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TREATMENT OF TEXTILE MATERIALS

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This invention relates to the treatment of textile materials and relates more particularly to the conditioning of fibers and filaments made of organic derivatives of cellulose whereby the same are rendered more amenable to textile operations such as carding, drafting, spinning and, also weaving or knitting, and to the formed yarns and fabrics made from or containing said organic derivatives of cellulose fibers or filaments.

An object of the present invention is the provision of an improved method of preparing a stable liquid for conditioning fibers and filaments comprising organic derivatives of cellulose to improve their amenability to textile operations such as carding, drafting, spinning, twisting, coning, plying, hanking, weaving, knitting and the like.

A further object of our invention is to provide a treatment for textile fibers or filaments containing organic derivatives of cellulose with a novel conditioning fluid whereby they are rendered more anti-static and have the proper amount of friction between the fibers to give a control to carding and drafting.

A further object of the present invention is to provide a process for the treatment of organic derivatives of cellulose textile materials with a conditioning fluid containing different types of lubricants, softeners and other ingredients whereby fabrics made from such materials have a softer hand and present a uniform appearance.

Another object of the invention is the provision of an improved textile material made of or containing organic derivative of cellulose fibers or filaments having applied thereto a conditioning fluid of the present invention.

Other objects of our invention will appear from the following detailed description and the appended claims.

Many substances such as vegetable, animal and mineral oils, both normal and specially treated, have been employed for lubricating or conditioning textile materials in order to render them more suitable for processing a fabric. While these substances have resulted in some improvements in processing, they still left much to be desired and in addition presented problems of their own. Thus, the oils tend to gum or polymerize with time so that lubricated fibers and filaments cannot be processed uniformly due to the hardening of the oil. Moreover, such gumming or polymerization makes it difficult for the conditioning agent to be removed from the fabrics made with such textile materials. Also lubricating or conditioning compositions heretofore used did not penetrate or spread evenly into or

upon the fibers or filaments treated or presented other difficulties of applications.

Particularly in the case of conditioning of relatively short length or staple fibers formed of organic derivatives of cellulose do the prior lubricating compositions fall short of what was desired. While some such compositions were capable of conditioning the fibers to withstand the numerous bendings and twistings imparted thereto during processing, they did not impart the desired degree of friction between the fibers to enable them to be drawn or drafted to fine yarns. On the other hand, some compositions are satisfactory with respect to their friction characteristic but do not properly condition the fibers for weaving, knitting or other textile operations.

We have found that these and other disadvantages arising out of the use of known conditioning fluids can be avoided by the use of the conditioning fluid of the present invention comprising a mixture of several ingredients, some of which react with each other. Fibers treated with our novel composition behave much more satisfactorily in carding and drafting operations and in subsequent winding, twisting, warping, weaving, knitting and like operations than do untreated fibers and filaments, or fibers and filaments treated with known conditioning fluids. Moreover, we have found that fibers treated with our conditioning fluids are not deleteriously affected upon storage and in some case may even be improved after being stored for a time. Furthermore, the conditioning fluid of our invention does not alter its effects on the fibers stored for long periods of time but retains the same balance of friction for carding and drafting operations, lubricative properties for other textile operations and conditioning properties to withstand the rigors of processing. Other advantages are also imparted to the yarn by our conditioning fluid as will appear hereinafter.

In accordance with our invention we treat fibers or filaments containing organic derivative of cellulose with a conditioning agent formed by reacting a mineral oil, a fatty acid and sulphuric acid and to this reaction product adding a vegetable oil, an alkali, an alkylolamine and water. This conditioning agent is stabilized, preserved against oxidation and given an enhanced covering power by the addition of an alkylated phenol or other spreading and penetrating agent.

The fibers or filaments to be treated in accordance with this invention may have as a basis any suitable organic derivative of cellulose such as organic esters of cellulose and cellulose ethers.

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Examples of organic esters of cellulose are cellulose acetate, cellulose propionate and cellulose butyrate or mixed esters such as cellulose acetate-butyrate or cellulose acetate-propionate, while examples of cellulose ethers are ethyl cellulose and benzyl cellulose. However, the conditioning agent of the instant invention is particularly advantageous in connection with the use of cellulose acetate as the basis for the fibers or filaments, especially acetone-soluble cellulose acetate having an acetyl value of 52½% to 56%, preferably 54½%, calculated as acetic acid. However, partially saponified organic esters of cellulose may be also employed as the basis of the fibers or filaments.

This invention is applicable to the treatment of fine filaments, or a plurality of such fine filaments associated together in the form of yarn, or larger filaments such as artificial bristles, horse-hair, straw and the like, and also to fabrics or other articles formed therefrom. It is particularly applicable to the treatment of relatively short lengths of fibers, say from ¼ inch to 6 or more inches in length that are known in the trade as staple fibers. The conditioning liquid may be applied to the staple fibers or to the continuous filaments from which the staple fibers are cut or to the filaments as they are being cut. The fibers or filaments need not consist wholly of fibers or filaments of organic derivative of cellulose but may contain fibers of other materials such as natural silk, artificial fibers of reconstituted cellulose, wool, cotton, etc. The conditioning liquid of the present invention may be employed on artificial fibers that contain finely divided pigment-like materials that alter the lustre and/or color of the fiber without deleterious effect.

