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TEXTILE WAX COMPOSITIONS

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The present invention relates to improvements in hydrocarbon wax compositions.

An object of the invention is to prepare a hydrocarbon wax composition that is particularly useful as a textile sizing material.

Another object is to provide such wax compositions that, after their application, as for example as a textile size, are easily scourable in water.

A more specific object is to provide textile sizing compositions, certain of which are capable of application either in the form of solutions in hydrocarbon solvents or in the form of emulsions with water, said compositions being capable of ready removal from the textile materials by reason of their dispersibility in water.

The above and other objects will become more fully apparent in the course of the following description.

The invention will be described particularly with reference to its use in the textile art, but it will be understood that the composition has properties that are useful in other arts.

Hydrocarbon waxes represent a plentiful source of materials that possess physical properties of lubricity and ability to form a coating, that are desirable in the processing of textile materials. However, these waxes are soluble only in certain non-aqueous solvents as a result of which their usefulness in the textile field has been limited. Solutions of hydrocarbon waxes can be applied to textile materials from non-aqueous solvents, but they are particularly objectionable because of high solvent retention and the difficulty in removing all traces of the wax when that becomes necessary. In particular, it is desirable in the processing of certain textile materials to apply a waxy coating to a yarn for the purpose of retaining twist and imparting lubricity during a knitting operation. At the conclusion of the knitting operation, the waxy coating must be removed to prepare the fabric for further operations, such as dyeing, and to render the fabric suitable for use. The hydrocarbon waxes themselves have not been considered to be useful as textile size materials because of the difficulties involved in the removal of the hydrocarbon wax from the fabric without injury thereto. Various attempts have been made to mix hydrocarbon waxes with different substances to render them more easily removable from a fabric. However, these earlier proposals have not been satisfactory either because of the characteristics of the compositions produced or because of the adverse effects of the compositions on the textile material or the machines used in handling it.

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The present invention provides a hydrocarbon wax composition which has highly desirable coating, twist retention, and lubricity properties, as well as other properties facilitating the knitting or other textile fabrication, and which has the property of dispersibility in water to such an extent that the composition can be readily removed from the textile material by a mild scouring treatment. The compositions of the present invention have no adverse effects either on the textile materials or on the machines used in handling them.

The compositions of the present invention comprise three ingredients; namely, the hydrocarbon wax, an emulsifier and a coupling or blending agent. The emulsifier has sufficient hydrophylic properties to render the composition, which is otherwise of a predominantly hydrophobe material, readily scourable in water. The coupling or blending agent tends to make the hydrophobe hydrocarbon wax and the hydrophilic emulsifier compatible, assists in making the composition scourable, and, at the same time, contributes other desirable properties to the composition. By varying the proportions of the materials, compositions of different degrees of hardness, titer, etc. can be formulated for best results under particular conditions.

The hydrocarbon wax employed in the compositions of the present invention is preferably a paraffin wax, for example, white crude scale wax of 124/126 A. M. P., a refined wax of 135/137 A. M. P. or a blend of paraffin wax with petrolatum or mineral oil. Other petroleum waxes, the fossil waxes or blended waxes such as ceresin can be used. As will be understood, other types of waxes such as carnauba, beeswax, or Japan wax, can be blended with the hydrocarbon wax to alter the physical properties of the latter.

The emulsifier used in the wax composition of the invention is a water-dispersible to soluble polyoxyethylene ether ester of a straight-chain monobasic aliphatic acid having at least 12 carbon atoms and not more than one unsaturated carbon to carbon bond. As is well-known, the minimum number of oxyethylene groups in the water-dispersible to soluble esters of this class varies depending upon the chain length of the acid and the number of the acid groups present. The esters having the longer chain acids require more oxyethylene groups to make them water-dispersible than do the esters of the shorter chain acids. Similarly, esters with two or more acid groups present require more oxyethylene groups to make them water-dispersible than do the esters having only one acid group present. While

