

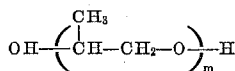
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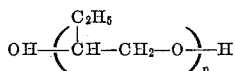
DETERGENT COMPOSITION

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9 Claims. (Cl. 252-137)

This invention relates to novel heavy-duty synthetic detergent compositions which can be successfully employed over a wide range of washing temperatures. More particularly, the invention is concerned with detergent compositions comprising: (1) an organic non-cationic detergent, (2) condensation product of a higher fatty alcohol or a higher alkyl phenol with one to three moles of ethylene oxide per mole of the alcohol or phenol, and (3) a polyalkoxy dihydric alcohol which may be represented by the formula:



or



or an isomer thereof wherein m stands for a whole number from about 7 to about 35 and n is an integer from about 3 to about 14.

It is known that the class of either ionic or non-ionic detergents has achieved a distinct status as a substitute for natural soap. However, such detergents suffer the disadvantages of relative inferior detergency as compared to natural soap. Moreover, they are substantially ineffective over a wide range of temperatures during use. For many purposes, soap itself is unsatisfactory since it tends to deposit a water insoluble residue, usually in the form of calcium oleate, upon the washed apparel. Such deposition inevitably imparts a distinct hard feel thereto. Thus, if non-cationic detergents could be enhanced whereby the detergency of soap is approached or exceeded without experiencing soap's disadvantages, such would be highly desirable.

A principal object of the invention is to provide a detergent composition of enhanced properties applicable over a wide range of temperatures. A further object is to provide a non-cationic detergent composition comparable to soap's detergency, absent insolubles which map precipitate upon the washed apparel. Other objects and advantages will become apparent from a consideration of the following detailed description.

Surprisingly, the foregoing objects can be attained in a straightforward manner by providing a detergent composition mixture comprising (a) a non-cationic detergent, (b) a polyalkoxy alcohol, and (c) a higher fatty alcohol or an alkyl phenol condensed with at least equimolar quantities but not more than three moles of ethylene oxide. None of the components, other than the detergent, exhibits any noticeable detergency. Notwithstanding the presence of a polyalkoxy alcohol and a condensate of 1-3 moles of ethylene oxide and one mole of a fatty alcohol or an alkyl phenol, an unexpectedly and markedly improved detergent composition has been found, whereby the major disadvantages of the prior art are obviated.

The compositions of my invention may be characterized as being substantially water insoluble. They comprise

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the abovementioned components, admixed in definite proportions. These components which comprise the detergent, the condensate of ethylene oxide with fatty alcohol or alkyl phenol and the polyalkoxy alcohol, are present in the mixture, on a weight basis, in an amount equal to from about one to three parts of each component, and preferably in a weight ratio of 1:1:1, respectively. The foregoing mixture may further be modified by adding thereto of from about one to ten parts of a phosphate builder, as for instance, an alkali tripolyphosphate, a tetraalkali metal pyrophosphate, an alkali hexametaphosphate and equivalents thereof as well as mixtures of the same; the alkali contemplated includes: sodium, potassium, lithium as well as ammonium radicals. It has been found that the defined compositions are effective when employed in relatively dilute aqueous concentrations from 0.04% to 2.0%, and preferably in concentrations from about 0.1% to 0.3%.

It has been further found that a large variety of non-cationic synthetic detergents of the anionic and non-ionic types either alone or in admixture can be successfully used herein. These may be taken from the following typical commercially available distinct classes:

(1) Ethylene oxide-higher alkyl phenol condensates in which the alkyl substituent may contain from 8 to 12 carbon atoms. The condensates, polyoxyethylene ethers, are prepared by condensing 6 to 30 moles ethylene oxide with 1 mole of the alkyl-substituted phenol. They are available commercially under such names as "Igepal CA" and "Igepal CO."

(2) Water soluble salts of the higher fatty acid amides of lower molecular weight amino alkyl sulfonic acids, including, for example, the sodium salt of oleic acid amide of N-methyl taurine or the sodium salt of palmitic acid amide of N-cyclohexyl taurine, known as "Igepon T" or "Igepon CN," respectively.

(3) Water soluble salts of higher alkyl benzene sulfonic, such as the octyl benzene sodium sulfonate, sold under the trademark "Nacconol NRSF."

(4) Water soluble salts of alkyl sulfonic acids as, for instance, the sodium salt of sulfonated mineral oil.

