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TEXTILE DYE ASSISTANT COMPOSITIONS

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ABSTRACT OF THE DISCLOSURE

Textile assistant containing an anionic polar dispersant, a nonpolar dispersant and an aromatic nonpolar swelling agent for hydrophobic fibers for dyeing with disperse and basic dyestuffs.

The application is a continuation-in-part of application Ser. No. 555,678, filed June 7, 1966.

The present invention relates to the dyeing of hydrophobic fibers and more particularly to a liquid textile dye assistant composition especially adapted for use in the level dyeing of hydrophobic fibers to deep shades even at a temperature below the boiling point of the dye bath and to cleansing aids for scouring hydrophobic fibers prior to treatment thereof with the dye assistant.

Dyeing of hydrophobic fibers has presented a considerable problem to the textile dye industry because the hydrophobic nature of the fibers renders them innately unreceptive to dyes. In order to increase the receptivity of the hydrophobic fibers to dyes, the textile dye industry heretofore has treated the hydrophobic fibers with a variety of textile dye assistants which are incorporated either in the dye bath itself or in a bath preceding the dye bath. However, the textile dye assistants employed heretofore suffer from a number of decided disadvantages discussed below.

Thus the dyeing has had to be performed at or above the boiling point of the dye bath using expensive heating and high pressure equipment. Even so, it has proved difficult to dye hydrophobic textile fibers levelly to deep shades of reds, blacks, blues and browns. Moreover, the heretofore known dyeing processes for the dyeing of hydrophobic fibers have necessitated a scouring treatment after the dyeing treatment. The use of orthophenylphenol as a textile dye assistant produces dyed hydrophobic fibers having poor light fastness with a great number of dyestuffs. The disadvantage of using trichlorobenzene as the textile dye assistant is its poor odor. The high cost of methyl salicylate as a textile dye assistant makes its use unattractive. Also, the use of methyl salicylate as a textile dye assistant results in a poor yield of dyestuff on the hydrophobic fibers. Although diphenyl has been proposed heretofore as a textile dye assistant, it requires the dyeing of hydrophobic fibers at a strong boil and gives a low yield of dye on the fibers. These various textile dye assistants have been used heretofore in combination with surface active agents which permitted the preparation of fine aqueous dispersions. However, the amount of surface active agent necessary has been about 30% or greater by weight of the textile dye assistant composition, which amount inhibits the low temperature dyeing.

Accordingly, it is an object of the present invention to provide a textile dye assistant composition which is characterized by its liquid state, its ability to effect rapid level dyeing of hydrophobic fibers even at a temperature below the boiling point of the dye bath, its ability to produce deep shades of dyed hydrophobic fibers, and its ability to eliminate the necessity of after-scouring dyed textile fabrics. It is a further object of the invention to provide a textile dye assistant composition which is inexpensive and substantially free of toxicity and obnoxious odor and which results in the dyeing of hydrophobic fibers with high, even exhaustive, dye yield and good light fastness of the dyed material. An additional object is to provide textile dye assistant compositions which utilize a low amount, e.g., 4–10%, of surface active agents and hence obviate inhibition of low temperature dyeing and produce low foaming systems in Becks and circulating machines.

It is also an object of the present invention to provide a cleansing aid for the scouring of hydrophobic fibers which are thereafter treated with the textile dye assistant comopsition of the invention.

The liquid textile dye assistant composition of the invention is especially adapted for use in the level dyeing of hydrophobic fibers even at a temperature below the boiling point of the dye bath, although higher dyeing temperatures can be used therewith, if desired. In general, the composition comprises three essential components in critical relative amounts. These components are an anionic polar dispersant mixture, a nonpolar dispersant mixture and a mononuclear aromatic nonpolar swelling agent for hydrophobic fibers. A water-miscible alcohol may also be included to render the composition more fluid and to increase the dispersibility thereof in water. More specifically the liquid textile dye assistant composition of the invention comprises (1) an anionic polar dispersant mixture of (a) a heat and acid stable anionic synthetic organic nonsoap surfactant and (b) a heat and acid unstable fatty acid soap (2) a nonpolar dispersant mixture of (c) a monohydric alcohol having a solubility in water of from about 0.5% to about 4% by weight and (d) a monohydric alcohol having a solubility in water of from about 6% to about 10% by weight; and (3) a mononuclear aromatic nonpolar swelling agent for hydrophobic fibers. A water-miscible alcohol may also be included, if desired.

The critical relative amounts of the components present in the composition of the invention are such that upon acidification of the dye bath, as this might become necessary in the dyeing of Dacron-wool blends, the level swelling performance of the textile dye assistant is not impaired. In addition to this condition there is always a certain amount of hardness in the water used in dyeing and for these two reasons the amount of the soap in the formulation is smaller than that of the nonsoap surfactant. The weight ratio of component (a) to component (b) calculated as fatty acid is from about 2:1 to about 4:1, and preferably about 3:1; the weight ratio of component (c) to component (d) is from about 2.5:1 to about 3.5:1; the weight ratio of nonpolar dispersant (2) to anionic dispersant (1) is from about 1.5:1 to about 3.5:1; and the weight ratio of swelling agent (3) to non-

polar dispersant (2) is from about 1.2:1 to about 2.5:1. The amount of optional water-miscible alcohol is from about 5% to about 10% by weight of the composition.

The heat and acid stable anionic synthetic organic nonsoap surfactants are well known materials. Typical examples thereof which can be employed in the compositions of the invention are set forth in "Surface Active Agents" by Schwartz and Perry. The linear biodegradable alkyl or alkylaryl sulfonic acids and sulfuric acids and water-soluble alkali metal salts thereof having an alkyl group of from 6 to 24 carbon atoms and an aryl group which is benzene or naphthalene, and blends thereof, are preferred. Representative examples thereof include sodium lauryl sulfate, linear dodecylbenzene sulfonic acid, the sodium salt of linear pentadecyl benzene sulfonic acid and the like.

