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DETERGENT FOR SOILED FIBERS

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6 Claims. (Cl. 252-89)

This invention relates to a cleaning composition or detergent formulation for cleaning soiled fabrics and the like and to a method of cleaning.

It has, of course, long been customary to clean soiled articles and surfaces such as fabrics, eating and cooking ware and utensils and the like by applying thereto an aqueous solution, customarily at an elevated temperature, of a surface active agent such as a soap or a synthetic detergent and such inorganic salts as to enhance the action of said surface active agent. In devices such as laundry equipment, dish washers and the like, more or less violent agitation or working is then used to loosen and disperse the dirt in the wash water so that it can later be discarded with the wash water. Any dispersed dirt remaining on the article being cleaned is then customarily flushed away with rinse water.

Among the troublesome organic soil ingredients on soiled articles such as fibers of cloth are fatty acids and the esters of fatty acids. Thus, fatty acids from the body are found on soiled clothing that has come in contact with the body where it picks up fatty acids. These fatty acids, of the type commonly called naturally occurring fatty acids, are found particularly on shirt collars and cuffs, undershirts, undergarments generally and the like. In addition, of course, naturally occurring fatty acids are also found in soil resulting from edible fatty acids such as salad oils, olive oil, fats from meat and dairy products and from inedible fatty acids also deposited on articles such as dishes and pots and pans and other articles in the natural soiling thereof. All such fatty acids and fatty acid derivatives which are the result of natural soiling of an article such as a fabric are referred to herein as naturally occurring fatty acids.

The cleaning composition of this invention includes as an active ingredient a water-soluble surface active compound. For general use, the surface active compound is preferably either an aliphatic amine, an alkanolamine, an aliphatic ether of an alkanolamine or an aromatic ether of an alkanolamine. In addition to the surface active compound the composition contains Hyperin GP-25, made by Dow Chemical Company, a propylene oxide adduct of glycerol containing 10 mols of propylene oxide per mol of glycerol. The amines or ethers of amines of the composition are those which are reactive in an aqueous medium with the fatty acid to form a surface active agent in situ. The fatty acid reacts with the amine quite vigorously to form in situ "water-soluble" amine surface active agents or soaps. These surface active agents formed in situ are extremely effective in emulsifying the remainder of the fats and oils present in the soil and removing the soil.

The Hyperin GP-25 serves to increase the efficiency of the cleaning operation when included as a part of the cleaning composition or detergent formulation of this invention. All cleaning, particularly by washing, is caused by a disruption of the physical-chemical energy bonds which exist between the soil and the substrate which is usually the fabric. The Hyperin GP-25 acts as a plasticizer which causes a swelling of the substrate and particularly where the substrate is a cellulose fabric. This plasticizing of the surface of the substrate serves to increase the efficiency of cleaning and to increase the completeness of the soil removal. Thus the Hyperin is useful in combination with any detergent or surface active agent and does

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not depend upon the chemical nature or structure of the agent so long as it is surface active.

The surface active agent, when formed by reaction of the fatty acid and the amine, forms on the surface of the article itself such as the fiber of fabrics. This is the area where the surface active agent is most efficient in its cleaning. Thus, with fabrics, the agent formation takes place in the interstices of the fibers. Although it has not been proven conclusively, it is believed that the heat from the formation of the surface active agent during the reaction of the fatty acid with the amine, which is an exothermic reaction, operates to aid in the cleaning action even though the solution as a whole may be quite cold. For these reasons, as well as others, the preferred surface active agents are those formed by the described reaction of the fatty acid and the amine on the article.

One of the features of this invention therefore is to provide an improved cleaning composition for soiled articles comprising a water-soluble surface active compound and Hyperin GP-25, made by Dow Chemical Company, a propylene oxide adduct of glycerol containing 10 mols of propylene oxide per mol of glycerol.

Another feature of the invention is to provide such a composition wherein the water-soluble surface active compound is formed by reacting with the fatty acids of the soiled article an aliphatic amine, an alkanolamine, an aliphatic ether of an alkanolamine, or an aromatic ether of an alkanolamine, the amine being reactive in an aqueous medium with the fatty acids to form a surface active agent in situ.