an ester having oxyethylene groups present in an amount in excess of the number required to make the ester water-soluble may be employed, the preferred esters are those in which the oxyethylene groups are not present in great excess over the number required to render the ester water-soluble. A large excess of oxyethylene groups over the number required to render the ester soluble contributes nothing to the ultimate composition and may render it too hydrophilic. Examples of ether esters falling within this class are the water-dispersible to soluble polyethylene glycol esters of the fatty acids. These esters can be prepared either by esterifying a polyglycol or by reacting the fatty acid with ethylene oxide. Of this type, the preferred emulsifiers are the polyethylene glycol monoesters of the fatty acids which contain a number of oxyethylene groups equal at least to the value

$$\frac{5}{3}c - 12$$

where c is the number of carbon atoms in the acid. A particularly valuable member of this group is a polyglycol monostearate produced by the reaction of ethylene oxide and stearic acid in the proportion of 20 mols of ethylene oxide per mol of stearic acid. Another emulsifier of this group is the polyglycol laurate with about 8 oxyethylene groups per mol of lauric acid. Further examples of the polyethylene glycol ester type are the polyglycol distearates which contain from 20 to 40 ethenoxy groups.

Another group of ether esters falling within this class are those in which the oxyethylene groups are coupled to the acid through polyhydric compounds, preferably those having at least 3 hydroxyl groups and from 3 to 6 carbon atoms, such as glucose or other sugar, hexitols, hexitans, hexides, glycerol, diglycerol, or the like. Specific examples of these emulsifiers are the products produced by adding an average of 20 ethenoxy groups to a sorbitan monoester of lauric or stearic acid.

A further type of emulsifier that can be used is prepared by first reacting a polyhydric composition such as a hexitol or sugar with ethylene oxide to form a polyhydroxy ethyl ether and then partially esterifying the ether with the selected acid. A specific example of such an emulsifier is a disterate of glucose polyoxyethylene ether in which the ether has approximately six oxyethylene groups per mol of glucose.

All of these emulsifiers contain a plurality of oxyethylene groups, ether groups, and at least one ester group. Accordingly, the term "polyoxyethylene ether ester" is used to include all of these variations. Mixtures of two or more emulsifiers of this class can be used. It should also be noted that commercial products of the types defined are actually mixtures due to the facts that commercial fatty acids are usually mixtures of homologous acids, and also the process by which the polyoxyethylene ether esters are made give rise to a number of products rather than a single compound. In particular, reactions with ethylene oxide produce a series of compounds of different polyoxyethylene chain lengths which are designated in trade and in the literature by a single name referring to the average chain length. While the polyoxyethylene chains are generally uninterrupted, it will be apparent that the presence of other hydrophilic oxyalkylene groups is permissible. For example, the ether esters can contain polyoxyalkylene chains composed of alternate oxyethylene and oxymethylene groups such as the compounds produced by reacting 1,3-dioxolane with the aliphatic acid or an ester thereof.

The coupling or blending agent used in the composition of the invention is selected from the class of straight-chain mono-basic aliphatic acids with at least 12 carbon atoms and no more than one unsaturated carbon-to-carbon linkage. Examples of suitable coupling agents are lauric, myristic, palmitic, stearic, and oleic acids. Commercial grades of the aliphatic acids are entirely suitable and the acids obtained from natural animal or vegetable oils by treatments including hydrogenation are especially desirable. Mixtures of two or more acids can be used. The coupling or blending agent enables the production of compositions which remain homogeneous on melting, on solution in hydrocarbon solvent, and on dispersion in water.

The aliphatic acid used as coupling agent serves several other useful functions in the composition. Among these other functions are the reduction of solvent pickup, or conversely more rapid release of solvent, which results in achieving a strong, firm coating within a short time after application. In the coating the free acid also has the effect of tempering the composition and reducing powdering. The coupling agent is selected with due regard to the physical characteristics of the hydrocarbon wax and the emulsifier so that the final product has the desired physical properties. As in the case of the emulsifiers, the coupling agents include materials ranging from liquids to hard waxes so that by selecting different members of the series the characteristics of the compositions can be varied.