The heat and acid unstable fatty acid soaps which can be employed include the ammonium, monoethanolamine, diethanolamine, triethanolamine and isopropanolamine salts of fatty acids having from 6 to 24 carbon atoms. Typical examples thereof are the ammonium, monoethanolamine, diethanolamine, triethanolamine and isopropanolamine salts of caprylic, capric, lauric, myristic, stearic, oleic and linoleic acids as well as such salts of the naturally occurring mixtures of fatty acids contained in oils and fats. It is preferred that the fatty acid salt be formed in situ in the composition by reaction between a fatty acid and ammonia or an amine.

Representative examples of suitable monohydric alcohols having a solubility in water of from about 0.5% to about 4% by weight include cyclohexanol, methyl cyclohexanol, benzyl alcohol, pentanol-1, 2-methyl-butanol-4, and the like.

Typical monohydric alcohols having a solubility in water of from about 6% to about 10% by weight which can be used in the compositions of the invention include normal butyl alcohol, isobutyl alcohol, and the like.

The mononuclear aromatic nonpolar swelling agents for hydrophobic fibers are well known materials in the dyeing industry, typical suitable examples of which include trichlorobenzene, dichlorotoluene, xylene, toluene, tolyl chloride, xylyl chloride and the like.

Suitable water-miscible alcohols include, for example, methyl alcohol, ethyl alcohol, normal-propyl alcohol, isopropyl alcohol and the like.

The functions of each essential component of the textile dye assistant composition of the invention are as follows. The heat stable anionic synthetic organic nonsoap surfactant constituent of the anionic polar dispersant mixture is a material which is heat stable, i.e., does not decompose at the use temperature. It is also stable toward acids. It is present in the composition to render the organic liquid composition spontaneously or homogeneously dispersible upon dilution thereof with an aqueous medium. The heat and acid unstable fatty acid soap constituent of the anionic polar dispersant mixture is unstable toward heat, i.e., it decomposes at use temperature, and serves to disperse the swelling agent and the nonpolar dispersant mixture of alcohols uniformly in the aqueous use bath and subsequently on the hydrophobic fiber fabric. The low amount thereof and the heat unstable nature thereof prevent inhibition of the uptake of the swelling agent, the alcohols and the dyestuff on the fibers as dyeing progresses so that exhaustion of the dye bath is possible. The monohydric alcohol having a solubility in water of from about 0.5% to about 4% by weight, which is a constituent of the nonpolar dispersant mixtures, serves as a spreader or wetting agent for the swelling agent upon the hydrophobic fibers to achieve uniform swelling and hence level dyeing, while the monohydric alcohol having a solubility in water of from about 6% to about 10% by weight, which is the other constituent of the nonpolar dispersant mixture, serves as an additional spreader or wetting agent for the swelling agent upon the hydrophobic fibers and also as a hydrator to enable the organic liquid composition to receive or take up water upon dilution thereof. The mononuclear aromatic nonpolar swelling agent serves to swell the hydrophobic fibers in order to render them dye receptive. The remaining optional component of the textile dye assistant composition, namely a water-miscible alcohol, acts as a viscosity reducer and temperature stabilizer. It also serves to accelerate the dispersion of the swelling agent during the dilution of the composition with water.

In another embodiment of the textile dye assistant composition of the invention there is present therein, in addition to the components specified above, a polynuclear aromatic nonpolar swelling agent for hydrophobic fibers having a lower diffusion rate in hydriphobic fibers than the mononuclear aromatic nonpolar swelling agent. Typical examples of this well known material to the dye industry are diphenyl, naphthene, diphenyl methane and the like. This material is used in an amount up to about 60% based on the weight of the mononuclear aromatic nonpolar swelling agent. The usable amount thereof increases as the dyeing temperature increases.

Although the compositions described above are suitable for use in the level dyeing of a variety of hydrophobic fibers with a variety of dyestuffs, the category of hydrophobic fibers which can be levelly dyed and the range of dyestuffs can be considerably expanded to include the very slow diffusing dyestuffs by a further embodiment of the textile dye assistant compositions of the invention. In this further embodiment of the textile dye assistant composition contains, in addition to the components discussed above, polar swelling agents of either hydrophilic or hydrophobic character for hydrophobic fibers, such as methyl salicylate, ortho-phenylphenol, beta-napthol, para-tertiarybutyl phenol, aniline, cresol, chlorophenol, phenol, diphenyl amine, toluidine and chloroaniline. Cresol, chlorophenol and phenol are less preferred because of their toxicity. These polar swelling agents serve as specific swelling agents for hydrophobic fibers, and especially for polyester fibers, and thereby further activate the hydrophobic fibers for the reception of dyes of the slower diffusing type. The polar swelling agent is employed in an amount up to about 60% based on the weight of the composition without impairing the lightfastness of the dyed fabric.

The textile dye assistant compositions of the invention can be still further modified to include therein a deodorant compound in an amount from about 2% to about 5% based on the weight of the composition which serves to deodorize materials having an obnoxious odor, such as chlorinated compounds or the phenols. Typical examples of such deodorants include ethylbenzoate, isobutyl benzoate, coumarine, benzyl acetate, and the like.

