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FILAMENTOUS TEXTILE HAVING A PROCESSING FINISH

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This invention relates to the production of textiles and related materials. More particularly the invention relates to the production of treated fibers, staple fibers, felts, threads, cords, yarns, pellicles, filaments, fabrics and the like of synthetic or natural origin.

It is the primary object of the present invention to provide specially treated fibers, staple fibers, felts, cords, threads yarns, pellicles, filaments, fabrics and the like for use in textile and related manufacture which possess combined characteristics of softness, lubricity, rewettability, scourability and anti-static properties which render them especially adaptable to machine handling. It is a further object to provide a process for producing such materials.

Other objects will become apparent in the course of the following specification and appended claims.

Adaptability of fibers, staple fibers, felts, cords, threads, yarns, pellicles, filaments, fabrics and the like to automatic handling operations is of extreme importance in the manufacture of textiles. Modern high speed machinery technique requires a feed of appropriate characteristics to permit uninterrupted and fault-free operation. Thus, lubricity, softness, electro-static qualities, etc., of the material processed are intimately related to performance of the automatic mechanisms. Furthermore, the condition of the feed when it is submitted to machine operations is likewise related to the excellence of the final product. For instance in the knitting industry, an improperly or poorly lubricated yarn produces uneven stitches. In the spinning of yarn, proper lubrication is essential to the production of an even yarn, free from slubs.

The problem is a most acute one in the use of the more modern machinery, such as for instance the converters employed in the "Tow to Top" spinning process. This process, gaining much favor with the trade due to its economy, is especially sensitive to the physical characteristics of the feed.

Coupled with considerations to facilitate handling, other factors which must be kept in mind in the application of any treating substance to a textile fiber, staple fiber, felt, thread, cord, yarn, pellicle, filament, or fabric are scourability and rewettability. Foreign substances frequently cause difficulties in dyeing such as uneven distribution, spotting, etc. Furthermore, undesirable, unnatural colors, apparent on longitudinal and/or sectional observation, sometimes result from degradation of unremoved treating agent.

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Thus, whatever assistant is temporarily applied to the material processed must lend itself to effective removal, preferable through scouring in the presence of mild detergents.

In accordance with the present invention it has been discovered that by treating textile fibers, staple fibers, felts, cords, threads, yarns, pellicles, filaments, fabrics, and the like so as to impregnate them with a composition of matter comprising a scourable textile lubricant in combination with a class of cationic surface active agents to be described herein, a product results which is highly adaptable to machine operations, combining the characteristics of softness, lubricity, rewettability, scourability and anti-static properties.

By the term "scourable textile lubricant" is intended an oily or waxy substance capable of imparting lubricity when applied to a textile and capable of removal upon scouring in the presence of mild detergents.

Particularly adaptable as scourable textile lubricants are the following materials:

(*a*) Partial esters of neutral polyhydroxylic organic compounds, with from 2 to 6 carbon atoms and fatty acids with from 12 to 30 carbon atoms,

(*b*) Diesters of hexides and saturated fatty acids with from 12 to 30 carbon atoms,

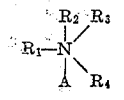
(*c*) Water insoluble esters of poloxyalkylene ethers of neutral polyhydroxylic organic compounds with from 2 to 6 carbon atoms, and fatty acids with from 12 to 30 carbon atoms, and

(*d*) Water insoluble polyoxyalkylene ethers of partial esters of neutral polyhydroxlyic organic compounds with from 2 to 6 carbon atoms and fatty acids with from 12 to 30 carbon atoms.

Specific esters of group (*a*) are the ethylene glycol, propylene glycol, glycerol, erythritol, diethylene glycol, penta-erythritol, diglycerol, triethylene glycol, hexitol, hexitan and hexide partial esters of lauric, oleic, palmitic, stearic, carnaubic, montanic and melissic acids or mixtures of such acids. Specific esters of group (*b*) are sorbide and mannide diesters of the named fatty acids. Specific esters of group (*c*) are the 12 to 30 carbon atom fatty acids, tetra-, penta-, and hexa-esters of a polyoxyethylene ether of sorbitol with an average of 6 oxyethylene groups per molecule of sorbitol, the tetra- and penta-esters of the corresponding polyoxyethylene ether of glucose, and the esters of the corresponding polyoxypropylene ether of sorbitol or of glucose. Specific ether esters of the group (*d*) include the polyoxyethylene ethers of hexitan

mono-, di- and tri-esters of fatty acids with from 12 to 30 carbon atoms wherein the number of oxyethylene groups is insufficient to render the ethers water-soluble, as for example, the polyoxyethylene ethers of sorbitan tristearate wherein there is an average of 16 oxyethylene groups per molecule of sorbitan tristearate. The polyoxypropylene ethers of hexitan fatty acid partial esters are further members of group (*d*). In each of these exemplified classes the oil-type derivatives are particularly preferred.

