers with cotton has

been the appreciable loss, about 30%, in strength of rayon fibers when subjected to the usual caustic soda treatment in mercerizing of cotton yarns and fabrics. Because of this appreciable loss in strength and the difficulties encountered in attempting to impart dimensional stability to rayon fibers and fabrics, the rayon content of blends of cotton and the prior art rayon fibers has been restricted to a maximum of about 30%. The fiber of this invention, on the other hand, when subjected to a mercerization treatment results in a loss of tensile strength of only 10% to 14%. In view of the initial high tenacity or tensile strength of the present fiber, such loss in strength does not seriously affect the strength of the cotton blend yarns and fabrics. Furthermore, the ability to stabilize dimensionally the fabrics formed of this fiber by physical treatment of the fabric permits the use of blends of cotton and this new fiber wherein the rayon content may be from 10% or less to about 70% to 75%.

The wet modulus as used herein is an average wet modulus and is the amount of stress in grams per denier of the fiber required to stretch the fully wet fiber 5% of its length divided by 0.05 which is the strain. The extensibility or elongation is the amount of stretching generally reported in percentage of the fiber length at the point of breaking of the fiber. Measurements of wet modulus and elongation or extensibility may be made on the conventional Instron Tensile Tester by conventional procedure. The wet modulus of the viscose rayon fiber of the present invention varies between about 15 and 30. This characteristic is approximately equal to and greater than the corresponding characteristic of cotton fibers and, hence, the fiber stretches to about the same extent as cotton during weaving and finishing of a woven fabric. This characteristic also contributes to the ability of increasing the rayon content of blends of cotton and rayon to 70%to 75%. This factor is a measure of the resistance of the fiber to stretching or elongation when subjected to tension. The elongation or extensibility of the fiber is generally within the range of from 14% to 17% when wet and about 11% to 14% in the conditioned state.

Woven fabrics formed entirely of these viscose rayon fibers have a progressive shrinkage after initial washing at the boil (100° C.) and subsequent successive washings of about 2% or less which is about the same as untreated cotton fabrics. The residual shrinkage of a woven fabric can be reduced to about 1.0 by subjecting the fabric to a compression treatment in the direction of the warp as shown in the patent to Cluett 1,861,422. This degree of shrinkage is similar to the residual shrinkage for corresponding cotton fabrics. Fabrics formed of the fiber exhibit about the same wet warp and filling tensile strengths as those formed of cotton. However, they exhibit a warp tensile strength in a conditioned state of about double that of a cotton fabric and a filling tensile strength of about 75% greater than corresponding cotton fabrics.

Prior rayon fibers having a high strength and a high wet modulus have been characterized in having an undesirable property of fibrillating excessively. A distinctive attribute of the fibers of this invention is their very low tendency toward fibrillation.

The fibers and filaments of this invention are obtained only by a close control and correlation of the viscose composition, the spinning bath composition and the spinning conditions. The viscose contains from 6% to 8% cellulose, from 5% to 9.6% caustic and from 28% to 40% carbon disulfide, based upon the weight of the cellulose. It is essential that the ratio of the proportion of the cellulose to the caustic soda be maintained within the range of 1:0.8 to about 1:1.2.

The viscose is formed in the conventional manner and either during its preparation or just prior to spinning is modified by the addition of a viscose or coagulation modifier. A large number of modifiers are known and are in use in the production of the various types of viscose rayon.

These modifiers include polyoxyalkylene glycols such as polyoxyethylene glycols, polyoxypropylene glycols and block copolymers of propylene and ethylene oxides; various amines including monoamines, diamines and polyamines such as diethylamine, dimethylamine, ethylene diamine and diethylenetriamine; reaction products of alkylene oxides with fatty acids, fatty alcohols, fatty amines, aromatic acids, aromatic alcohols, aromatic amines, partial esters of fatty acids and polyhydric alcohols such as reaction products of ethylene oxide with lauryl alcohol, phenol, lauryl amine, glycerol monostearate, etc.; quaternary ammonium compounds and the like. The amount of modifier may vary from about 2% to about 5%, based on the weight of the cellulose.