In another embodiment of the textile dye assistant compositions of the invention the component which is a monohydric alcohol having a solubility in water of from about 6% to about 10% by weight can be eliminated and replaced by a hydrophilic polar swelling agent for hydrophobic fibers, namely methyl salicylate or an amino-benzene compound, such as aniline, chloro-aniline, toluidine and the like. These compositions comprise (1) an anionic polar dispersant mixture of (a) a heat and acid stable anionic synthetic organic nonsoap surfactant, as described above, and (b) a heat and acid unstable fatty acid soap, as described above, the weight ratio of component (a) to component (b) calculated as fatty acid being from about 2:1 to about 4:1; (2) at least one nonpolar dispersant selected from the group consisting of a monohydric alcohol and an amino-benzene compound, having a solubility in water of from about 0.5% to about 4% by weight, as described above, the weight ratio of non-polar dispersant (2) to anionic polar dispersant (1) being from about 1.5:1 to about 3.5:1 or to about 4.1:1; (3) a mononuclear aromatic nonpolar swelling agent for hydrophobic fibers, as described above, the weight ratio of swelling agent (3) to nonpolar dispersant (2) being from about

1.2:1 to about 2.5:1; (4) a polynuclear aromatic nonpolar swelling agent for hydrophobic fibers having a lower diffusion rate in hydrophobic fibers than the mononuclear aromatic nonpolar swelling agent, as described above, in an amount up to about 60% based on the weight of the swelling agent (3); and (5) a hydrophilic polar swelling agent for hydrophobic fibers, the weight ratio of hydrophilic polar swelling agent (5) to nonpolar swelling agent (4) being from about 1:1 to about 2:1. A water-miscible alcohol, as described above, may be present in an amount from about 5% to about 10% by weight of the composition.

The textile dye assistant compositions can be readily prepared by merely blending the components thereof together at room temperature or higher, if desired. The preferred order of addition of the components is the addition of the solid components to the liquid components with neutralization as the last step so as to avoid an intermediate gel state of the soap. Grinding of originally solid components is unnecessary.

The textile dye assistant compositions are liquids which are homogeneous and clear. Moreover, generally for most of the compositions from about 50% to about 200%, and more usually 100%, by weight of water can be added thereto while still retaining uniformity and clarity of the compositions. Upon further dilution with water in use, a stable finely dispersed milky emulsion is otbained, which emulsion can be used to pretreat the fabric prior to dyeing or can be present in the dye bath itself. The textile dye assistant composition is used in an aqueous bath in an amount from about 2% to about 40%, preferably about 15%, based on the weight of the fabric to be treated therewith.

In order to produce level or uniform dyeing of hydrophobic fibers and thereby prevent block off and unevenness, it is essential that the fibers be cleaned or scoured to a greater degree than has been thought necessary heretofore and to a greater degree than has been possible by the heretofore known scouring with alkali or alkali and emulsified solvents. Therefore, the invention further provides a cleansing aid for the scouring of hydrophobic fibers prior to treatment thereof with the textile dye assistant composition. This cleansing aid comprises (1) an anionic polar dispersant mixture of (a) a heat and acid stable anionic synthetic organic nonsoap surfactant, as described above, and (b) a heat and acid unstable fatty acid soap, as described above, the weight ratio of component (a) to component (b) calculated as fatty acid being from about 2:1 to about 4:1, preferably about 3:1; (2) a nonpolar dispersant mixture of (c) a monohydric alcohol having a solubility in water of from about 0.5% to about 4% by weight, as described above, and (d) a monohydric alcohol having a solubility in water of from about 6% to about 10% by weight, as described above, the weight ratio of component (c) to component (d) being from about 2.5:1 to about 3.5:1 and the weight ratio of nonpolar dispersant (2) to anionic polar dispersant (1) being from about 1.5:1 to about 3.5:1; and (3) a solvent for waxy materials, such as perchloroethylene, trichloroethylene, hexane, heptane and the like, the weight ratio of solvent (3) to nonpolar dispersant (2) being from about 1.2:1 to about 2.5:1. A water-miscible alcohol, as described above, may be present in an amount from about 5% to about 10% by weight of the composition.

The cleansing aid is used in an aqueous bath in an amount from about 10% to about 20%, and preferably about 15%, based on the weight of the fabric to be cleaned therewith.

The invention also provides a cleansing aid, fiber wetter, dye dispersant and swelling retarder for use with hydrophobic fibers which comprises (1) an anionic polar dispersant mixture of (a) a heat and acid stable anionic synthetic organic nonsoap surfactant, as described above, and (b) a heat and acid unstable fatty acid soap, as described above, the weight ratio of component (a) to component (b) calculated as fatty acid being about 3:1; (2) a nonpolar dispersant mixture of (c) a monohydric alcohol having a solubility in water of from about 0.5% to about 4% by weight, as described above, and (d) a monohydric alcohol having a solubility in water of from about 6% to about 10% by weight, as described above, the weight ratio of component (c) to component (d) being about 3.4:1 and the weight ratio of nonpolar dispersant (2) to anionic polar dispersant (1) being about 0.2:1; (3) a mononuclear aromatic nonpolar swelling agent for hydrophobic fibers, as described above, the weight ratio of swelling agent (3) to nonpolar dispersant (2) being about 1.6:1; (4) a water-miscible alcohol, as described above, in an amount of about 19% by weight of the composition; (5) a polynuclear aromatic nonpolar swelling agent for hydrophobic fibers having a lower diffusion rate in hydrophobic fibers than the mononuclear aromatic nonpolar swelling agent, as described above, in an amount of about 12% based on the weight of the nonpolar swelling agent (3); and (6) a polar swelling agent for hydrophobic fibers, as described above, in an amount of about 10% based on the weight of the composition. Further components which may be present in the cleansing aid include (7) a deodorant compound, as described above, in an amount of about 0.04% based on the weight of the composition.