(5) Water soluble salts of the higher alcohol esters of sulfocarboxylic acids.

(6) Water soluble salts of the higher alkyl sulfates of 10 to 14 carbon atoms, e.g., "Duponol C."

(7) Water soluble salts of higher fatty acids of monoesters of monohydroxy alkyl or polyhydroxy alkyl sulfonic acid as, for example, the sodium salt of oleic acid ester of isethionic acid (e.g., "Igepon AC-78").

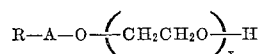
(8) Water soluble salts of the sulfuric acid esters of the fatty acid monoglycerides as for instance, the sodium salt of coconut oil fatty acid ester of 1,2-dihydroxypropane-3-sulfuric acid, available as "Syntex T."

(9) Condensates of ethylene oxide-higher fatty acid (or higher fatty alcohols) prepared by reacting 1 mole of stearic or oleic acid (lauryl or tallow alcohols) with 6 to 15 moles ethylene oxide and are available under trademarks such as "Renex" or "Stearox AS" (or "Stearox CD," "Siponic E"), respectively.

(10) Polyoxypropylene glycol-ethylene oxide condensates prepared by reacting polypropylene oxide and polyethylene glycol, available as "Pluronic L-44."

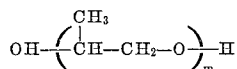
Although each of the above-listed class of compounds exhibits various degrees of detergency, its detergency is markedly enhanced many fold by the addition thereto of a higher fatty alcohol or alkyl phenol condensed with

1 to 3 moles of ethylene oxide having the general formula:



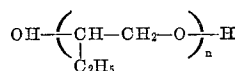
where R is an alkyl radical of from 8 to 12 carbon atoms, A is ethylidene ($-\text{CH}_2\text{CH}_2-$) or disubstituted benzene and x is an integer from 1 to 3, and a polyalkoxy dihydric alcohol. The latter alcohol may be represented by the general formula:

(I)



or

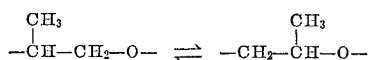
(II)



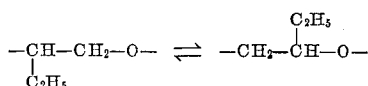
and isomers thereof, where m is an integer from about 7 to about 35 (i.e., average molecular weight of about 425 to about 2000) and n is an integer from about 3 to about 14 (i.e., average molecular weight of about 250 to 1000).

These dihydric alcohols may be prepared by known methods. For instance, Compound I is prepared by reacting 1 mole of 1,2-propylene glycol with at least about 6 moles of 1,2-propylene oxide. Resultant polypropylene glycol polymer should not exceed a molecular weight of about 2000. Compound II can be prepared by reacting 1 mole of 1,2-butylen glycol with at least about 2 moles of 1,2-butylen oxide. However, the molecular weight (M.W.) of the resultant polybutylene glycol polymer should not exceed about 1000. Although the structures as set forth are the preferred representations of the polyalkoxy alcohols, it is to be understood that isomers thereof are also contemplated. For instance, in the polypropoxy linkage, the following may be written:

(Ia)



(IIa)



Thus (Ia) polypropoxy glycols of average molecular weight ranging from about 425 to 2000, preferably from about 950 to 1200, and (IIa) polybutoxy glycols of average molecular weight ranging from about 250 to 1000, and preferably about 450 to 500, are contemplated in the practice of this invention.

The higher fatty alcohols and higher alkyl phenols which are useful in the practice of the invention include: decanol, undecanol, dodecanol, lauryl alcohol, tridecanol and myristyl alcohol as well as octyl phenol, nonyl phenol, decyl phenol, undecyl phenol, dodecyl phenol or lauryl phenols, lauryl alcohol and p-nonyl phenol being preferred. As previously stated, each of the compounds are reacted with 1 to 3 moles of ethylene oxide per mole of the alcohol or the phenol.

As stated previously, alkali metal phosphate builders are advantageously added to the above-defined multi-component compositions. However, other adjuvants may also be added concomitantly in the present practice. Such adjuvants are for instance starch, sodium carboxy methyl cellulose, glue, clay, sodium cellulose acetate and equivalents thereof, all being added in conventional amounts.