As stated above, our novel conditioning fluid comprises the reaction product of mineral oil, fatty acid and sulphuric acid, which reaction product is reacted with a raw vegetable oil, an alkali, an alkylolamine and water and the whole resulting compound stabilized and otherwise improved by the addition of an alkylated phenol, or where the fibers to be treated contain an ester of cellulose with an alkylated phenol and/or esterified vegetable oil. In a preferred form of our invention all or a part of the raw vegetable oil is added with the fatty acid and takes part in the first reaction. Other materials may also be added, such as, for example, softeners for particular fibers being treated; substances which aid in emulsifying the composition and also facilitate the removal of the same by scouring; preservatives such as Dowicide A (sodium ortho phenyl phenate), etc. Fugitive dyes or tints may also be added to identify the materials in processing also permanent dyes, etc. may be added.

The mineral oil employed in forming the conditioning liquid of our invention may be one having a paraffinic or naphthenic base and a viscosity of 50 to 75 seconds. The viscosity referred to herein is Saybolt Universal at 100° F. However, the viscosity of the mineral oil employed is determined by the over-all viscosity desired in the conditioning liquid or, in other words, the limit of viscosity of the mineral oil is set by the over-all viscosity of the conditioning liquid which dried on the fibers gives desirable textile characteristics thereto. This over-all viscosity may be on the order of 80 to 200 seconds and preferably about 150 seconds. Optimum results are obtained using a white mineral oil having a paraffinic base and a viscosity of 50 seconds.

The fatty acid employed in the first reaction

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step of our invention may be any suitable fatty acid, examples of which are oleic acid, ricinoleic acid, palmitic acid, etc. The preferred fatty acid, however, is oleic acid of at least technical grade or better. The sulphuric acid employed is fuming sulphuric acid containing about 20% SO₃ and is commonly termed "Oleum 20%".

A preferred method of preparing the conditioning fluid of our invention is as follows:

About 29 parts of a white mineral oil of 50 viscosity, 21.5 parts of oleic acid or its equivalent of other fatty acids and 10.5 parts of raw vegetable oil such as olive oil, rice oil or peanut oil are mixed and cooled to about 10° C. in a jacketed mixer through the jacket of which circulates a cooling medium having a temperature of -10° to -20° C. With constant stirring about 6.5 parts of fuming sulphuric acid are slowly added, say in a 30 minute period. The temperature rises to about 20° C. during the reaction time of about 75 minutes.

To the above reaction product is added about 5 parts of diamyl phenol and then a mixture of about 11.6 parts of triethanolamine or its equivalent of other alkylolamine, 1.6 parts of sodium hydroxide or its equivalent of potassium hydroxide and 14 parts of water. The whole batch is stirred until all reaction ceases and a clear oil is formed. Some of the raw vegetable oil may be added with the alkali, if so desired. This conditioning liquid may be mixed with water and applied as an emulsion to the fibers, filaments, yarns, etc.

In the resulting product substantially 40% of the original oleic or equivalent fatty acid is sulfated and/or sulfonated; substantially 9% of the original raw vegetable oil is sulfated and/or sulfonated; the mineral oil remains substantially unaffected chemically; none of the vegetable oil is saponified by the alkali and triethanolamine which has been added in amounts to neutralize all the sulfuric acid present and most but not all of the oleic or other fatty acid used. The product is slightly acid due to the presence of about 10% of unneutralized oleic acid.

The product is an oily compound which readily forms a stable, white emulsion in water, 2% emulsion thereof having a pH of 6.8.

In place of all or a part of the diamyl phenol employed in the above formula there may be substituted other alkyl derivatives of phenols. The alkylated phenol not only acts as an anti-oxidant but also enhances the penetrative and spreading effects of the conditioning liquid in and on the fibers and yarns and stabilizes the conditioning liquid whereby it does not separate into its components upon standing. Examples of other alkyl derivatives of phenols or alkylated phenols are dibutyl and diamyl derivatives of cresols and xylenols, the dibutyl and diamyl derivatives of any of the mono-chlorophenols, etc. The diamyl phenol may also be replaced in whole or in part by tricresyl phosphate or triphenyl phosphate or similar compounds. When the fiber or yarn being treated contains organic esters of cellulose, the addition of an acetylated vegetable oil, such as acetylated castor or olive oil, may be employed advantageously. These agents although having several functions are called, for the purpose of simplifying the description of the invention, spreading and penetrating agents.

In place of all or a part of the triethanolamine there may be substituted other hydroxylated amines such as monoethanolamine, diethanolamine, diethylamino ethanol, ethyl diethanolamine, 2 methyl-2-amino propanol, etc.

