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SCORCH RESISTANT TEXTILE SOFTENING FINISH COMPOSITION

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This invention relates to improved textile finishing compositions. More particularly this invention relates to textile finishing compositions which impart softness to fibers, yarns and fabrics but which will not cause the fibers, yarns and fabrics treated with these compositions to scorch when subjected to elevated temperatures.

Softness is very frequently required in textile materials, particularly in fabrics used for clothing. The natural waxy, oily, or fatty protective coatings of native fibers are often removed during the process of scouring and/or bleaching these fibers. The fibers generally become harsher when these lubricants are removed, and fabrics formed from these fibers display an undesirable handle. In addition, certain coloring matters are apt to impart a dryness and an unpleasant handle to the fabric. Oftentimes softeners are applied to the fibers themselves to aid in the mechanical handling of these fibers since it is very difficult to spin any fiber from which the natural oils or waxes have been removed or, as in the case of man-made fibers, those which do not contain a natural lubricant. The situations with which this invention is particularly concerned are those in which softeners are applied to a yarn or fabric as a finish in themselves, to impart softness, smoothness, lubricity, fullness, suppleness, flexibility, and in some cases sewability as well.

There are a great many preparations available for softening textile materials and most, if not all, of these preparations are based on long chain fatty or waxy compounds. Water-soluble soaps appear in a great many of these preparations. These soaps which have textile softening properties in and of themselves are often used as emulsifying agents for fats. However, fabrics, treated with these soaps or soap-fat emulsions at their normally alkaline pH, exhibit a tendency to scorch when heated to the elevated temperatures encountered in certain textile processing operations. This tendency to scorch is apparently attributable to the presence of the soap. The manufacture of shirt collars for white shirts is illustrative of a situation in which this scorching tendency is particularly troublesome. Shirt collars are often made by interposing a thermoplastic resin between two thicknesses of cloth and subjecting the composite to elevated temperatures. At these elevated temperatures, the textile softening compositions containing fats and/or soaps become discolored or scorched, thus marring the appearance of the fabric.

Textile manufacturers do not find it economically expedient to treat only a portion of a particular lot of fabric with a scorch resistant textile finish. Furthermore, it is not known by the manufacturers how much or what part of a particular lot of fabric is to be subjected to elevated temperatures. What has been desired and has been heretofore unavailable is an adequately emulsified soap-containing scorch resistant softener which could compete costwise with other softeners so that entire lots of a particular fabric could be treated with the scorch resistant softener at little or no economic disadvantage.

The textile softening compositions with which we are

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concerned contain soaps. Since these soaps are salts of weak acids and strong bases, they ionize in aqueous solution, and are distinctly alkaline. The pH of the aqueous solutions of textile softening finishes which contain soap as an emulsifying agent is normally about 9 to 10 when the finishes are applied to the fabric. As the pH is lowered below 9, an increasing scorch resistance becomes apparent, with the optimum pH being about 5-7. However, the addition of a mineral or organic acid to the composition in sufficient quantity to impart scorch resistance will cause separation in the composition and/or cause it to become non-dispersible in water. The fat or wax should be thoroughly dispersed in the application liquor in order to assure the uniformity of application to the fiber, yarn, or fabric which is necessary for maximum effectiveness of the composition.

Although emulsifying agents other than soaps might conceivably be used as emulsifying agents in the soap-fat compositions of the present inventions, the soaps enjoy at least three advantages. Soaps, especially those of higher fatty acids, in addition to acting as excellent emulsifiers, also contribute to the softening and/or lubricating effect of the composition. Secondly, soaps are abundant and inexpensive. Thirdly, soaps, as finishes, are dermatologically safer than many other types of softeners. Finishes are often applied by the manufacturer to fabrics, such as shirting material, which will come in contact with the skin of the consumer without prior removal of the softener; also, many commercial laundries apply finishes to their work. Since these finishing compositions remain largely on the surface of the fiber, the possibility of deleterious dermatological effects must be considered.

It is an object of this invention to provide soap-containing textile softening finishes which are highly scorch resistant. It is a further object to provide a method for rendering scorch resistant those textile softening finishes which display a tendency to scorch at their normally alkaline pH. It is a further object to provide scorch resistant textile softening finishes which have excellent emulsion characteristics.