For cleansing polyester fiber blends there is used from 1% to 5% of the above composition together with an amount of alkali varying from 1% to 10% or more, based on the cloth weight, depending on the fiber blend. This treatment gives the fiber excellent rewetting properties which aid in the uniform application of the textile dye assistants as these are introduced into the dye bath. The above cleansing formulation has been found particularly valuable on Dacron-cotton blends in pad steam operations and in the Beck preparation of the cloth prior to dyeing, in conjunction with bleaching aids.

A further application of the above composition is as a retarder in the sense that it aids the uniform uptake of the textile dye assistant, particularly when this is used in comparatively low amounts of 3% to 5% on the weight of the goods. At these low amounts non-uniform wetting will cause localized strikes and streaks. These faults can be corrected by pretreatment with 1% of the above composition for 15 to 20 minutes at the temperature varying between 160° F. to 180° F. prior to adding the textile dye assistant composition at the lower temperature of 140° F.

Another use of the above composition is as an additive to aqueous dye dispersions thus permitting finer dye dispersions to be obtained with reduced staining properties. An advantage of the above composition over the conventional surfactants used heretofore in dye dispersion is that finer dispersions are prepared without inhibition of dye uptake by polyester fibers. The use of the above composition with the dye is particularly recommended when very light shades are prepared thus permitting the greatest spread of the dye on the cloth. Under these conditions the weight ratio with the dye will vary between 1:1 to 1:5 depending on the ease of dispersion of the dye, the cloth to be dyed, and the depth of shade.

Finally one of the most important applications of the above composition is in the ability of completing shade adjustment operations rapidly at the dyeing temperature. Heretofore it has been necessary for the dyer to lower the temperature of the dye bath to make dye additions when these are required for the production of a definite shade. This operation is time consuming and reduces plant productivity, since often it has to be done more than once. The amount of the above composition to be associated with the dye is between 10% and 50% based on the weight of the dye added.

Hydrophobic fibers which can be treated with the compositions of the invention are well known materials and include the polyester fibers such as Dacron, Kodel, Vycron, Terylene and Teron; cellulose triacetate fibers

such as Arnel and Tricel; the acrylic fibers such as Acrilan, Dynel and Creslan as well as blends of hydrophobic fibers with hydrophilic fibers, for example blends of Dacron-wool and Dacron-cotton.

The dyes with which the textile dye assistant compositions of the invention are employed usually are the conventional disperse dyes for hydrophobic fibers. These disperse dyes are generally water-insoluble azo, diazo, azomethine and anthraquinone dyes, typical examples of which include Latyl Yellow 3G (Disperse Yellow 54), Latyl Cerise B (Disperse Red 59), Resolin Blue FBL (Disperse Blue 71), Latyl Bordeaux B (Disperse Violet 26), Latyl Red MG (Disperse Red 56), Samaron Pink HGG (Carbic-Hoechst, Disperse Pink), Latyl Brown MS (Disperse Brown 2), Latyl Blue LS (Disperse Blue 2), Latyl Violet BN (Disperse Violet 27), Latyl Red GFS (Dupont, Disperse Red), and Latyl Yellow 4RL (Disperse Yellow 23). Conventional amounts of disperse dye in the dye bath are employed, i.e., from about 0.1% to about 15% thereof based on the weight of the fabric to be dyed therewith.

The textile dye assistant compositions can also be employed with basic dyes, such as Sevron Red 4G (Basic Red 14), Astrazon Orange 3RL (Basic Orange 27), Sevron Blue 5G Basic Blue 4), Astrazon Yellow 7GLL (Basic Yellow 21) and DuPont Basic Black A (Dupont, Basic Black), in the dyeing of Dacron 62 (a sulfonated polyester) without ruining the lightfastness of these dyes as long as the ortho-phenyl phenol content of the textile dye assistant is kept below about 10% by weight of the assistant.

Illustrative, but non-limiting, examples of the various embodiments of the textile dye assistant compositions of the invention are set forth in the following nine examples.

EXAMPLES 1–3

Textile dye assistant compositions were prepared by blending together the following components at room temperature:

Example	Parts by weight 1	2	3
Components:			
Dodecylbenzene sulfonic acid	9.2	4.6	9.2
Oleic acid	3.1	1.55	3.1
Monoethanolamine	3.4	1.55	3.4
Methyl cyclohexanol	4	4	4
Cyclohexanol	17.7	17.7	17.7
Butyl alcohol	7.81	7.81	7.81
Trichlorobenzene	47.5	47.5	47.5
Isopropyl alcohol	7.3	7.3	
Total	100.01	92.01	92.71

5 cc. of the above product of Example 1 was clear and retained its clarity when diluted with between 3 to 9 cc. of water. In Example 2, 5 cc. thereof was clear and retained its clarity when diluted with between 3 to 4 cc. of water. The dyeing properties of Example 2 which contained even less surface active agents were superior in depth and brightness to those of Example 1, thereby clearly demonstrating the inhibition by surface active agents on the uptake of dyes, such as Resolin Blue FBL and Latyl Brown MS. 5 cc. of the above product of Example 3 was clear and retained its clarity when diluted with between 4 to 10 cc. of water. The dyeing properties were the same as for Example 1.