The class of cationic surface active agents found suitable for the purposes of the invention comprises quaternary ammonium compounds of the following structural configuration:



wherein A is an anion; R_1 is an aliphatic hydrocarbon radical containing from 12 to 18 carbon atoms; R_2 and R_3 are selected from the group consisting of short chain alkyl, alkylol and aliphatic radicals which together with the nitrogen atom may form a heterocyclic ring; and R_4 is selected from the group consisting of short alkyl and lower aralkyl. The preferred classes of substitution appear in Table I.

TABLE I

R_1	R_2	R_3	R_4	A
Lauryl Myristyl Cetyl Oleyl Stearyl	Methyl Ethyl Carbinol Hydroxyethyl	Methyl Ethyl Carbinol Hydroxyethyl	Methyl Ethyl Benzyl Phenethyl	Halide Nitrate Sulfate Alkylsulfate Cyanide Phosphate Acetate Benzoate Citrate Tartrate
	Morpholinium Piperidinium			

The especially valuable quaternary compounds for the purpose include:

N-cetyl, N-methyl, morpholinium methosulfate
N-myristyl, N-benzyl, piperidinium methosulfate
Lauryl, diethyl, ethanol ammonium ethosulfate
Oleyl, diethanol benzyl ammonium chloride
Stearyl diethanol benzyl ammonium chloride.

Methods of preparation of such quaternary ammonium compounds are fully disclosed in the prior art and need not be elaborated here. It is pointed out, however, that instead of the specifically indicated pure compounds, mixtures thereof may be employed. For example, mixtures are produced when the quaternary is made from commercial grade primary amines wherein the long chain radical is derived from and corresponds in hydrocarbon chain to the acids found (as triglycerides) in fats and oils), such as soya oil, cottonseed oil, cocoanut oil, animal fats and the like.

The compositions described herein may be applied with advantage to animal, vegetable, mineral or synthetic materials in any of the forms of fiber, staple fiber, felt, thread, cord, yarn, pellicle, filament, fabric and the like of synthetic or natural origin in preparation to feeding in any machining operation, such as twisting, carding, combing, coning, quilling, spinning, weaving, knitting, sewing and the like. It may be applied by any of the conventional means such as spraying, dipping, padding, or roller or continuous flowing saturation in either the emulsified or non-aqueous form. The composition is especially adaptable to emulsion use, being particularly stable as compared with many other emulsion applied finishes.

In the textile assistants of the present invention, the content of the scourable textile lubricant based on the sum of scourable lubricant and cationic compound, is at least 50% and preferably is at least 60%. For maximum stabilizing effect of aqueous emulsions of the compositions, it is preferred to employ at least 20% of said cationic compound based on the sum of scourable lubricant and cationic compound, and in any event to employ at least 2.5%. Thus the broadly operable proportion of scourable lubricant to cationic compound lies between the limits of 50 to 50% and 97.5 to 2.5% and the preferred range lies between the limits of 60 to 40% and 80 to 20%.

It is understood, of course, that the scourable lubricants modified as described above may be combined with other textile specialties which act primarily as diluents to assist application. Thus oils of mineral, animal or vegetable origin, such as petroleum oil of suitable purity and viscosity, paraffin wax, lanolin, cottonseed oil, castor oil, soya oil, palm oil, etc., which have been found compatible with the modified scourable lubricants described are available as application assistants. They may be added to the previously described modified scourable lubricant in amounts the upper range of which is determined only by the scourability of the final mixture. Due to the high dispersing action of the modified scourable lubricants, the specialty phase may be as high as 98%.

Specific emulsifiable compositions which have demonstrated their power to impart superior qualities relative to softness, lubricity, rewettability, scourability and anti-static tendencies to the various textiles are listed below by way of example. The compositions of Examples 1 to 3 were applied to cellulosic fibers.