This invention is based on the discovery that the addition of minor amounts of a compound having a near neutral pH in aqueous solution, but capable of breaking down to an acid fraction when heated, renders scorch resistant those textile finishes which contain soap and therefore have a tendency to scorch at their normal alkaline pH. These heat labile acid forming salts are particularly effective when used in conjunction with soap-fat finishes which have emulsions which become unstable in the presence of acids in an amount necessary to lower the pH to a level at which the textile finishes are scorch resistant.

The major component of the improved scorch resistant soap-fat textile softening finishes of this invention consists of a mixture of higher molecular weight mono-, di-, and triglycerides which triglycerides may be found in hardened or unhardened tallow and which mixture may be produced by reacting glycerin with a fat and using a catalyst such as sodium hydroxide. The fatty acids should contain from about 14 to about 22 carbon atoms. For maximum effectiveness, fats containing unsaturated fatty acids should preferably be hardened by hydrogenating the double bonds. Hydrogenated tallow is a preferred source of suitable fatty acids. Tallow is both inexpensive and abundant and capable of giving excellent softening to textiles if properly hardened and emulsified. However, the preparation of a suitable emulsion of tallow mono-, di-, and triglycerides is difficult, particularly when the tallow has been hardened.

The water-soluble soaps of higher fatty acids are excellent emulsifying agents for the mono-, di-, and triglycerides. In particular, the water-soluble soaps of the higher fatty acids obtained from tallow are excellent

emulsifiers for the tallow mono-, di-, and triglycerides. The water-soluble soaps may be admixed mechanically with the mixture of glycerides, or they may be formed along with the formation of the mono-, di-, and triglycerides by using an excess of suitable alkaline catalyst. Since the use of the excess catalyst such as sodium hydroxide results in the formation of the primary softening agent, i.e., the mono-, di-, and triglycerides, and an emulsifier, i.e., the sodium soap, in a single reaction, this procedure is preferred to the separate formation and mechanical admixture of the components.

Examples of the scorch-inhibiting compounds useful in the practice of this invention are ammonium salts such as ammonium chloride, ammonium sulfate, ammonium salts of sulfate esters of fatty alcohols, and ammonium stearate and amine salts such as glycine hydrochloride, hydroxylamine hydrochloride, and ethanolamine hydrochloride. We prefer to use ammonium chloride since it is relatively inexpensive, is only mildly acidic under normal conditions, and will not liberate a free acid in quantity until subjected to a high temperature so that it can be much more easily incorporated in the composition.

The same soaps which are used to emulsify the higher fatty mono-, di-, and triglycerides can also be employed as textile finishes by themselves. Although the problem of unstable emulsions is not as prominent in the absence of the glycerides, the use of the compounds characterized herein as heat labile acid forming salts rather than an acid to preserve emulsion or solution stability is nevertheless desirable, since the scorching problem is just as troublesome, and the heat labile acid forming salts are equally as effective in resolving this problem. The following table demonstrates the remarkable effectiveness of one such heat labile acid forming salt, ammonium chloride, in reducing the tendency of soaps to cause scorching.

One percent solutions of each of two soap compositions were prepared and each preparation divided into several portions. Composition No. 1 contained 90% real soap, 0.1% brightener, 0.5% sodium silicate, 1.4% sodium chloride and 8% moisture. Composition No. 2 contained 91% real soap, 0.5% sodium silicate, 1.5% sodium chloride, and 7% moisture. Varying amounts of ammonium chloride were added to each portion, the clear solutions applied to cotton crash toweling and the toweling passed between two squeeze rolls. After drying overnight, the fabrics were scorched at 400° F. for 30 seconds. The degree of scorching was determined visually and expressed in terms of a scorch rating as follows with a rating of 10 indicating the least scorching. The ammonium chloride is expressed as a percent based on the weight of the soap composition.

TABLE I

Percent NH ₄ Cl	Scorch Rating	
	Composition No. 1	Composition No. 2
0.0.....	0	0
5.0.....	4	3
10.0.....	7	5
15.0.....	10	9
20.0.....	8	8
25.0.....	6	6
Water Control (blank).....	9	10

The addition of a synthetic surface active agent to prevent thickening of soap-fat mixtures is sometimes desirable during the manufacturing step when the latent acid salt is added. Not all latent acid salts require the addition of this surface active agent and those which require it when present in high concentrations do not necessarily require it when present in lower concentrations. The surface active agents also act as an additional emulsifier, giving the product greater fluidity, better dispersi-

bility and, when the product is otherwise emulsified, greater stability. Alkyl phenol-ethylene oxide condensates are preferred, but any nonionic emulsifier when present in proper concentration can be employed, provided that it has the proper hydrophile-lipophile balance. When the hydrophile-lipophile balance is too low, the product is firmer than is desirable, whereas too high a hydrophile-lipophile balance will cause separation or layering. We have found that nonyl phenol-ethylene oxide condensates having from 5 to 9 mols of ethylene oxide per mole of nonyl phenol, and isooctyl phenol-ethylene oxide condensates having from 4 to 8 mols of ethylene oxide per mole of isooctyl phenol have a satisfactory hydrophile-lipophile balance.