The criticality of the components of the textile dye assistant compositions of the invention is demonstrated by the following facts. The omission of either the heat and acid stable anionic synthetic organic nonsoap surfactant, e.g., dodecylbenzene sulfonic acid, or the heat and acid unstable fatty acid soaps, e.g., oleic acid plus monoethanolamine, or the monohydric alcohol having a solubility in water of from about 0.5% to about 4% by weight, e.g., methyl cyclohexanol and cyclohexanol, or the monohydric alcohol having a solubility in water of from about 0.5% to about 4% by weight, e.g., methyl cyclohexanol and cyclohexanol, plus the monohydric alcohol having a solubility in water of from about 6% to about 10% by weight, e.g., butyl alcohol, from the composition results in very coarse aqueous emulsions and unlevel dyeing of hydrophobic fibers while the omission of the mononuclear aromatic nonpolar swelling agent for hydrophobic fibers, e.g., trichlorobenzene, from the composition results in pale rather than deep shades on dyeing.

EXAMPLE 4

A textile dye assistant composition was prepared by blending together the following components at room temperature:

Components:	Parts by weight
Dodecylbenzene sulfonic acid	7.7
Oleic acid	2.6
Monoethanolamine	3.0
Methyl cyclohexanol	7.0
Cyclohexanol	17.7
Butyl alcohol	8.5
Trichlorobenzene	47.5
Isopropyl alcohol	7.3
Total	101.3

5 cc. of the above product was clear and retained its clarity when diluted with between 3.5 to 7.5 cc. of water.

EXAMPLE 5

A textile dye assistant composition was prepared by blending together the following components at room temperature:

Components:	Parts by weight
Dodecylbenzene sulfonic acid	8.4
Oleic acid	2.82
Monoethanolamine	3.15
Methyl cyclohexanol	4.42
Cyclohexanol	19.6
Butyl alcohol	8.6
Trichlorobenzene	40.7
Isopropyl alcohol	7.05
Diphenyl	4.8
Total	99.54

5 cc. of the above product was clear and retained its clarity when diluted with between 5 to 8 cc. of water.

EXAMPLE 6

A textile dye assistant composition was prepared by blending together the following components at room temperature:

Components:	Parts by weight
Dodecylbenzene sulfonic acid	7.7
Oleic acid	2.6
Monoethanolamine	3.2
Benzyl alcohol	8
Cyclohexanol	17.7
Butyl alcohol	8.5
Trichlorobenzene	41.5
Isopropyl alcohol	7.3
Diphenyl	6
Total	102.5

5 cc. of the above product was clear and retained its clarity when diluted with between 3 to 5 cc. of water.

The products of Examples 5 and 6 differ from the products of Examples 1 through 4 in that they further contain a polynuclear aromatic nonpolar swelling agent for hydrophobic fibers having a lower diffusion rate in hydrophobic fibers than the mononuclear aromatic nonpolar swelling agent, namely diphenyl.

EXAMPLE 7

The textile dye assistant composition set forth below was also prepared by blending together the following components at room temperature:

Components:	Parts by weight
Dodecylbenzene sulfonic acid	8.3
Oleic acid	2.75
Monoethanolamine	2.75
Cyclohexanol	8.45
Benzyl alcohol	7.1
Butyl alcohol	4.62
Trichlorobenzene	33.8
Isopropyl alcohol	5.32
Diphenyl	4.1
Ortho-phenyl phenol	6.65
Para-tertiary-butyl phenol	2.94
Methyl salicylate	4.0
Aniline	7.1
Ethyl benzoate	1.062
Isobutyl benzoate	1.16
Coumarine	0.8
Total	100.902

5 cc. of the above product was clear and retained its clarity upon dilution with between 3 to 5 cc. of water.

The product of Example 7 differs primarily from those set forth in Examples 1 through 6 in that it further contains a polar swelling agent for hydrophobic fibers, namely ortho-phenyl phenol, para-tertiary-butyl phenol, methyl salicylate and aniline, also a deodorant, namely ethyl benzoate, isobutyl benzoate and coumarine.

EXAMPLE 8

The following textile dye assistant composition was prepared by blending together the components set forth below at room temperature:

Components:	Parts by weight
Dodecylbenzene sulfonic acid	9
Oleic acid	3
Monoethanolamine	3
Benzyl alcohol	8
Cyclohexanol	14
Trichlorobenzene	41.5
Isopropyl alcohol	7
Diphenyl	6
Aniline	8
Total	99.5

5 cc. of the above product was clear and retained its clarity when diluted with between 3 to 7.5 cc. of water.

The product of Example 8 differs primarily from those set forth in Examples 1 through 7 in that it does not contain a monohydric alcohol having a solubility in water of from about 6% to about 10% by weight, such as butyl alcohol, but does instead contain a hydrophilic polar swelling agent for hydrophobic fibers, namely aniline. This product will enhance dyeing without in any way effecting the lightfastness of the dyed material.

EXAMPLE 9

An example of a textile dye assistant composition wherein most of the alcohols are replaced by aniline, a hydrophilic polar swelling agent as well as a nonpolar dispersant, is as follows:

Components:	Parts by weight
Dodecylbenzene sulfonic acid	3.6
Oleic acid	1.2
Monoethanolamine	1.2
Cyclohexanol	1.4
Butyl alcohol	1.0
Trichlorobenzene	25.0
Isopropyl alcohol	8.0
Diphenyl	15.0
Ortho-phenyl phenol	19.5

Components:	Parts by weight
Methyl salicylate	9.5
Aniline	13.5
Ethyl benzoate	0.5
Isobutyl benzoate	0.5
Coumarine	0.1
Total	100.0

This composition is particularly valuable because of its low odor and its ability to apply dyes characterized by their low diffusion rate while at the same time the light fastness after heat setting is satisfactory because of the low amount of ortho-phenol in the composition.