Example	Monoester	Percent	Cationic	Percent
1	Diethylene glycol monostearate.	75	N-cetyl, N-ethyl morpholinium ethosulfate.	25
2	Diethylene glycol monolaurate.	80	N-cetyl, N-ethyl morpholinium ethosulfate.	20
3	Triethylene glycol monooleate.	60	Stearyl, diethanol, benzyl ammonium chloride.	40

Example 4

The product of Example 1 was dispersed in water at a temperature of about 60° C. to form an emulsion containing 5% solids. The resulting emulsion was stable and was diluted to 0.4% solids without evidence of separation. The diluted emulsion was applied to cakes of fresh viscose rayon yarn of 150 denier, 40 filament size by subjecting said cakes to continuous flowing saturation with the emulsion at 45° C. for twelve minutes. Following drying, this yarn was found to be desirably soft yet firm in the cake and to have a low order of friction when passing over a metal guide. These properties resulted in improved windability and subsequent processing characteristics of the yarn.

Example 5

The product of Example 2 was dispersed in water at a temperature of about 60° C. to form

an emulsion containing 3% solids. This emulsion was applied to package dyed cotton yarn of 20 singles count by passing the yarn over a metal roll turning at a speed of 8 R. P. M. in a trough containing the emulsion. The treated yarn produced an excellent stitch and a soft fabric when knit on a Thompson circular knitting machine.

Example 6

A composition consisting of 75 parts diethylene glycol monolaurate and 25 parts lauryl diethyl ethanol ammonium etho-sulfate was applied to viscose rayon broadcloth fabric by padding from an emulsion containing 1% solids based on the weight of the fabric at a bath concentration of 50 parts water to 1 part fabric by weight. A soft, full finish was imparted to the fabric by this treatment.

Example 7

A composition consisting of 37.5% of sorbitan monopalmitate, 37.5% of sorbitan tristearate condensed with 16 mols of ethylene oxide and 25% of cetyl ethyl morpholinium ethosulfate was dispersed in water at 60° C. to produce an emulsion having a total solids content of 0.1%. This emulsion was applied to 3 denier bright bleached viscose rayon tow by passing the tow through the emulsion as the final step in the wet processing during production. During the treatment, the pH value of the bath was controlled at approximately 8 by the addition of sodium hydroxide solution when necessary. The tow was then dried and was observed to have unusually good softness and to exhibit outstanding qualities during conversion to top on the Pacific converter. Subsequent drafting and spinning of the top demonstrated that the finish provided excellent cohesion of the fibers and eliminated flaky deposits normally found on the drawing frames and in the yarn. Floc produced by cutting the tow treated in the above manner was found to be characterized by a very desirable softness and freedom from "pilling" which markedly facilitated its handling and processing.

The following example is inserted to illustrate the essential character of the quaternary ammonium component.

Example 8

A composition having the same constitution as specified in Example 7, except that the cetyl ethyl morpholinium ethosulfate was omitted, was applied to 3 denier bright bleached viscose rayon tow in the manner described in Example 7. The treated tow was observed to lack the cohesive properties noted in Example 7 and was very difficult to process on the Pacific converter. Subsequent spinning of the converted tow indicated that it processed less efficiently than the tow treated as described in Example 7.

Example 9

A composition having the same constitution as specified in Example 7 was dispersed in an aqueous solution of 0.05% sodium sorbitol borate to produce an emulsion containing 0.2% of the specified composition. This emulsion was then applied to 5.5 denier bright unbleached viscose rayon staple fiber having a staple length of from 3 to 5 inches by continuous flowing saturation of the fiber in the form of a loosely assembled mat supported by a mechanism capable of moving it progressively in a horizontal plane while the emulsion was caused to cascade downward through the mat as the final step in the wet processing during production. During the treatment the pH of the emulsion was maintained at approximately 8 by the addition of sodium hydroxide solution when necessary and the concentration of the emulsion was maintained at approximately the original level by continuous fortification with an emulsion containing the same specified composition at a concentration of about 2%. The fiber was subsequently dried and was observed to exhibit outstanding properties when opened and carded. Of particular note were the absence of broken filaments, freedom from fly and generally efficient operation. Subsequent drawing and spinning of the treated fiber produced yarns having excellent physical properties and a desirable softness.