The detergent compositions are further characterized as being substantially water insoluble. They are, however, dispersible in water. The indications are that a cloudy solution appears at elevated temperatures of 120° F. or higher above. If desired, a wetting agent other than the detergent itself may be advantageously added to the composition in an amount approximating the quan-

tity of synthetic detergent, so as to solubilize the latter, particularly in a high phosphate salt environment. Such wetting agents include, for instance, the soluble salts of xylene sulfonates, of alkylsulfosuccinates, of long chain fatty acid sulfates, or of unpolymerized alkyl naphthalene-sulfonic acids. More specifically, wetting agents such as sodium xylene sulfonate, lauryl sulfate, dioctyl sodium sulfosuccinate and potassium isopropyl naphthalene sulfonate are contemplated herein. In general, any of the commercially available wetting agents may be used.

The enhanced detergent properties of the compositions according to the practice of the present invention are determined in a conventional manner. The latter requires the use of a launderometer as fully described in the AATCC year book for 1955, page 55 and following. As employed herein, "AATCC" means the American Association Textile Chemists and Colorists.

In a typical run a standard soiled swatch and stainless steel balls, together with the specified testing bath containing 0.2% test detergent composition as more fully described in Examples A, B and C below, are charged to a launderometer jar. After a twenty minute wash cycle at 140° F., the washed swatch is removed from the jar, rinsed in ordinary tap water of 60 p.p.m. hardness, based on the presence of calcium and magnesium salts and calculated as CaCO_3 and Mg_2CO_3 in a weight ratio of 2:1.

To illustrate the enhanced detergency of the compositions of the present invention, comparisons with known natural soaps and synthetic detergent compositions are made. In the following examples, the control detergent compositions are set forth; all parts are based on weight unless otherwise specified. The compositions are then used in 0.2% concentration in the launderometer.

EXAMPLE A

This example illustrates a standard natural built soap.

	Parts
Sodium oleate.....	66
Sodium tripolyphosphate.....	20
Sodium metasilicate.....	10
Water	4

EXAMPLE B

This example illustrates a standard built sudsing synthetic detergent.

	Parts
Sodium lauryl alcohol sulfate.....	5
Sodium dodecyl benzene sulfonate.....	15
Sodium tripolyphosphate.....	25
Tetrasodium Pyrophosphate.....	30
Sodium metasilicate.....	10
Sodium carboxymethylcellulose.....	1
Sodium sulfate.....	14

EXAMPLE C

This example illustrates a conventional nonsudsing built detergent.

	Parts
Condensate of 1 mole coconut oil fatty acids and 12-15 moles of ethylene oxide.....	15
Tetrasodium pyrophosphate.....	25
Sodium silicate.....	5
Starch	50
Sodium carboxymethylcellulose.....	1
Water	4

Each detergent composition of the foregoing examples was employed to wash standardized, imprinted oily-type, carbon soiled cotton swatches in a launderometer maintained at 140° F. Embodiments of temperature and concentration conditions herein approximate good laundry practice. Test reflectance readings are recorded. However, prior to washing, the reflectance reading of the soiled portion of the standard swatch is recorded at 29, while

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the unsoiled portion of the same swatch is recorded at 100. The recorded data after washing is tabularized as follows:

Table I

Example	Reflectance Reading of Soiled Portion of Cotton Swatch	Reflectance Reading of Unsoiled Portion of Cotton Swatch	Percent Detergency ¹
A-----	70	99.5	57.8
B-----	66	99.5	52.1
C-----	59	98.5	42.3

¹ Determined by the formula:

$$\frac{R_t (\text{washed soiled area}) - R_t (\text{standard soiled area}) \times 100}{R_t (\text{standard unsoiled area}) - R_t (\text{standard soiled area})}$$

where R_t is defined as the reflectance reading value.

From the above table, it can be readily seen that a natural built soap will possess superior detergency as compared to the representative synthetic sudsing and non-sudsing detergents. It can also be observed that the reflectance reading of the unsoiled portion of the test cotton swatch is somewhat reduced. Unfortunately, after several washings, increased graying of wearing apparel becomes apparent. The continued use of the latter compositions, representative of the prior art, is highly undesirable.

For purposes of comparison, the composition of the following examples constituting several embodiments of my invention are employed in a manner similar to the previously defined compositions of Examples A to C above. The compositions are all employed as an aqueous detergent bath which is adjusted to about 0.03% based on the weight of the active organic detergent component. However, based on the detergent component concentrations as low as 0.01% and as high as 0.10% may also be employed advantageously. These examples are merely illustrative of the preferred modus operandi, and are not intended to be taken as limitative, except as to the extent defined by the appended claims.