EXAMPLE 9A

A further exmaple of a textile dye assistant composition wherein most of the alcohols are replaced by aniline, a hydrophilic polar swelling agent as well as a nonpolar dispersant is as follows:

Components:	Parts by weight
Dodecylbenzene sulfonic acid	2.5
Oleic acid	0.8
Monoethanolamine	0.4
Cyclohexanol	1.7
Butyl alcohol	1.3
Trichlorobenzene	25.0
Isopropyl alcohol	10
Diphenyl	15.0
Orthophenyl phenol	19.5
Methyl salicylate	5.2
Aniline	13.5
Orthochloroaniline	4.3
Ethylbenzoate	0.5
Isobutylbenzoate	0.5
Total	100.2

For its application this product is diluted with 1–3 parts of water and submitted to high shear mixing for the purpose of producing a very fine emulsion which is used as an additive to the dye bath. For ease of emulsification the amount of monoethanolamine in the above formulation may be raised to 0.9 parts by weight.

The product is particularly valuable because of its lower odor than Example 9, lower foaming bath and the very high yield it produces even with disperse dyestuffs of very low diffusion rate such as those required for the permanent press.

The following Example 10 illustrates the cleansing aid of the invention for the scouring of hydrophobic fibers prior to treatment thereof with the textile dye assistant composition.

EXAMPLE 10

The following cleansing aid was prepared by blending together the components set forth below at room temperature:

Components:	Parts by weight
Dodecylbenzene sulfonic acid	7.7
Oleic acid	2.6
Monoethanolamine	3.0
Methylcyclohexanol	7
Cyclohexanol	17.7
Butyl alcohol	8.5
Perchloroethylene	47.5
Isopropyl alcohol	7.3
Total	94.3

5 cc. of the above product was clear and retained its clarity when diluted with between 4.5 to 10 cc. of water.

EXAMPLE 10A

The following Example 10A is illustrative of the cleansing aid, fiber wetter, swelling retarder and dye dispersant for use with hydrophobic fibers.

Components:	Parts by weight
Dodecylbenzene sulfonic acid	25.8
Oleic acid	8.6
Monoethanolamine	8.6
Cyclohexanol	3.9
Benzyl alcohol	3.6
Butyl alcohol	2.2
Trichlorobenzene	15.7
Isopropyl alcohol	19.2
Diphenyl	1.9
Orthophenyl phenol	3.1
Paratertiary butyl phenol	1.4
Methyl salicylate	1.87
Aniline	3.32
Ethylbenzoate	0.5
Isobutylbenzoate	0.55
Coumarine	0.04
Total	100.28

The example given below illustrate the use of the cleansing aid and textile dye assistant compositions of the invention in the dyeing of fabrics containing hydrophobic fibers.

EXAMPLES 11–16

Five parts of Dacron polyester cloth were placed in an aqueous bath containing 0.75 parts of the cleansing aid of Example 10. The aqueous cleansing bath was heated for 15 minutes to 180° F. There was then added to the aqueous cleansing bath 1–2 parts of soda ash. Thereupon the bath was further heated to 180–190° F. for 15–40 minutes and subsequently cooled.

Five parts of the Dacron polyester cloth were then passed into another aqueous bath containing 1 part of the textile dye assistant composition of Example 1. (In other examples the same amount of the textile dye assistant compositions of Examples 2 through 9 were separately employed). The bath was thereupon heated to 140° F. and 5.3% based on the cloth weight of disperse dye composed of 1.8% Latyl Yellow 3G, 2.5% Latyl Cerise B and 1% Resolin Blue FBL was added thereto. (In other examples the following disperse dyes were employed in the dye bath: (1) 2% Latyl Bordeaux B; (2) Latyl Red MG; (3) 2.5% Resolin Blue FBL; (4) 1% Samaron Pink HGG; (5) 4% Brown MS and 2% Blue LS and (6) 6% Violet BN, 3% Blue LS, 2% Red GFS and 2% Yellow 4RL.) The dye bath was exhausted in less than 2 hours at a dyeing temperature of 170° F.–180° F. In all cases the Dacron polyester fabric was uniformly or levelly dyed to lightfast deep shades of the disperse dyes which included navy (dye 3), brown (dye 5) and black (dye 6). Comparable results were obtained in the dyeing of hydrophobic fibers other than Dacron.

The Examples 17 through 21 set forth below illustrate the use of the textile dye assistant compositions of the invention in the dyeing of Dacron 62 fabric with basic dyes. Dacron 62 is a copolyester fiber of polyethylene glycol terephthalate containing sulfoisophthalic acid.

EXAMPLES 17–20

Five parts of Dacron 62 cloth were placed in an aqueous bath containing 0.75 parts of the cleansing aid of Example 10. The aqueous cleansing bath was heated for 15 minutes to 180° F. There was then added to the aqueous cleansing bath 1–2 parts of soda ash. Thereupon the bath was further heated to 180–190° F. for 15–40 minutes and subsequently cooled.

Five parts of the Dacron 62 sulfonated polyester cloth were then passed into another aqueous bath containing 0.5 part of the textile dye assistant composition of Example 7. The bath was thereupon heated to 140° F. and 2% based on the cloth weight of Sevron Red 4G basic dye was added thereto. (In other examples the following basic dyes were employed in the dye bath: (1) 2% Astrazon Orange 3RL; (2) Sevron Blue 5G and (3) 2% Astrazon Yellow 7GLL). The dye bath was exhausted in less than 1 hour at a dyeing temperature of 205° F. In all four cases the Dacron 62 sulfonated polyester fabric was uniformly or levelly dyed to lightfast deep shades of the basic dyes.

EXAMPLE 21

The procedure of Examples 17 through 20 was repeated with the following variations only therein: 0.75 parts of the textile dye assistant composition of Example 7 was employed and 7.7% based on the cloth weight of DuPont Basic Black A basic dye was used. The dye bath was exhausted in about 1.5 hours at a dyeing temperature of 205° F. The Dacron 62 fabric was uniformly and levelly dyed to a lightfast deep black shade.