In the practice of the present invention, the viscose must contain a modifier such as a polyoxyalkylene glycol, or a reaction product of an alkylene oxide as set forth hereinabove, or a polyoxyalkylene glycol ether of an aromatic alcohol or a polyhydric alcohol wherein the glycol or ether has a molecular weight of between about 600 and about 4000 to 6000; for example, a polyoxyethylene glycol or a polyethylene glycol ether of phenol or sorbitol having a molecular weight within the stated range. The amount of the modifier added to the viscose may very from about 2% to 5%, based on the weight of the cellulose in the viscose. Alternatively, the viscose may contain a combination of modifiers such as a monoamine and a polyalkylene glycol or a polyalkylene glycol ether; for example, dimethylamine and a glycol or glycol ether of the type described. In the use of the combination of modifiers, the monoamine is added in an amount of from about 0.5% to 3% and the glycol or ether in an amount of from about 1% to 4%, both proportions being based upon the weight of the cellulose.

The viscose is aged (including the mixing and holding periods) from 10 to 30 hours and has a total sulfur content of approximately 1.4% to 2.7% and a xanthate sulfur content of from about 1.0% to 1.8%. The sodium chloride salt test at the time of spinning may be between 6 and 11 at the time of spinning and the ball fall is between 55 and 90.

The spinning bath may be classed as a low-acid, low-salt bath and should contain between 5.5% and 8% sulfuric acid, 2.5% to 7% zinc sulfate, from 10% to 14% sodium sulfate and from 0.25% to 1.0% formaldehyde. During spinning, the temperature of the bath should be maintained between 25° and 45° C. and the spinning speed may be between 20 and 40 meters per minute. From the spinning bath, the filaments prior to washing are passed through a second bath or stretch bath maintained at a temperature between 85° C. and 100° C. and the filaments are stretched from about 150% to about 220% during their travel through this bath. The stretch bath may be a hot water bath or may contain from 1% to 5% sulfuric acid, about 1% to 4% zinc sulfate and from about 4% to 7% sodium sulfate.

Following the stretching of the filaments, they are subjected to a hot water bath or hot dilute acid bath at a temperature maintained between 80° and 100° C. for a period sufficient to substantially complete the regeneration of the cellulose. The period is about 5 minutes and the specific form of treatment will depend upon the product being produced. In the case of continuous filaments, they may be collected in a conventional spinning bucket and the cake may then be held in the hot bath for the required period. In the case of staple fibers, they may be placed in the hot bath for the required period or they may be treated as a blanket of fibers in a suitable sluice. The bath solution is then allowed to drain from the filamentary cake or from the staple fibers, as the case may be, and the filaments or fibers then washed and subjected to the conventional after-treatments such as desulfurizing, bleaching, washing and finally dried.

Filaments and fibers produced from the viscose and spun under the foregoing conditions possess the properties and characteristics as described herein.

The fibers and filaments may be produced and the method of forming them may be practiced in conventional equipment such as that shown diagrammatically in the accompanying drawing. A trough or tank **1** is provided as a container for the spinning bath **2** which is generally recirculated in practice. Means for circulating the bath are not shown, such means being conventional in the art. A spinneret **3** mounted at the end of rounder **4** is positioned in the tank **2** being submerged in the spinning bath. The viscose is delivered from a suitable source (not shown) to the rounder and is extruded through the spinneret to form the filaments **5** which upon leaving the spinning bath pass to positively driven godet **6** and then on to a second positively driven godet **7**. The godet **7** is driven at a speed greater than godet **6** and the relative speeds of the godets are selected so as to provide for the required stretching of the filaments between the two godets. Interposed between the godets, there is mounted a trough **8** through which a second or stretching bath is passed. The stretching bath is maintained at a high temperature which plasticizes to some extent the filaments and permits a higher degree of stretching. The stretching bath also effects a further regeneration of the cellulose in the coagulated and partially regenerated filaments formed in the spinning bath **2**.