EXAMPLE 1

Nonyl phenol (1 mole) condensed with 10-11 moles ethylene oxide-----	Parts 45
Nonyl phenol condensed with ethylene oxide in equimolecular quantities-----	14
Polypropylene glycol polymer (1025 average molecular weight)-----	6
Tetrapotassium polyphosphate-----	50
	12
	25

EXAMPLE 2

A composition of Example 1 is prepared except that the quantity of the polypropylene glycol polymer is increased to 16 parts of said polymer.

EXAMPLE 3

Polyoxyethylene ether of oleyl alcohol prepared by reacting 12 moles of ethylene oxide per mole of oleyl alcohol-----	Parts 60
Condensate of equimolar quantities of ethylene oxide and nonyl phenol-----	10
Polypropylene glycol polymer (average molecular weight=1025)-----	5
Tetrasodium pyrophosphate-----	65
	5
	25

EXAMPLE 4

Condensate of 1 mole of tallow alcohol and 11 moles of ethylene oxide-----	10
Condensate of nonyl phenol (1 mole) and 1.5 moles of ethylene oxide-----	5
	75

6

Polypropylene glycol polymer (average molecular weight=1025)-----	6
Tetrasodium pyrophosphate-----	25

EXAMPLE 5

For the condensate of tallow alcohol and ethylene oxide of Example 4 is substituted sodium lauryl sulfate and the composition therein otherwise identical, is prepared.

EXAMPLE 6

The components of the composition in Example 4 are admixed as indicated, except that sodium octyl benzene sulfonate is substituted for the condensate of tallow alcohol and ethylene oxide.

EXAMPLE 7

Tridecyl alcohol (1 mole) condensed with ethylene oxide (10 moles)-----	Parts 5
Condensate of equimoles of p-nonyl phenol and ethylene oxide-----	5
Polypropylene glycol polymer (average molecular weight=425)-----	5
Tetrasodium pyrophosphate-----	25
	5

EXAMPLE 8

Tridecyl alcohol (1 mole) condensed with ethylene oxide (8 moles)-----	5
Condensate of equimoles of p-nonyl phenol and ethylene oxide-----	5
Polypropylene glycol polymer (average molecular weight=2000)-----	5
Tetrasodium pyrophosphate-----	100
Carboxymethylcellulose-----	35
Sodium metasilicate-----	1
	25

The detergency property of the above-defined compositions is observed at the usual laundry temperature of 140° F. However, temperatures as low as room temperature and as high as 200° F. may also be used. Detergent compositions employed at 160° F. are illustrated in the following examples.

EXAMPLE 9

Polyoxyethylene ether of stearyl alcohol prepared by reacting one mole of stearyl alcohol with 12 moles of ethylene oxide-----	Parts 5
Condensate of 1 mole lauryl alcohol with 3 moles of ethylene oxide-----	3
Polypropylene glycol polymer (average molecular weight=1025)-----	5
Tetrasodium pyrophosphate-----	25

EXAMPLE 10

Polyoxyethylene ether of stearyl alcohol, prepared by reacting 1 mole of myristyl alcohol with 12 moles of ethylene oxide-----	5
Equimolar condensate of myristyl alcohol and 1 mole ethylene oxide-----	3
Polypropylene glycol polymer (average molecular weight=1200)-----	5
Tetrasodium pyrophosphate-----	25

Although it is generally recognized in the laundry art that an increase in washing temperature above about 140° F. decreases the detergency value of the synthetic detergent swiftly, surprisingly, a contrary effect is noted with the enhanced detergent compositions of the present invention. Further, even in the absence of soft water and where hard water is used (450 p.p.m. Ca—Mg calculated as CaCO_3 and Mg_2CO_3 in 2:1 weight ratio), the reflectance reading of the unsoiled area of the standard cotton swatch is noted in each case to be 99.9+.

The reflectance data was collected and recorded in the table as follows:

Table II

Example	Reflectance Reading (R ₁) (Soiled Portion of Swatch)	Percent Detergency (See Table I)	H ₂ O Hardness (Ca-Mg Salts)	Temp. (° F.)
1-----	75	65.0	60	140
2-----	80	71.8	60	140
3-----	73	61.5	60	140
4-----	73	61.5	60	140
5-----	73	61.5	60	140
6-----	73	61.5	60	140
6A ¹ -----	51	31.0	60	80
6B ¹ -----	62	47.8	60	120
6C ¹ -----	78	69.0	60	160
6D ¹ -----	82	74.6	60	180
6E ¹ -----	86	80.0	60	200
7-----	72	60.0	60	140
7A-----	74	63.5	450	140
8-----	73	61.5	60	140
8A-----	76	66.2	450	140
9-----	78	69.0	60	160
10-----	74	63.5	60	160
A+ ² -----	41	16.9	450	140
B+ ² -----	53	33.9	450	140

¹ These examples show the effect of temperature variations as compared to Example 6.