Another feature of the invention is to provide an improved method of cleaning a soiled article having a fatty acid occurring as natural soil therein comprising applying to said article an aqueous solution of a cleaning composition including a member of the class consisting of aliphatic amines, alkanolamines, aliphatic ethers of alkanolamines and aromatic ethers of alkanolamines, the member being reactive in an aqueous medium with said fatty acid to form a surface active agent in situ, and said Hyperin GP-25.

Other features and advantages of the invention will be apparent from the following description of certain embodiments thereof.

The aliphatic amines of the preferred composition are of course those which have a reactive hydrogen atom available for reacting with the fatty acid to form the surface active agent which is a salt of the acid. The amine is liquid at the temperature of cleaning in order to enter into the reaction with the fatty acid. This temperature may be from 32° F. to 212° F. with the reaction rate increasing for each degree rise in temperature depending on the amine used. The preferred amine is an alkanolamine with the alkyl radical being of relatively low molecular weight, preferably of 2-6 carbon atoms. Typical amines are monoethanolamine, diethanolamine, triethanolamine, N-methyl ethanolamine, N-methyl diethanolamine, dimethyl ethanolamine, N,N-diethyl ethanolamine, N-butyl ethanolamine, N,N-dibutyl ethanolamine, N,N-diisopropyl ethanolamine, N-aminoethyl ethanolamine, N-ethyl diethanolamine, benzyl dimethylamine, dimethylamine, phenyl ethanolamine, monoisopropanolamine, mixed isopropanolamines, dibutyl isopropanolamine, morpholine, N-methyl morpholine, N-(2-hydroxyethyl) morpholine, 2,6-dimethyl morpholine, N-ethyl morpholine, N-aminopropyl morpholine, N-aminoethyl morpholine and cyclic amines such as piperazine derivatives.

Typical amines are any of the aliphatic amines having an available reactive hydrogen atom as discussed above. As the necessary characteristic of the amine, as defined above, is the ability of the amine to react with the fatty acid on the soiled article to form a surface active agent

thereof and the amine is preferably a liquid at the temperature of cleaning, and because of the simplicity of the reaction involved and the simplicity of the fundamental requirements of the amine (having a reactive hydrogen atom to form the surface active agent salt with the fatty acid) it is obvious to those skilled in the art to select the required amine, alkanolamine, or aliphatic or aromatic ether of an alkanolamine.

The cleaning composition of this invention preferably includes a water dispersible carrier such as a water-soluble carrier so as to be easily added to the wash water in the required amounts. Furthermore, the water dispersible carrier may include other ingredients such as additional alkalizers, softening agents for the fabric when the article being cleaned is a fabric, additional surface active agents, optical dyes which are customarily used in cleaning compositions, soil suspending agents, such as the sodium salt of carboxy methyl cellulose, polyvinyl pyrrolidone and the like and agents stable in aqueous solution to chelate the calcium and magnesium ions in hard water. Thus, a typical cleaning composition may contain about 1-10 parts of a surface active compound per 10 parts of Hyperin GP-25.

The preferred cleaning composition may contain from 2-6 parts of the amine, as defined above and 15-20 parts of an additional wetting or dispersing agent of which an excellent example is an ethylene oxide condensation product of a fatty alcohol of the formula



in which R is either an aliphatic radical of 8-22 carbon atoms that is either straight chain, cyclic or branch chain, or a similar aliphatic substitution on an aromatic nucleus, X is hydrogen or an alkyl radical of up to 5 carbon atoms and n is a whole number of about 4 to 30. An anionic surface active agent can also be used in place of the non-ionic surface active agent if desired.

Another ingredient in the cleaning composition can be from 10-25 parts of urea where the article being cleaned is a cotton fabric wherein urea acts as a softener. Another ingredient in this combination that is useful is from 0.1-1.0 part of a customary optical dye while another ingredient in the combination can be an alkali such as an alkali metal carbonate in an amount of about 2-4 parts. Another ingredient can be from 2-10 parts of a chelating agent such as the sodium salt of ethylene diamine tetra acetic acid. Another can be a soil suspending agent of a high molecular weight polymer, preferably in an amount of about 0.1-1%. All of the parts and percentages given herein are parts by weight. These ingredients when mixed and in the proper proportions give a stable liquid that does not separate. In all of these cleaning compositions (or detergent formulations) the Hyperin GP-25 is preferably present in an amount of 1-15% of the composition.