In the production of staple fibers, the filaments pass from godet **7** in the form of a bundle or tow over a tow roller **9** to a suitable cutting means **10** where the tow is cut into fibers of predetermined length as indicated at **11**. The cut fibers fall into a suitable trough or sluice **12** containing the hot aqueous liquid **15**. The hot aqueous bath may be supplied by a spray **13** which saturates the fibers as they fall into the sluice **12**. Subsequently, the aqueous liquid is drained through a suitable discharge line **14**.

Alternatively, in the production of continuous filaments, the bundle or tow of filaments passing over the tow roller **9** are delivered to a conventional spinning bucket. After the desired size of cake is formed in the spinning bucket, the cake is removed in a conventional manner and is then placed in the hot aqueous liquid to substantially complete the regeneration of the cellulose in the filaments. Subsequently, the hot aqueous liquid is allowed to drain from the cakes.

The fibers or the continuous filaments after the draining of the hot aqueous liquid are then washed and subjected to the conventional after-treating steps such as desulfurizing bleaching and washing and are finally dried.

To illustrate more specifically the method of forming filaments and fibers of the present invention, the following examples are included.

EXAMPLES

Viscoses were prepared in the conventional manner having the following compositions:

	Fiber I	Fiber II
Cellulose, percent	7.5	6
Caustic soda, percent	6.5	7
Carbon disulfide, percent	34	34
Cellulose to caustic soda ratio	0.87	1.16

Both viscoses were modified by the addition, during mixing, of 1.75% dimethylamine and 3.5% of a polyoxyethylene glycol ether of phenol containing an average of 15 ethylene oxide units per mole of phenol. The percentages were based on the weight of the cellulose. The viscoses were aged in a conventional manner at 18° C. for 20 hours and had sodium chloride salt tests of 8.5 to 9.5 and ball fall viscosities of about 90 seconds.

The viscose samples were spun into baths maintained at about 35° C. to form a 1.5 denier, 12,000 filament yarns by extrusion of the viscoses through orifices about 0.0025 in. in diameter. In the spinnig of Fiber I, the spinning bath contained 5.5% sulfuric acid, 10.5% sodium sulfate, 3.5% zinc sulfate and 0.5% formaldehyde. In the spinning of Fiber II, the spinning bath contained 6.5% sulfuric acid, 10.5% sodium sulfate, 3.5% zinc sulfate and 0.75% formaldehyde. In each instance, the filaments were withdrawn from the bath, passed over a first godet, through a hot second bath and over a second godet. The second bath was formed to contain about 1.5% sulfuric acid, about 0.75% zinc sulfate and about 2.5% sodium sulfate and was maintained at a temperature of about 95° C. Because of carry-over, formaldehyde will be introduced and preferably should be maintained so as not to exceed about 0.25%. During passage of the filaments through the hot bath, they were stretched as indicated in the table. The spinning speed was about 25 meters per minute. The filaments were collected and placed in hot water (95° C.) for about 5 minutes. Upon removal from the hot water, excess water was allowed to drain and the filaments then were washed, desulfurized and bleached by conventional treatments.

The physical properties of the filaments are set forth in the following table:

TABLE I

	Percent stretch	Denier	T_w	E_w	T_c	E_c	M_w	S_w	Sol, percent
Fiber I	180	1.40	4.44	15.9	6.0	13.0	19.0	27.8	3
Fiber II	190	1.44	4.58	13.9	5.63	9.0	28.0	33	3

T_w–T_c=Tenacity in grams per denier in wet and conditioned state, respectively.

E_w–E_c=Elongation in wet and conditioned state, respectively.

M_w=Wet modulus at 5% elongation.

S_w=Wet stiffness factor (T_w/E_w).

Sol=Alkali solubility-weight loss after 5 minutes, 6% NaOH solution at room temperature.

Note.—All fibers exhibited a Single Fiber Flex at about 115,000 cycles.