It may be desirable to incorporate into the scorch resistant textile finishes of the present invention certain bacterial and mold growth inhibitors such as phenyl mercuric acetate.

The mixture of higher molecular weight, fatty mono-, di-, and triglycerides, which is the primary softening agent in the improved soap-fat scorch resistant textile softening finishes of this invention, is present in an amount by weight of from about 10% to about 50% of the total product. The water-soluble soaps of higher fatty acids used to emulsify the mixture of glycerides will be present in an amount by weight of from 10% to about 50% of the amount by weight of the mono-, di-, and triglycerides present in the composition. When the mono-, di-, and triglycerides are produced concurrently by reacting glycerin and a fat using an excess of sodium hydroxide catalyst, the reaction product will comprise the mixture of glycerides and a lesser amount of the sodium soap of the fatty acids contained in the fat molecule. The components of this reaction product will be present in a ratio of from about 2 to about 4 parts of the glycerides to about 1 part of the sodium soaps with the proper amount of sodium hydroxide catalyst, and the total reaction product will preferably constitute from about 15% to about 25% by weight of the scorch resistant textile finish.

The water-soluble heat labile acid forming salts (ammonium salts and/or amine salts) which will break down to an acid fraction at elevated temperatures generally comprise by weight from about 0.2% to about 3% of the soap-fat textile softening finishes. When ammonium chloride is employed as the heat labile acid forming salt in these soap-fat compositions, the scorch resistance and ease of dispersion and emulsification is best when the ammonium chloride comprises from about 0.3% to about 1% by weight of the total product. However, since there must be present in the scorch resistant textile finishes of this invention an amount of heat labile acid forming salt sufficient to lower the pH of the finish, when heated to elevated temperatures, to below 9, the requisite amount of the heat labile acid forming salt is determined primarily by the alkalinity of the finish. If a large amount of soap is present in the finish, amounts of the heat labile acid forming salt in excess of 3% will be needed to give optimum results. Also, in exceptional cases where the textile material to be finished is unusually alkaline it may be advantageous to increase the amount of heat labile acid forming salt over and above that which would normally be considered sufficient.

The synthetic surface active agents when present as additional emulsifiers will generally comprise more than about 1% by weight, based on total product, and an amount which is sufficient to maintain the product in a fluid state and which will not cause separation or layering. Particularly good emulsification, dispersibility and fluidity are obtained when the nonionic emulsifiers hereinbefore described comprise from about 3% to about 6% of a product having the general composition disclosed in Example 1. However, because of the complicated physical-chemical systems encountered in the com-

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positions of this invention, factors such as relatively minor variations in composition or amount of the fats and/or water-soluble soaps and particularly the presence or absence of an amount of a strong electrolyte such as ammonium chloride have considerable effect on the necessary hydrophile-lipophile balance of the nonionic emulsifiers as well as the amounts of these emulsifiers necessary to give a fluid stable product.

Water constitutes substantially the balance of the improved scorch resistant textile finishes of the present invention.

The following examples are additionally illustrative of the nature of the present invention and it will be understood that the invention is not limited thereto.

Example I

To 20 parts of a composition containing a mixture of mono-, di-, and triglycerides of hardened tallow and the sodium soap of hardened tallow, said composition consisting of 75% of the mono-, di-, and triglycerides and 25% of the tallow soap, are added, with agitation, 4.5 parts of a nonyl phenol-ethylene oxide condensate containing 7 moles of ethylene oxide per mole of nonyl phenol, 0.7 part of ammonium chloride, and 74.8 parts of water. The fluid composition thus formed has an extremely stable emulsion, and fabric treated with this composition displays an outstanding scorch resistance when subjected to temperatures of 400° F.