As noted above the textile dye assistant compositions of the invention can be used either in a concentrated form or as a dispersion in an aqueous medium, which is rapidly taken up by hydrophobic fibers, including polyester fibers, and which converts the fibers from a state of very low dye affinity to a state of very high dye affinity. Hydrophobic fibers brought in contact with these assistants in their concentrated form or in a dye bath containing them or in a printing composition show a tremendous enhancement in dye up-take as evidenced by the ability to dye rapidly, levelly and under exhaustive conditions to deep shades at temperatures between 80° F. and 190° F. or higher whereby deep shades of reds, browns, navies and blacks are obtained under economical conditions with the conventional equipment of the dyehouse in a relatively short period of time of about 2 to 4 hours. When the same assistants are incorporated in printing formulations containing dye dispersed in gum, fixation of the dye is obtained more intensely than by the use of the classical paraphenyl phenol carrier. The textile dye assistant compositions are characterized by their very high substantivity to polyesters and other hydrophobic fibers. These assistants penetrate the fibers very rapidly causing them to swell thus enhancing the up-take of either disperse or basic dyes either present in this bath or in a second bath following the swelling treatment. The new assistants thus permit the continuous dyeing of polyester and other hydrophobic fibers without having to resort to high temperatures as presently practiced with the Thermosol process. The ability to dye at low temperatures permits the continuous processing of texturized and delicate fabrics as well as Dacron-wool and Dacron-cotton blends which cannot be treated in the Thermosol process because of the effect of the high temperature on the wool.

Unlike the assistants used to date, namely orthophenyl phenol, diphenyl and trichlorobenzene, the new assistants are esterophylic and hydrophylic at the same time. As a result of these hydrophilic properties it is now possible to reduce the amount of surface active agents required to produce a fine dispersion in water of these textile dye assistants thus reducing the inhibition of the adsorption of the assistant and the dye on the hydrophobic fibers and reducing the foaming tendency of the dye bath. Also the adsorption of these assistants and dyestuffs into hydrophobic fibers is purposely uninhibited and highly activated due to the fact that the amount of surface active agents or dispersants of polar and nonpolar character is reduced to the minimum required for the preparation of a state which is dilutable in water to provide a very fine dispersion of the active ingredient which is both esterphilic and hydrophilic and further due to the fact that a heat unstable anionic polar dispersant is present which makes the aqueous dispersion or emulsion unstable during the heat of use. Unlike the assistants used heretofore in their concentrated state or emulsified state most of the new assist-

ants as prepared are capable of taking up water while they will maintain their clairty. The amount of water taken up by those new formulations while retaining clarity is generally between 50% and 200%, and more usually about 100%, on the original weight of the assistant prior to leading to dispersion or emulsion. According to this invention, such hydrophilic systems are capable of rapid and uniform up-take by hydrophobic and other polyester fibers provided the amount of heat and acid stable surface active agent is extremely small and less than 12% by weight of the total composition. Only when the amount of heat and acid stable surface active agent is so reduced is there provided low temperature swelling of fibers which is fundamental for the subsequent low temperature dyeing of such fibers.

It will be appreciated that various modifications and changes may be made in the products and process of the invention in addition to those set forth above by those skilled in the art without departing from the spirit of the inventon and accordingly the invention is to be limited only within the scope of the appended claims.

What is claimed is:

1. A liquid textile dye assistant composition especially adapted for use in the level dyeing of hydrophobic fibers to deep shades even at a temperature below the boiling point of the aqueous dye bath, comprising (1) an anionic polar dispersant mixture of (a) an anionic synthetic organic nonsoap surfactant which is heat and acid stable in the aqueous dye bath and (b) an ammonium or lower alkanolamine fatty acid soap which is heat and acid unstable in the aqueous dye bath, the weight ratio of component (a) to component (b) calculated as fatty acid being from about 2:1 to about 4:1; (2) a nonpolar dispersant mixture of (c) a monohydric alcohol having a solubility in water of from about 0.5% to about 4% by weight and (d) a monohydric alcohol having a solubility in water of from about 6% to about 10% by weight, the weight ratio of component (c) to component (d) being from about 2.5:1 to about 3.5:1 and the weight ratio of nonpolar dispersant (2) to anionic polar dispersant (1) being from about 1.5:1 to about 3.5:1; and (3) a mononuclear aromatic nonpolar swelling agent for hydrophobic fibers, the weight ratio of swelling agent (3) to nonpolar dispersant (2) being from about 1.2:1 to about 2.5:1, said anionic polar and nonpolar dispersants serving as dispersants for mononuclear aromatic nonpolar swelling agents for hydrophobic fibers and as dispersants for textile dyes in aqueous medium, said components (c) and (d) serving as wetting agents for mononuclear aromatic nonpolar swelling agents for hydrophobic fibers and said component (d) further serving as a hydrator.

2. The composition as defined by claim **1** which further contains (4) a water-miscible alcohol in an amount from about 5% to about 10% by weight of the composition.

3. The composition as defined by claim **1** which further contains (5) a polynuclear aromatic nonpolar swelling agent for hydrophobic fibers having a lower diffusion rate in hydrophobic fibers than the mononuclear aromatic nonpolar swelling agent in an amount up to about 60% based on the weight of the nonpolar swelling agent (3).

4. The composition defined by claim **1** which further contains (6) a polar swelling agent for hydrophobic fibers in an amount up to about 60% based on the weight of the composition.

5. The composition as defined by claim **3** which further contains (6) a polar swelling agent for hydrophobic fibers in an amount up to about 60% based on the weight of the composition.