The Single Fiber Flex is measured on a Fiber Flex Tester made by Fiber Test Inc., Arcweld Building, Grove City, Pa. This testing machine measures the resistance of single fibers to fatigue in flexure. In this apparatus, a fiber is secured to a reciprocating element and passes over a carefully machined bar having an edge closely ground to a diameter of approximately 0.005 inch and the other end of the filament is secured to a small weight (about 0.57 gm.). As the element is reciprocated, the filament is drawn across the edge of the bar. The number of cycles up to the time the filament breaks is recorded. As reported in the above table, 10 filaments were subjected to this test and the number of cycles is reported at the time the sixth of the ten fibers fail. This is considered the median value. The corresponding Single Fiber Flex Test for cotton showed 69,000 cycles. This test is directly related to the wear properties of fabrics formed of the specific fibers. This method of testing fibers is described in an article by Lefferdink and Briar, "Interpretation of Fiber Properties," published in Textile Research Journal, vol. 29, June 1959.

Staple fibers having lengths of 1 1/16 inches were formed from prior art high strength, high wet modulus viscose rayon filaments herein designated as Fiber A and from rayon filaments formed in accordance with this invention

and designated as Fiber C. The properties of these fibers were as follows:

TABLE IA

	Percent stretch	Denier	T_w	E_w, percent	T_c	E_c, percent	M_w	S_w	Sol, percent
Fiber A	147	1.49	3.34	18.1	4.95	16.0	10	18.5	8
Fiber C	192	1.44	4.37	14.9	5.88	13.4	22	29.3	3

The staple fibers and cotton fibers were spun to form 41/1 yarns which were then woven into standard 80 x 80 print cloths. Samples of the fabrics were processed in the usual manner by singeing, desizing, scouring, bleaching and drying. Certain fabric samples were subjected to a conventional resin treatment using a 5% solution of a urea-formaldehyde resin (dimethylol ethylene urea-Rhonite R–1, manufactured by Rohm & Haas Co., Philadelphia, Pa.).

Samples of the plain finished fabrics were then examined for texture and were subjected to standard fabric tests. The Grab Strength and the Elongation at break were measured in accordance with the Grab Test Method of ASTM Method D1682–59T. The Elmendorf Tear Strengths were determined by using the Elmendorf Tear Test Machine in accordance with Method 5132 of Federal Specifications CCC–T–191b. Samples of the fabrics were also subjected to 10 successive boiling washes in accordance with Test Method 5550 of Federal Specifications CCC–T–191b.

The measured properties of the plain finished fabrics were as shown in the following table:

TABLE II

	Fiber C	Fiber A	Cotton
Texture	88x80	88x82	82x76
Grab strength (pounds):			
Conditioned:			
W	116	98	58
F	75	69	42
Wet:			
W	74	64	68
F	50	45	50
Elongation (percent):			
Conditioned:			
W	22	20	13
F	24	29	23
Wet:			
W	23	27	19
F	28	35	26
Elmendorf tear (pounds):			
Conditioned:			
W	8.0	6.2	----------
F	2.8	4.3	----------
Shrinkage (percent) boil:			
1st wash:			
W	4.2	5.8	4.0
F	0.8	2.9	1.4
5th wash:			
W	4.3	6.7	5.3
F	0.7	1.8	1.1
10th wash:			
W	5.4	7.6	5.6
F	1.0	2.1	1.3

The warp tensile strength of the fabrics of the present invention in a conditioned state was substantially greater than that of fabrics formed of prior high wet modulus fibers and about double that of a corresponding cotton fabric. In the wet condition, fabrics formed in accordance with the present invention showed a small improvement over fabrics formed of prior high wet modulus fibers and corresponding cotton fabrics.

The washing tests also illustrate that fabrics formed of the fibers of the present invention exhibit an appreciable improvement over fabrics formed of prior high wet modulus fibers and about the same shrinkage characteristics of cotton fabrics.