The proportions of the three ingredients may be varied over relatively wide ranges within which it is possible to obtain compositions with variations in hardness, titer, film strength, ease of dispersibility in water and other properties. It is also possible to obtain a large number of compositions of different ingredients which have essentially the same properties. However, in the compositions of the present invention, the emulsifiers and coupling agent are each used in substantial proportions, the emulsifier being present in the wax composition in a proportion of at least 6% and the coupling agent being present in a proportion of at least 10%. The hydrocarbon wax may vary from 20 to 75%, the balance of 100% being made up of the emulsifier and coupling agent. The preferred compositions of the present invention contain at least 40% of the wax. Thus, for example, a preferred composition is one containing from 40 to 70% white crude scale wax 124/126 A. M. P., 10 to 40% stearic acid and 6 to 30% of a polyglycol monostearate produced by the reaction of ethylene oxide and stearic acid in the proportion of 20 mols of ethylene oxide per mol of stearic acid.

Examples

The following table illustrates a number of compositions according to the invention. These compositions were prepared by weighing the required amounts of each of the three materials into a container and then heating to 60° C. to melt the ingredients together. Each of these compositions was compatible in the molten condition, although in some cases it was necessary that a small amount of water, on the order of 1% or less be present. Where the addition of this small amount of water was required, it was noted to

have no adverse effect on hydrocarbon solvent solubility or the other properties of the composition. The compositions in the table were soluble to the extent of at least 50% in Stoddard's solvent at a temperature of 60° C. and the compositions were insoluble or substantially less than 50% soluble in that solvent at room temperature. Solubility at elevated temperature is important since the preferred method of applying these waxy sizes to yarns is to treat the yarns with a warm solution which, of course, makes the solvent evaporate more readily after the yarn leaves the bath. Insolubility at room temperature facilitates complete solvent release from the coating. The compositions were also evaluated for dispersibility in water by stirring 10 grams of the composition in 200 cc. of distilled water at 60° C. The emulsions so prepared were allowed to stand overnight to determine their stability. All of the compositions in the table gave emulsions that remained stable by this test.

Example	Wax	Percent	Coupling Agent	Percent	Emulsifier	Percent
1	white crude scale 124/126 A. M. P.	45	stearic acid	30	polyglycol monostearate average 20 ethenoxy groups per mol stearic acid.	25
2	do	50	do	30	do	20
3	do	62.5	do	37.5	do	10
4	do	62.4	do	10	do	25.6
5	do	30	do	42	do	28
6	do	31.3	do	18.7	do	50
7	do	35.7	do	50	do	14.3
8	do	50	lauric acid	30	do	20
9	do	20	do	50	do	30
10	do	30	do	42	do	28
11	do	35.7	do	50	do	14.3
12	do	50	oleic acid	30	do	20
13	do	20	do	50	do	30
14	do	43.8	do	26.2	do	30
15	do	35.7	do	50	do	14.3
16	do	20	palmitic acid	50	do	30
17	do	30	do	42	do	28
18	do	75	do	15	do	10
19	do	20	myristic acid	50	do	30
20	do	30	do	40	do	30
21	do	60	do	15	do	25
22	do	20	do	60	do	20
23	do	50	stearic acid	30	polyglycol distearate, average 20 ethenoxy groups per mol.	20
24	do	45	do	30	sorbitan trioleate polyglycol ether, 20 ethenoxy groups.	12.5
					sorbitan monostearate polyglycol ether, 20 ethenoxy groups.	12.5
25	do	45	do	30	polyglycol distearate, 40 ethenoxy groups	25
26	do	45	do	30	sorbitan trioleate polyglycol ether, 20 ethenoxy groups.	25
27	ceresin	45	do	30	polyglycol monostearate, 20 ethenoxy groups	25
28	microcrystalline	30	do	40	do	30
29	white crude scale 124/126 A.M.P.	50	do	30	distearate of glucose polyoxyethylene ether, 6 ethenoxy groups.	20
30	do	50	do	30	sorbitan monolaurate polyoxyethylene ether, 20 ethenoxy groups.	20
31	do	50	do	30	sorbitan monostearate polyoxyethylene ether, 20 ethenoxy groups per mol.	20

The compositions are prepared as indicated above by mixing the ingredients together at a temperature sufficient to melt them all. After cooling, the product is preferably comminuted or powdered for the convenience of users.

The compositions of the present invention may be applied to yarn or other products which it is desired to protect in any suitable manner. Many of the compositions of the present invention are soluble in hydrocarbon solvents and are also self-dispersible in water to form sufficiently stable emulsions that they can be applied either in the form of a solution or an emulsion. By the term "self-dispersible" is meant that the product forms stable emulsions in water when agitated therewith at a temperature above the melting point of the product.