The proportions of the several ingredients may be varied to some degree, depending somewhat on the use to which the treated fibers are to be put and the properties which it is desired to emphasize. Thus, where it is desired to increase the spreading and wetting properties the amount of diamyl phenol may be increased from 5 parts to 10 or more parts. Also the amount of mineral oil may be varied from 20 parts to 35 parts depending on the lubricity desired. Also the amount of alkali and alkylolamines may be varied. In this respect we have found that the preferred conditioning liquid should be one that a 2% emulsion of same in water has a pH of from 6.6 to 7.

The conditioning liquid obtained in accordance with our invention may be applied to fibers and filaments in the concentrated form or it may be applied as an emulsion, or dissolved or suspended in a carrier. The amount of conditioning liquid applied may vary from 1 to 10 or more per cent based on the weight of the untreated fibers. The conditioning liquid is preferably applied to running yarns and filaments by wicks, rollers or other furnishing devices. However, it may also be applied to fibers by dipping bales thereof in a bath of the conditioning liquid or by spraying the same with a mist of same.

The term "sulfonation" as used in the appended claims designates not only the phenomenon of sulfonation proper (that is the formation of products wherein sulfur atoms are linked directly to carbon atoms) but also sulfation (that is the formation of products wherein the sulfur atoms are linked to oxygen atoms that are in turn linked to carbon atoms).

It is to be understood that the foregoing detailed description is given merely by way of illustration and that many variations may be made therein without departing from the spirit of our invention.

Having described our invention, what we desire to secure by Letters Patent is:

1. Process for the preparation of a conditioning liquid for textile materials which comprises reacting a mixture comprising a mineral oil, a vegetable oil, a higher fatty acid and fuming sulphuric acid at a temperature no greater than about 20° C. whereby sulphonation of at least part of the fatty acid and vegetable oil occurs and then adding a spreading and penetrating agent and an amount of alkali-metal hydroxide and an alkylolamine to neutralize all of the sulfuric acid and the major portion of the higher fatty acid.

2. Process for the preparation of a conditioning liquid for textile materials which comprises reacting a mixture comprising a mineral oil, a vegetable oil, a higher fatty acid and fuming sulphuric acid at a temperature no greater than about 20° C. whereby sulphonation of at least part of the fatty acid and vegetable oil occurs and then adding an alkylated phenol and an amount of alkali-metal hydroxide and an alkylolamine to neutralize all of the sulfuric acid and the major portion of the higher fatty acid.

3. Process for the preparation of a conditioning liquid for textile materials which comprises

reacting a mixture comprising a mineral oil, a vegetable oil, a higher fatty acid and fuming sulphuric acid at a temperature no greater than about 20° C. whereby sulphonation of at least part of the fatty acid and vegetable oil occurs and then adding diamyl phenol and an amount of alkali-metal hydroxide and an alkylolamine to neutralize all of the sulfuric acid and the major portion of the higher fatty acid.

4. Process for the preparation of a conditioning liquid for textile materials which comprises reacting a mixture comprising a mineral oil, a vegetable oil, a higher fatty acid and fuming sulphuric acid at a temperature no greater than about 20° C. whereby sulphonation of at least part of the fatty acid and vegetable oil occurs and then adding an acetylated castor oil and an amount of alkali-metal hydroxide and an alkylolamine to neutralize all of the sulfuric acid and the major portion of the higher fatty acid.

5. Process for the preparation of a conditioning liquid for textile materials which comprises reacting a mixture comprising a mineral oil, a vegetable oil, oleic acid and fuming sulphuric acid at a temperature no greater than about 20° C. whereby sulphonation of at least part of the fatty acid and vegetable oil occurs and then adding a spreading and penetrating agent and an amount of alkali-metal hydroxide and an alkylolamine to neutralize all of the sulfuric acid and the major portion of the higher fatty acid.

6. Process for the preparation of a conditioning liquid for textile materials which comprises reacting a mixture comprising a mineral oil, a vegetable oil, oleic acid and fuming sulphuric acid at a temperature no greater than about 20° C. whereby sulphonation of at least part of the fatty acid and vegetable oil occurs and then adding diamyl phenol and an amount of alkali-metal hydroxide and an alkylolamine to neutralize all of the sulfuric acid and the major portion of the higher fatty acid.

7. Process for the preparation of a conditioning liquid for textile materials which comprises reacting a mixture comprising a mineral oil, a vegetable oil, oleic acid and fuming sulphuric acid at a temperature no greater than about 20° C. whereby sulphonation of at least part of the fatty acid and vegetable oil occurs and then adding an acetylated castor oil and an amount of alkali-metal hydroxide and an alkylolamine to neutralize all of the sulphuric acid and the major portion of the higher fatty acid.

8. Process for the preparation of a conditioning liquid for textile materials which comprises reacting a mixture comprising a mineral oil, raw peanut oil, oleic acid and fuming sulphuric acid at a temperature no greater than about 20° C. whereby sulphonation of at least part of the fatty acid and vegetable oil occurs and then adding a spreading and penetrating agent and an amount of alkali-metal hydroxide and an alkylolamine to neutralize all of the sulphuric acid and the major portion of the higher fatty acid.

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