² Previously defined examples which illustrate the use of hard water (450 p.p.m.). Otherwise the conditions previously stated are the same.

EXAMPLE 11

A mixture is prepared which comprises 10.5 parts of nonyl phenol-ethylene oxide condensate (prepared by reacting 1.5 moles of the oxide per mole of the alkyl phenol), 10.5 parts of polypropylene glycol polymer of average molecular weight equal to about 1025, 15 parts sodium salt of oleic acid amide of N-methyl taurine and 15 parts of tetrapotassium pyrophosphate. To this mixture is added 30 parts sodium xylene sulfonate. Sufficient tap water (60 p.p.m. CaMg salts) is added to increase the total number of parts of the composition to 185. The wetting agent, sodium xylene sulfonate, is advantageously added principally to effect solubilization of the detergent to form a substantially clear solution. When the stated composition is employed in dilute aqueous concentrations of 0.3%, 0.4% and 0.5%, respectively, reflectance readings subsequent to washing at 140° F. are 72, 75 and 82, respectively.

EXAMPLE 12

A mixture was prepared containing the ingredients:

	Parts
(1) Condensate of 12 moles ethylene oxide and 1 mole of oleyl alcohol-----	6
(2) Sodium salt of oleic acid amide of N-methyl taurine-----	10
(3) Polybutylene glycol polymer (average molecular weight=1000)-----	8
(4) Nonyl phenol condensed with 1.5 moles ethylene oxide-----	10
(5) Sodium xylene sulfonate-----	40
(6) Tetrasodium pyrophosphate-----	11

Sufficient water was then added to dilute the mixture to 150 parts.

Washing a test soiled swatch in a launderometer at 140° F. as described previously, using 0.3% concentration of the foregoing detergent composition, a reflectance reading of 74 is observed.

EXAMPLE 13

The above Example 12 was repeated in every respect except the polybutylene glycol polymer was replaced by 6 parts of polybutylene glycol polymer of an average molecular weight of about 500. When the soiled swatch is washed in the detergent composition, a reflectance reading of 76 is observed.

It is an important advantage of the present invention that the detergent compositions can be prepared by admixing the components together in the form of a dry mixture, dispersion, suspension and the like, either in the presence or absence of additional alkali metal phosphates. In this fashion, the compositions can be packaged with ease.

EXAMPLE 14

A 25 pound load of soiled white shirts and containing a standard soiled swatch is charged to a conventional commercial washer containing hot water (160° F.). To the latter is next charged three ounces of detergent consisting of 14 parts of a condensate prepared by reacting 1 mole tridecanol and 12 moles of ethylene oxide, 6 parts of a condensate nonyl phenol (1 mole) and ethylene oxide (2 moles) and 8 parts polypropylene glycol polymer (average molecular weight 1025) and one and one-half ounces of mixed phosphates which consist of 50% tetrasodium pyrophosphate, 49% trisodium phosphate and 1% carboxymethyl-cellulose. After a ten minute washing cycle, the wash water is discarded and the wash is further treated for an additional ten minutes with eight ounces of mixed phosphates previously defined. The wash water is discarded again, the load rinsed first with hot water, then with cool water and, finally, dried.

Reflectance reading of the standard swatch included along with the shirts is observed as 95, and none of the washed shirts had to be withdrawn from the load to be rewashed for cuff or collar stains and soils. The percent whiteness retention was found to be 100%.

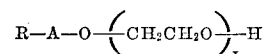
EXAMPLE 15

Repeating the procedure of Example 14 in every material detail except that natural soap is substituted for the synthetic detergent mixture, a reflectance reading taken on the included test soiled swatch is noted as 53.5 and the whiteness retention is recorded as 99.5%. However, more than one-fourth of the load used in this example had to be rewashed for cuff and collar stains.