Example II

	Percent
Sodium soap of tallow fatty acids	20
Ammonium chloride	3
Water	77

A fabric treated with a 1% soap solution of this composition and then subjected to temperatures of 400° F. for 30 seconds displayed a scorch resistance equivalent to that of the untreated fabric while a control fabric treated with a 1% solution of the same soap without added ammonium chloride scorched badly when heated under the same conditions of time and temperature.

Example III

	Percent
Mono-, di-, and triglycerides of a mixture of fatty acids having from 18 to 22 carbon atoms	30
Sodium soap of tallow fatty acids	15
Ammonium acetate	1.5
Nonyl phenol-ethylene oxide condensate containing 9 moles of ethylene oxide per mole of nonyl phenol	9
Water	44.5

Example IV

	Percent
Mono-, di-, and triglycerides of a mixtures of fatty acids having from 14 to 18 carbon atoms	10
Sodium soap of fatty acids having from 14 to 18 carbon atoms	5
Ethanolamine hydrochloride	3
Phenyl mercuric acetate	0.1
Water	81.9

Example V

	Percent
Mono-, di-, and triglycerides and tallow	18
Sodium soap of tallow fatty acids	2
Ammonium chloride	0.3
Isooctyl phenol-ethylene oxide condensate having 4 moles of ethylene oxide per mole of isooctyl phenol	5
Water	76.7

We are primarily concerned with the manufacture of a marketable scorch resistant textile softening finish. However, it will be apparent to those skilled in the art that the heat labile acid forming salts which we have discovered to be effective scorch inhibitors can be added

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by a textile manufacturer or finisher to a textile softening composition which contains soap, immediately prior to the treatment of a fabric with the composition. It will be understood that our invention includes such usage of the heat labile acid forming salts.

Having thus described our invention, what we claim is:

1. An improved scorch resistant textile softening finish composition consisting essentially of from about 10% to about 50% by weight, based on the total composition, of a mixture of higher molecular weight fatty mono-, di-, and triglycerides, from about 10% to about 50% by weight, based on said mixture of mono-, di-, and triglycerides, of a water-soluble soap of higher molecular weight fatty acids, at least one water-soluble heat labile acid forming salt selected from the group consisting of ammonium salts and amine salts in an amount from about 0.2% to about 3% based on the total of said mixture of mono-, di-, and triglyceride and said water-soluble soap and in an amount sufficient to lower the pH of said textile softening finish, when subjected to elevated temperatures, to less than 9 and to a level at which said textile softening finish is scorch resistant, and water constituting substantially all the remainder of said textile softening finish.

2. An improved scorch resistant textile softening finish composition consisting essentially of from about 15% to about 25% by weight, based on the total composition, of a mixture of hardened tallow mono-, di-, and triglycerides, an amount of sodium soap of hardened tallow fatty acids which is less than the amount of the mixture of hardened tallow mono-, di-, and triglycerides, ammonium chloride in an amount from about 0.2% to about 3% based on the total of said mixture of mono-, di-, and triglyceride and said water-soluble soap and in an amount sufficient to lower the pH of said textile softening finish when subjected to elevated temperatures to less than 9 and to a level at which textile softening finish is scorch resistant, and water constituting substantially all the remainder of said textile softening finish.

3. An improved scorch resistant textile softening finish consisting essentially of from about 15% to about 25% by weight, based on the total composition, of a mixture of hardened tallow mono-, di- and triglycerides, and sodium soap of hardened tallow fatty acids, the ratio of total mono-, di- and triglycerides to tallow soap being from about 4 to 1 to about 2 to 1, ammonium chloride in an amount from about 0.2% to about 3% based on the total of said mixture of mono-, di-, and triglyceride and said water-soluble soaps and in an amount sufficient to lower the pH of said textile softening finish to less than 9 and to a level at which said textile softening finish when subjected to elevated temperatures is scorch resistant, and water constituting substantially all the remainder of said textile finishing agent.

4. The textiles softening finish composition of claim 1 containing a nonionic synthetic surface active agent in an amount from about one percent to about six percent by weight, based on total product, and sufficient to maintain the product in a fluid state and not to cause separation or layering.

5. The textiles softening finish composition of claim 2 containing a nonionic emulsifier in an amount from about one percent to about six percent by weight, based on total product, and sufficient to maintain the product in a fluid state and not to cause separation or layering.

6. The textiles softening finish composition of claim 3 containing a nonionic emulsifier in an amount from about three percent to about six percent by weight, based on total product, and sufficient to maintain the product in a fluid state and not to cause separation or layering.

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