Example 10

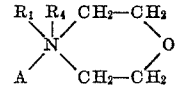
A composition consisting of 75 parts of diethylene glycol monolaurate and 25 parts of stearyl diethanol benzyl ammonium chloride was dispersed in water at 60° C. to form an emulsion containing 5% solids. The resulting emulsion was stable and was applied to scoured wool stock by spraying during the picking operation in such a manner that about 0.5% of the specified composition was applied to the wool. This treatment resulted in improved carding efficiency with a reduction in fly waste and in very favorable spinning properties which produced yarns having excellent physical characteristics and a desirable softness.

The compositions as described herein may be advantageously applied to any of the forms of such textile materials as silk, wool, glass, rayon, cotton, linen, nylon, asbestos, leather, etc.

It will be apparent that many variations can be made without departing from the scope of the invention which is defined in the appended claims.

What is claimed is:

1. A filamentous textile having incorporated therewith, a processing finish consisting essentially of from 50% to 97.5% of a scourable textile lubricant selected from the group consisting of (1) partial esters of neutral polyhydroxylic organic compounds with from 2 to 6 carbon atoms and saturated fatty acids with from 12 to 30 carbon atoms, (2) diesters of hexides and saturated fatty acids with from 12 to 30 carbon atoms, (3) water-insoluble esters of polyoxyalkylene ethers of neutral polyhydroxylic compounds with from 2 to 6 carbon atoms and saturated fatty acids with from 12 to 30 carbon atoms, and (4) water-insoluble polyoxyalkylene ethers of partial esters of neutral polyhydroxylic organic compounds with from 2 to 6 carbon atoms and saturated fatty acids with from 12 to 30 carbon atoms, and from 50% to 2.5% of a quaternary morpholinium compound of the formula:



wherein, A is an alkyl sulfate anion having from 1 to 2 carbon atoms, R_1 is an aliphatic radical containing from 12 to 30 carbon atoms, and R_4 is an alkyl radical having from 1 to 2 carbon atoms.

2. A textile as defined in claim 1, wherein the textile is in the form of a staple fiber.

3. A textile as defined in claim 1, wherein the textile is in the form of a tow.

4. A textile as defined in claim 1, wherein the textile is in the form of yarn.

5. A textile as defined in claim 1, wherein the textile is in the form of a fabric.

6. A textile as defined in claim 1, wherein the textile is of natural origin.

7. A textile as defined in claim 1, wherein the textile is of mineral origin.

8. A textile as defined in claim 1, wherein the textile is of animal origin.

9. A textile as defined in claim 1, wherein the textile is of vegetable origin.

10. A textile as defined in claim 1, wherein the textile is of synthetic textile material.

11. A textile as defined in claim 1, wherein the textile is a regenerated cellulose.

12. A viscose staple fiber, having incorporated therewith a processing finish consisting essentially of from 50 to 97.5 parts of diethylene glycol monostearate and from 50 to 2.5 parts of N-cetyl, N-ethyl morpholinium ethosulfate.

13. A cotton yarn, having incorporated therewith a processing finish consisting essentially of from 50 to 97.5 parts of diethylene glycol monolaurate and from 50 to 2.5 parts of N-cetyl, N-ethyl morpholinium ethosulfate.

14. A viscose rayon tow, having incorporated

therewith a processing finish consisting essentially of from 50 to 97.5 parts of a mixture of sorbitan monopalmitate and polyoxyethylene sorbitan tristearate containing an average of 16 oxyethylene groups per mol and from 50 to 2.5 parts of N-cetyl, N-ethyl morpholinium ethosulfate.

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References Cited in the file of this patent

UNITED STATES PATENTS

Number	Name	Date
2,127,586	Dreyfus et al.	Aug. 23, 1938
2,174,760	Schuette	Oct. 3, 1939
2,186,628	Dickey	Jan. 9, 1940
2,196,753	Dickey et al.	Apr. 9, 1940
2,312,469	Freund	Mar. 2, 1943
2,372,985	Roth	Apr. 3, 1945
2,417,992	Niederl et al.	Mar. 25, 1947
2,436,980	Standley et al.	Mar. 2, 1948
2,461,043	Eisen	Feb. 8, 1949
2,471,945	Figdor	May 31, 1949

OTHER REFERENCES

Chemicals Glyco, 1942, pages 15, 16, 50 and 51.