The amine as defined herein may be used in combination, preferably in the amounts specified, with either the surface active agent, the urea, the dye or the alkaline material or with any other customary washing ingredient depending upon the nature of the article being cleaned. Thus, the amine can be used alone or in combination either with the surface active agent or with the urea or with the dye or with the alkalizer or with any combination thereof. In addition, where an optical dye is used it is preferable to use a solubilizing coupling agent therefor such as polyethylene glycol having a molecular weight of about 400. Other modifying ingredients may, of course, be used if desired.

In cleaning, the preferred cleaning composition is preferably added to water in such an amount that the amine is present in the solution in an amount of at least about 0.1%, and preferably 0.25-0.35%. Lesser amounts may of course be used if less efficient cleaning operation is desired, and greater amounts may also be used. Of course, excess amounts are economically wasteful and as a prac-

tical matter it is seldom necessary to employ more than 10-25% of the amine in the aqueous solution.

Example 1

One example of a cleaning composition or detergent formulation according to this invention is one containing 1 part of monoethanolamine, 18 parts of a surface active agent having the above structural formula wherein R is 10, X is methyl and n is 8, 2 parts of Hyperin GP-25 and 80 parts of water.

Example 2

A second example is a similar composition in which there is present in addition to the above amine, surface active agent and Hyperin GP-25, 10 parts of urea, 2 parts of polyethylene glycol of 400 molecular weight, 0.1 part of an optical dye whitener, 3 parts of potassium carbonate and 65.9 parts of water. In both this and the preceding example a washing solution was made by adding enough of the composition to water to give a 0.2-0.4% by weight solution in the water.

Similar examples were prepared in which the amine was in one instance diethanolamine, in another triethanolamine and in another hydroxyethyl piperazine.

Other examples which use surface active agents of ordinary and well known types, whether nonionic, anionic or cationic, are as follows:

Example 3

	lbs.
Water	65
Propylene adduct of glycerine with 10 mols of ethylene oxide	5
Lauryl dimethylamine acetate	15
Monoethanolamine	15

Example 4

Ethoxylated acid amide	10
Propylene adduct of glycerine with 10 mols of ethylene oxide	5
Sodium tripolyphosphate	40
Sodium carbonate	30
Sodium silicate	12
Carboxymethylcellulose	2

Example 5

Ethoxylated lauryl alcohol	10
Propylene adduct of glycerine with 10 mols of ethylene oxide	5
Potassium tripolyphosphate	20
Carboxymethylcellulose	1
Water	59
Potassium silicate	5

Example 6

Lauryl polyglycol ether (reaction product of lauryl alcohol and 10-15 mols of ethylene oxide)	10
Propylene adduct of glycerine with 10 mols of ethylene oxide	5
Sodium carbonate	30
Sodium tripolyphosphate	40
Sodium silicate	12
Carboxymethylcellulose	1

Example 7

Reaction product of p-isooctyl phenol with 10 mols of ethylene oxide	10
Propylene adduct of glycerine with 10 mols of ethylene oxide	5
Sodium carbonate	30
Sodium tripolyphosphate	40
Sodium silicate	12
Carboxymethylcellulose	1

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Example 8

Alkyl sulfonate where the alkyl group is 10-16 carbons	20
Sodium carbonate	30
Sodium silicate	15
Sodium tripolyphosphate	20
Propylene adduct of glycerine with 10 mols of ethylene oxide	5
Carboxymethylcellulose	1

Example 9

Potassium tetra propyl benzene sulfonate	15
Potassium tripolyphosphate	20
Potassium silicate	5
Carboxymethylcellulose	1
Propylene adduct of glycerine with 10 mols of ethylene oxide	5
Water	54

Example 10

Sodium tetra propyl benzene sulfonate	20
Propylene adduct of glycerine with 10 mols of ethylene oxide	5
Sodium carbonate	30
Sodium silicate	10
Sodium sulfate	20
Carboxymethylcellulose	1
Lauryl amide	4

Example 11

Sodium lauryl sulfate	15
Sodium tallow sulfate	5
Sodium tripolyphosphate	20
Sodium carbonate	30
Sodium silicate	10
Carboxymethylcellulose	2
Propylene adduct of glycerine with 10 mols of ethylene oxide	5

Having described my invention as related to the embodiments set out herein, it is my intention that the invention be not limited by any of the details of description, unless otherwise specified, but rather be construed broadly within its spirit and scope as set out in the accompanying claims.