The wax compositions of the invention are particularly useful for application to cellulosic yarns such as yarns of viscose rayon, cuproammonium rayon and cellulose acetate. The compositions can be applied to yarn in skein or cake form or on 5B or twister bobbins.

As an example of the application to yarn of a composition of the present invention in the form of a solution of the composition in a hydrocarbon solvent, the following is given.

A 50% solution of the composition of Example 1 in Stoddard solvent at about 60° C. is prepared and the yarn is soaked therein for 10 to 20 minutes. The yarn is then removed from the solution and placed in a centrifugal extractor to remove excess solution. The soaking and extracting operation should be performed to leave about 8 to 10% of the composition on the yarn. Following the extraction, the yarn can be wound immediately on spools and then twisted or used in other ways. During a twisting operation, the residual Stoddard solvent evaporates and the waxy coating serves to hold the twist in the yarn. Whether the yarn is twisted or not, the waxy coating is advantageous because of the lubricity it imparts and the improvement in knitting and handling properties resulting from its use. After the yarn is knitted, for example, the waxy composition can be removed either in a separate operation or in the dye bath. In a combined scouring and dyeing operation in the case of knitted viscose it is recommended to use a boiling solution of the dyes, 6% soap, 2% pine oil, and 3% tetrasodium pyrophosphate based on weight of the goods. After 10 minutes of scouring and dyeing Glauber's salt is added in amounts up to 5%. The goods are then removed from the bath, rinsed, and finished for use. It is not necessary to use a boiling solution to scour the waxy composition from the material. For example, cellulose acetate knitted goods are completely scoured and dyed in a bath at a temperature of about 160° F. (71° C.)

The following is an example of the application of a composition of the invention to yarn by means of an aqueous emulsion. An emulsion containing 10 to 20% of the composition of Example 1 is prepared by mixing the composition and water at about 60° C. The yarn is then soaked in the emulsion, extracted in a centrifuge,

and dried. The yarn then carries the waxy coating and can be used in the same way as the yarn treated with hydrocarbon solution described above. An advantage of the composition used resides in the fact that even distribution is obtained when yarn in cake form is soaked in the emulsion. A number of emulsifiable compositions that have been suggested as yarn sizes give unsatisfactory results on application to yarn in this form due to a wicking effect which concentrates the size at the outside layer of the cake.

In the foregoing examples of yarn sizing, the treating baths, hydrocarbon solvent solutions or aqueous emulsions can be used repeatedly with necessary replacement of the amount absorbed by the yarn. Likewise the effluent from the centrifugal extractor can be returned to the bath and reused.

The invention has been described as applied to use as a textile size since it is in that field that it has the greatest usefulness at the present time. The properties of the compositions of the invention, however, suggest their use for other purposes where it is advantageous to deposit a water-dispersible waxy coating on a surface.

It will be understood that the compositions of the invention can be used in conjunction with other substances. Various substances, such as coloring agents or agents designed to accomplish some other effect on the yarn or other material to be treated, can be added to the compositions or to their solutions or emulsions provided, of course, that they do not adversely affect the composition.

What is claimed is:

1. A solid composition consisting essentially of 40 to 70% hydrocarbon wax, 6 to 30% of a polyethylene glycol monostearate produced by the reaction of ethylene oxide and stearic acid in the proportion of at least 18 mols of ethylene oxide per mol of stearic acid, and 10 to 40% stearic acid, to make a total of 100% of said mixture.

2. A solid composition consisting essentially of 40 to 70% paraffin scale wax, 6 to 30% of a polyethylene glycol monostearate produced by the reaction of ethylene oxide and stearic acid in the proportion of about 20 mols ethylene oxide per mol of stearic acid, and 10 to 40% stearic acid, to make a total of 100% of said mixture.

3. A solid composition consisting essentially of about 45% paraffin scale wax of 124/126 A. M. P., about 30% stearic acid, and about 25% of a polyethylene glycol monostearate produced by the reaction of ethylene oxide and stearic acid in the proportion of 20 mols ethylene oxide per mol of stearic acid.

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