I claim:

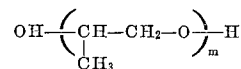
1. An improved multi-component cleansing and laundry detergent composition substantially water insoluble which consists essentially of:

- (a) 1 to 3 parts of a non-cationic, non-soap and organic synthetic detergent selected from the group consisting of a synthetic anionic detergent, a synthetic nonionic detergent and mixtures thereof,
- (b) 1 to 3 parts by weight of an ethylene oxide ether having the general formula:

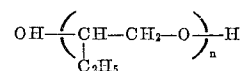


where R is an alkyl group of from 8 to 12 carbon atoms, A is a radical selected from the class consisting of disubstituted phenyl and ethylidene and x is an integer from 1 to 3,

- (c) 1 to 3 parts by weight of a polyalkoxy dihydric alcohol selected from the structure consisting of:



and



where m is an integer from about 7 to 35 and n is an integer from about 3 to 14, and isomers thereof, and

- (d) 1 to 10 parts by weight of an alkali metal polyphosphate.
2. The detergent composition of claim 1 in which the weight ratio of the components is 1:1:1:5, respectively.
3. The detergent composition of claim 1 in which the

non-cationic detergent is the condensate of 1 mole of nonyl phenol and about 10 moles of ethylene oxide, the alkyl phenol is the equimolar condensate of nonyl phenol and ethylene oxide, the polyalkyl alcohol is polypropylene glycol polymer of average molecular weight 1025, and the alkali metal polyphosphate is tetrasodium pyrophosphate.

4. The detergent composition of claim 1 in which the detergent is the condensate of 1 mole of octyl phenol and about 8 moles of ethylene oxide, the ethylene oxide ether is the condensate of equimolar quantities of ethylene oxide and nonyl phenol, the polyalkoxy alcohol is polypropylene glycol polymer of average molecular weight equal to about 1025, and the alkali metal polyphosphate is tetrapotassium pyrophosphate.

5. The detergent composition of claim 1 in which the detergent is the condensate of 1 mole of oleyl alcohol and 12 moles of ethylene oxide; the ethylene oxide ether is the condensate of equimolar amounts of ethylene oxide and nonyl phenol; the polyalkoxy alcohol is polypropylene glycol polymer of average molecular weight equal to 1025; and the alkali metal polyphosphate is tetrasodium pyrophosphate.

6. The detergent composition of claim 1 in which the detergent is the condensate of 1 mole of tallow alcohol and 11 moles of ethylene oxide, the ethylene oxide ether is the condensate of 1 mole of nonyl phenol and 1.5 moles of ethylene oxide, the polyalkoxy alcohol is polypropylene glycol polymer of average molecular weight equal to 1025, and the alkali metal polyphosphate is tetrasodium pyrophosphate.

7. The detergent composition of claim 1 in which the organic detergent is a mixture comprising the condensate of 12 moles of ethylene oxide and 1 mole of oleyl alcohol

and the sodium salt of oleic acid amide of N-methyl taurine, the polyalkoxy alcohol is polybutylene glycol polymer of average molecular weight equal to about 1000, the ethylene oxide ether is the condensate of 1 mole of nonyl phenol and 1.5 moles of ethylene oxide, and the alkali metal polyphosphate is tetrasodium pyrophosphate.

8. The detergent composition of claim 1 in which the detergent is the condensate of 1 mole of stearyl alcohol and 12 moles of ethylene oxide, the ethylene oxide ether is the condensate of equimolar quantities of ethylene oxide and myristyl alcohol, the polyalkoxy alcohol is polypropylene glycol polymer of average molecular weight equal to about 1200, and the alkali metal polyphosphate is tetrapotassium pyrophosphate.

9. The detergent composition of claim 1 in which the detergent is the condensate of 1 mole of stearyl alcohol and 12 moles of ethylene oxide; the ethylene oxide ether is the condensate of equimolar amounts of ethylene oxide and lauryl alcohol; the polyalkoxy alcohol is polypropylene glycol polymer of average molecular weight equal to 1025; and the alkali metal polyphosphate is tetrasodium pyrophosphate.

References Cited in the file of this patent

UNITED STATES PATENTS

2,089,569	Orthner	Aug. 10, 1937
2,213,477	Steindorff	Sept. 3, 1940
2,477,383	Lewis	July 26, 1949
2,575,276	Jacoby	Nov. 13, 1951
2,806,001	Fong et al.	Sept. 10, 1957

FOREIGN PATENTS

716,641	Great Britain	Oct. 13, 1954
540,798	Canada	May 14, 1957