The embodiments of the invention in which an exclusive property or privilege is claimed are defined as follows:

1. A cleaning composition for soiled fibers, consisting essentially of: about 1-10 parts by weight of a detergent material per about 10 parts by weight of a propylene oxide adduct of glycerol containing about 10 mols of propylene oxide per mol of glycerol as a plasticizer for said fibers.

2. The composition of claim 1 wherein said detergent material is a water soluble alkanolamine.

3. The composition of claim 1 wherein said detergent is a water soluble aliphatic amine.

4. A cleaning composition for soiled fibers containing a naturally occurring fatty acid as a part of the soil, consisting essentially of about 1-10 parts by weight of a detergent material member of the class consisting of monoethanolamine, diethanolamine, triethanolamine, N-methyl ethanolamine, N-methyl diethanolamine, dimethyl eth-

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anolamine, N,N-diethyl ethanolamine, N-butyl ethanolamine, N,N-dibutyl ethanolamine, N,N-diisopropyl ethanolamine, N-aminoethyl ethanolamine, N-ethyl diethanolamine, benzyl dimethylamine, dimethylamine, phenyl ethanolamine, monoisopropanolamine, mixed isopropanolamines, dibutyl isopropanolamine, morpholine, N-methyl morpholine, N-(2-hydroxyethyl) morpholine, 2,6-dimethyl morpholine, N-ethyl morpholine, N-aminopropyl morpholine, and N-aminoethyl morpholine, the member being reactive in an aqueous medium with said naturally occurring fatty acid to form a surface active agent in situ; and about 10 parts by weight of a propylene oxide adduct of glycerol containing 10 mols of propylene oxide per mol of glycerol as a plasticizer for said fibers, said detergent material being a liquid at the temperature of cleaning and present in an amount of at least about 0.1% by weight of said composition.

5. The method of cleaning a soiled fibrous article comprising applying thereto a water solution of about 10 parts of a propylene oxide adduct of glycerol containing about 10 mols of propylene oxide per mol of glycerol as a plasticizer for the fibers of said article and about 1-10 parts of a water-soluble detergent material, said solution having a concentration of about 0.1-0.35% of said detergent material, said parts and percents being by weight.

6. The method of cleaning a soiled fibrous article containing a fatty acid consisting essentially of: applying to said article an aqueous solution at a temperature of about 32-212° F. of a cleaning composition consisting essentially of about 1-10 parts by weight of a detergent material member of the class consisting of monoethanolamine, diethanolamine, triethanolamine, N-methyl ethanolamine, N-methyl diethanolamine, dimethyl ethanolamine, N,N-diethyl ethanolamine, N-butyl ethanolamine, N,N-dibutyl ethanolamine, N,N-diisopropyl ethanolamine, N-aminoethyl ethanolamine, N-ethyl diethanolamine, benzyl dimethylamine, dimethylamine, phenyl ethanolamine, monoisopropanolamine, mixed isopropanolamines, dibutyl isopropanolamine, morpholine, N-methyl morpholine, N-(2-hydroxyethyl)morpholine, 2,6-dimethyl morpholine, N-ethyl morpholine, N-aminopropyl morpholine, and N-aminoethyl morpholine, the detergent material being reactive in an aqueous medium with said fatty acid to form a surface active agent in situ; and about 10 parts by weight of a propylene oxide adduct of glycerol containing 10 mols of propylene oxide per mol of glycerol as a plasticizer for the fibers of said article.

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UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

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It is hereby certified that error appears in the above numbered patent requiring correction and that the said Letters Patent should read as corrected below.

Column 5, line 56, after "detergent" insert -- material --.

Signed and sealed this 16th day of August 1966.

(SEAL)

Attest:

ERNEST W. SWIDER

Attesting Officer

EDWARD J. BRENNER

Commissioner of Patents