The resin finished fabrics were subjected to similar tests with the exception that the shrinkage characteristics were determined by 5 successive washings at 140° F. These fabrics were also subjected to a crease or wrinkle recovery test in accordance with the Monsanto Wrinkle Recovery Test of ASTM Method D–1295 and wash and wear tests wherein the fabrics were subjected to drip drying and tumble drying in accordance with AATCC Method 88.

The measured properties of the resin finished fabrics were as shown in the following table:

TABLE III

	Fiber C	Fiber A	Cotton
Texture	87 x 79	87 x 81	90 x 74
Grab strength (pounds):			
Conditioned:			
W	125	107	39
F	80	67	22
Wet:			
W	92	78	39
F	61	50	21
Elmendorf tear (pounds):			
Conditioned:			
W	12.5	9.7	1.5
F	6.3	5.9	0.7
Wet:			
W	4.6	4.3	--------
F	3.0	2.8	--------
Shrinkage (percent) 140° F:			
1st Wash:			
W	2.3	1.8	0.0
F	+0.9	1.9	0.4
5th Wash:			
W	2.3	2.2	0.2
F	+0.8	2.1	0.3
Crease recovery (deg.):			
W	142	138	130
F	136	137	146
Wash and wear:			
Drip dry	2.8	1.8	4.8
Tumble dry	3.5	3.8	5.0

The foregoing data illustrate that the improvements in fabric characteristics imparted by the fibers of this invention as compared to prior high wet modulus fibers are also extended to fabrics given conventional treatments such as a resin finishing treatment.

Although the foregoing examples represent the preferred viscose and bath compositions and the spinning conditions, the fibers formed as described are representative of fibers formed within the ranges set forth hereinabove. Similarly, the fabric examples are represnetative of improved fabrics formed with the fibers of this invention. Similar improvements are obtained in fabrics formed of blends of the fibers of this invention and cotton.

We claim:

1. A regenerated cellulose filamentary structure having a wet tenacity of at least 4 grams per denier, a conditioned tenacity of at least 5.5 grams per denier, a wet modulus of between about 15 and 30, a conditioned extensibility of between about 11% and 14%, an alkali solubiilty of from about 3% to about 4% and being further characterized in being nonfibrillatable.

2. fabric formed of regenerated cellulose filamentary structures as defined in claim 1.

3. A fabric comprising regenerated cellulose filamentary structures as defined in claim 1.

4. A fabric consisting essentially of cotton and from 10% to 70% by weight of the fabric of regenerated cellulose filamentary structures as defined in claim 1.

5. A method of forming regeneratde cellulose filaments which comprises extruding viscose containing from 6% to 8% cellulose, from 5% to 9.6% caustic soda, the ratio of cellulose to caustic soda being from 1:0.8 to about 1:1.2, from 28% to 40% carbon disulfide, based upon the weight of the cellulose, and a biscose modifier in an amount of from about 2% to about 5%, based upon the weight of the cellulose, into a spinning bath containing from 5.5% to 8% sulfuric acid, 2.5% to 7% zinc sulfate, from 10% to 14% sodium sulfate and from 0.25% to 1.0% formaldehyde maintained at a temperature of from 25° C. to 45° C. to form coagulated and partially regenerated cellulose filaments, withdrawing the filaments from the spinning bath, passing the filaments through an aqueous stretch bath maintained at a temperature between 85° C. and 100° C., stretching the filaments in the stretch

bath from about 150% to about 220%, and then subjecting the filaments in a relaxed state to an aqueous bath maintained at a temperature between 85° C. and 100° C. for a period sufficient to substantially complete the regeneration of the cellulose.

6. A method as defined in claim **5** wherein the viscose at the time of extrusion has a sodium chloride salt test of between 6 and 11 and the stretch bath contains from 1% to 5% sulfuric acid, from 1% to 4% zinc sulfate and from 4% to 7% sodium sulfate.