6. The composition as defined by claim **4** which further contains (7) a deodorant compound in an amount from about 2% to about 5% based on the weight of the composition.

7. The composition as defined by claim **5** which further contains (7) a deodorant compound in an amount from about 2% to about 5% based on the weight of the composition.

8. A liquid textile dye assistant composition especially adapted for use in the level dyeing of hydrophobic fibers to deep shades even at a temperature below the boiling point of the aqueous dye bath, comprising (1) an anionic polar dispersant mixture of (a) an anionic synthetic organic nonsoap surfactant which is heat and acid stable in the aqueous dye bath and (b) an ammonium or lower alkanolamine fatty acid soap which is heat and acid unstable in the aqueous dye bath, the weight ratio of component (a) to component (b) calculated as fatty acid being from about 2:1 to about 4:1; (2) at least one nonpolar dispersant selected from the group consisting of a monohydric alcohol and an amino-benzene compound, having a solubility in water of from about 0.5% to about 4% by weight, the weight ratio of nonpolar dispersant (2) to anionic polar dispersant (1) being from about 1.5:1 to about 4.1:1; (3) a mononuclear aromatic nonpolar swelling agent for hydrophobic fibers, the weight ratio of nonpolar swelling agent (3) to nonpolar dispersant (2) being from about 1.2:1 to about 2.5:1; (4) a polynuclear aromatic nonpolar swelling agent for hydrophobic fibers having a lower diffusion rate in hydrophobic fibers than the mononuclear aromatic nonpolar swelling agent in an amount up to about 60% based on the weight of the swelling agent (3); and (5) a hydrophilic polar swelling agent for hydrophobic fibers, the weight ratio of hydrophilic polar swelling agent (5) to nonpolar swelling agent (4) being from about 1:1 to about 2:1, said anionic polar and nonpolar dispersants serving as dispersants for mononuclear aromatic nonpolar swelling agents for hydrophobic fibers and as dispersants for textile dyes in aqueous medium, and said component (2) serving as a wetting agent for mononuclear aromatic nonpolar swelling agents for hydrophobic fibers.

9. The composition as defined by claim **8** wherein the weight ratio of nonpolar dispersant (2) to anionic polar dispersant (1) is from about 1.5:1 to about 3.5:1.

10. The composition as defined by claim **8** which further contains a water-miscible alcohol in an amount from about 5% to about 10% by weight of the composition.

11. A cleansing aid for the scouring of hydrophobic fibers to be dyed comprising (1) an anionic polar dispersant mixture of (a) a heat and acid stable anionic synthetic organic nonsoap surfactant and (b) an ammonium or lower alkanolamine fatty acid soap, the weight ratio of component (a) to component (b) calculated as fatty acid being from about 2:1 to about 4:1; (2) a nonpolar dispersant mixture of (c) a monohydric alcohol having a solubility in water of from about 0.5% to about 4% by weight and (d) a monohydric alcohol having a solubility in water of from about 6% to about 10% by weight, the weight ratio of component (c) to component (d) being from about 2.5:1 to about 3.5:1 and the weight ratio of nonpolar dispersant (2) to anionic polar dispersant (1) being from about 1.5:1 to about 3.5:1; and (3) a solvent for waxy material, the weight ratio of solvent (3) to nonpolar dispersant (2) being from about 1.2:1 to about 2.5:1, said anionic polar and nonpolar dispersants serving as dispersants for mononuclear aromatic nonpolar swelling agents for hydrophobic fibers and as dispersants for textile dyes in aqueous medium, said components (c) and (d) serving as wetting agents for mononuclear aromatic nonpolar swelling agents for hydrophobic fibers and said component (d) further serving as a hydrator.

12. The composition as defined by claim **11**, which further contains a water-miscible alcohol in an amount from about 5% to about 10% by weight of the composition.

13. A cleansing aid, fiber wetter, dye dispersant and swelling retarder for use with hydrophobic fibers comprising (1) an anionic polar dispersant mixture of (a) a

heat and acid stable anionic synthetic organic nonsoap surfactant and (b) an ammonium or lower alkanolamine fatty acid soap, the weight ratio of component (a) to component (b) calculated as fatty acid being about 3:1; (2) a nonpolar dispersant mixture of (c) a monohydric alcohol having a solubility in water of from about 0.5% to about 4% by weight and (d) a monohydric alcohol having a solubility in water of from about 6% to about 10% by weight, the weight ratio of component (c) to component (d) being about 3.4:1 and the weight of nonpolar dispersant (2) to anionic polar dispersant (1) being about 0.2:1; (3) a mononuclear aromatic nonpolar swelling agent for hydrophobic fibers, the weight ratio of swelling agent (3) to nonpolar dispersant (2) being about 1.6:1; (4) a water-miscible alcohol in an amount of about 19% by weight of the composition; (5) a polynuclear aromatic nonpolar swelling agent for hydrophobic fibers having a lower diffusion rate in hydrophobic fibers than the mononuclear aromatic nonpolar swelling agent in an amount of about 12% based on the weight of the nonpolar swelling agent (3); and (6) a polar swelling agent for hydrophobic fibers in an amount of about 10% based on the weight of the composition, said anionic polar and

nonpolar dispersants serving as dispersants for mononuclear aromatic nonpolar swelling agents for hydrophobic fibers and as dispersants for textile dyes in aqueous medium, said components (c) and (d) serving as wetting agents for mononuclear aromatic nonpolar swelling agents for hydrophobic fibers and said component (d) further serving as a hydrator.

14. The composition as defined by claim **13** which further contains (7) a deodorant compound in an amount of about 0.04% based on the weight of the composition.

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