7. A method as defined in claim **5** wherein the viscose contains from about 2% to 5% of a substance having a molecular weight of between about 600 and about 6000 and selected from the group consisting of polyoxyalkylene glycols, polyoxyalkylene glycol ethers of an aromatic alcohol and polyoxyalkylene glycol ethers of polyhydric alcohols, the proportions being based upon the weight of the cellulose in the viscose, the viscose at the time of extrusion has a sodium chloride salt test of between 6 and 11 and the stretch bath contains from 1% to 5% sulfuric acid, from 1% to 4% zinc sulfate and from 4% to 7% sodium sulfate.

8. A method as defined in claim **5** wherein the viscose contains from about 0.5% to 3% of a monoamine viscose modifier and from about 1% to 4% of a substance having a molecular weight of between about 600 and about 6000 and selected from the group consisting of polyoxyalkylene glycols, polyoxyalkylene glycol ethers of an aromatic alcohol and polyoxyalkylene glycol ethers of poyhydric alcohols, the proportions being based upon the weight of the cellulose in the viscose, the viscose at the time of extrusion has a sodium chloride salt test of between 6 and 11 and the stretch bath contains from 1% to 5% sulfuric acid, from 1% to 4% zinc sulfate and from 4% to 7% sodium sulfate.

9. A method as defined in claim **5** wherein the viscose contains from about 2% to 5% of a polyoxyalkylene glycol having a molecular weight of between about 600 and about 6000, the proportions being based upon the weight of the cellulose in the viscose, the viscose at the time of extrusion has a sodium chloride salt test of between 6 and 11 and the stretch bath contains from 1% to 5% sulfuric acid, from 1% to 4% zinc sulfate and from 4% to 7% sodium sulfate.

10. A method as defined in claim **5** wherein the viscose contains from about 0.5% to 3% dimethylamine and from about 1% to 4% of a polyoxyalkylene glycol having a molecular weight of between about 600 and about 6000, the proportions being based upon the weight of the cellulose in the viscose, the viscose at the time of extrusion has a sodium chloride salt test of between 6 and 11 and the stretch bath contains from 1% to 5% sulfuric acid, from 1% to 4% zinc sulfate and from 4% to 7% sodium sulfate.

11. A method as defined in claim **5** wherein the viscose contains from about 2% to 5% of a polyoxyalkylene glycol ether of phenol having a molecular weight of between about 600 and about 6000, the proportions being based upon the weight of the cellulose in the viscose, the viscose at the time of extrusion has a sodium chloride salt test of between 6 and 11 and the stretch bath contains from 1% to 5% sulfuric acid, from 1% to 4% zinc sulfate and from 4% to 7% sodium sulfate.

12. A method as defined in claim **5** wherein the viscose contains from about 0.5% to 3% dimethylamine and from about 1% to 4% of a polyoxyalkylene glycol of phenol having a molecular weight of between about 600 and about 6000, the proportions being based upon the weight of the cellulose in the viscose, the viscose at the time of extrusion has a sodium chloride salt test of between 6 and 11 and the stretch bath contains from 1% to 5% sulfuric acid, from 1% to 4% zinc sulfate and from 4% to 7% sodium sulfate.

13. A method of forming regenerated cellulose filaments which comprises extruding viscose containing about 7.5% cellulose, about 6.5% caustic soda, about 34% carbon disulfide, based upon the weight of the cellulose, about 1.75% dimethylamine, based upon the weight of the cellulose, and about 3.5%, based upon the weight of the cellulose, of a polyoxyethylene glycol ether of phenol containing about 15 ethylene oxide units per mole of phenol and having a sodium chloride salt test of about 8.5 to 9.5 into a spinning bath containing about 5.5% sulfuric acid, about 10.5% sodium sulfate, about 3.5% zinc sulfate and about 0.5% formaldehyde maintained at a temperature of about 35° C. to form coagulated and partially regenerated cellulose filaments, withdrawing the filaments from the spinning bath, passing the filaments through a stretch bath comprising about 1.5% sulfuric acid, about 0.75% zinc sulfate and about 2.5% sodium sulfate maintained at a temperature of about 95° C., stretching the filaments in the stretch bath about 180%, and subjecting the filaments in a relaxed state to an aqueous bath maintained at a temperature of about 95° C. for about 5 minutes.

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