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ALKALINE CLEANING COMPOSITIONS

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8 Claims. (Cl. 252—135)

This invention relates to alkaline cleaning compositions and more particularly to non-foaming alkaline cleaners.

The development of synthetic detergents has made possible in recent years the formulation of cleaning compositions of greatly enhanced detergent power, through combination of these detergents with various alkalies, acids or soaps. Synthetic detergents fall into three main classes, called anionic, non-ionic and cationic detergents. Of these, the non-ionic detergents exhibit outstanding ability to resist decomposition in alkalies, and for this reason they are favored for use in strongly alkaline cleaning compositions.

However, the non-ionic detergents suffer a serious drawback in that generally they tend to cause cleaning solutions to foam excessively. Many cleaning compositions are hampered by the presence of foam, particularly where vigorous agitation of the cleaning solution forms a part of the detergent action. In spray cleaning particularly, the detrimental effects of foam are so great as to preclude the use of non-ionic detergents in spray applications.

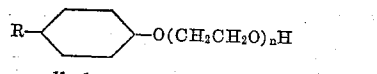
It has now been discovered that, by the addition to an alkaline cleaner of a small amount of an alkyl phenol-ethylene oxide condensation product together with a small amount of a phosphate ester, the resulting composition is not only substantially free from foam even when used in spray applications but the composition has greatly improved cleaning power. As a result not only are the compositions of the present invention free from foam but also the cleaning power is substantially superior to the heretofore known alkaline cleaning compositions whether or not they contained non-ionic detergents.

The improved cleaning power of the compositions of the present invention is readily illustrated by the following table, wherein they are compared with compositions containing several other types of synthetic detergents. This table has been prepared from data obtained when metal panels initially coated with mill oil soil were cleaned with a 1% solution of sodium orthosilicate containing 0.50% (by dry weight of the silicate) of the additive.

TABLE I

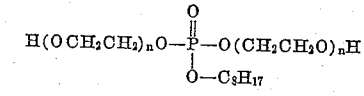
Additive	Percent water break
Alkyl phenol-ethylene oxide condensate with phosphate ester (50% of each)	6
Alkyl phenol-ethylene oxide condensate (84%) with phosphate ester (16%)	0
Rosin fatty acid-ethylene oxide condensate	75
Di-tert. acetylenic glycol	75
Alkyl aryl sodium sulfonate	98
Tall oil-ethylene oxide condensate	98

The alkyl phenol-ethylene oxide condensation product used in practicing the present invention may be represented by the formula



wherein R is an alkyl group containing 8 or 9 carbon atoms and n has a value of 8 to 10. Products of this type generally consist of a mixture of compounds differing in the number of ethoxy (CH_2CH_2O) units condensed on each molecule, and it is therefore customary to identify products having particular characteristics by indicating the range of ethoxy units per molecule within which the largest proportion of the compound falls.

The phosphate ester, to be included together with the alkyl phenol-ethylene oxide condensate in the alkaline cleaning compositions of the present invention, has the structure:



wherein the C_8H_{17} radical is a 2-ethyl hexyl group and n has a value of approximately 4 to 6.

The amounts in which the alkyl phenol-ethylene oxide condensate and the phosphate ester may be used in the compositions of the present invention are very low, these materials being effective in amounts as low as 0.05% alkyl phenol-ethylene oxide condensate and 0.01% phosphate ester, based on the dry weight of the composition. It is generally preferred, however, that the alkyl phenol-ethylene oxide condensate be present in amounts of at least 0.25% and the phosphate ester in amounts of at least 0.05% by dry weight. Though larger amounts of these materials may be used with no deleterious effects, no particular advantage is obtained by using them in amounts in excess of about 5% alkyl phenol-ethylene oxide condensate and 1% phosphate ester.

With respect to the alkalies which may be used in the alkaline cleaning compositions of the present invention, any of the generally known alkalies used in the cleaning industry, or any combination thereof, are suitable. The term "alkali" as used in the claims is intended to denote any of such alkalies. Examples of such alkalies include caustic soda, caustic potash, sodium carbonate, sodium bicarbonate, sodium and potassium silicates having silica to alkali metal oxide ratios up to about 3.5, the alkali metal phosphates such as trisodium phosphate, tetrasodium pyrophosphate, sodium tripolyphosphate, etc. While the alkali or alkali mixture generally comprises the major portion of the compositions of the present invention, and should be present in amounts of at least 50% thereof, there may also be included various cleaning aids such as sequestering agents, corrosion inhibitors, abrasives, etc., as may be desired in specific applications.

In order to illustrate more clearly the manner in which the compositions of the present invention may be made and used, and the advantages obtained thereby, the following examples are submitted. Modifications other than those shown are understood to be within the scope of the invention.

Example I

In a steel mill assembly line, the sheet steel after processing was passed through a spray cleaning apparatus for final removal of mill oil, shop dirt, etc. The spray nozzles were arranged to impinge the cleaning solution on the steel sheets, the run-off solution being collected in a tank and recycled. Difficulty in completely removing the soil had been encountered, using a cleaner containing about 50% sodium metasilicate pentahydrate together with sodium carbonate, sodium bicarbonate, sodium tripolyphosphate and a rust inhibitor. In an effort to produce more effective cleaning there were added to this cleaner small amounts of a synthetic non-ionic detergent and also a synthetic anionic detergent of the alkyl benzene sulfonate class. The improvement in soil removal was disappointingly slight, while the persistent foaming of the solution was almost disastrous, the foam rapidly overflowing from the run-off tank, interfering with the

action of the recycling pumps and slowing down the whole assembly line.

In place of the above cleaner there was then substituted in the same spray apparatus a cleaning composition having the following ingredients:

	Percent by weight
Sodium metasilicate pentahydrate	52
Sodium carbonate	18.1
Sodium bicarbonate	13
Sodium tripolyphosphate	8
Potassium dichromate (a rust-inhibiting compound)	8
Nonyl phenol-ethylene oxide condensate	0.6
2-ethyl hexyl-polyoxyethylene phosphate ester, described hereinabove	0.3

This composition, at a concentration of one ounce per gallon gave highly effective cleaning, and moreover produced hardly any foam, the slight amount which did form dissipating immediately before it could build up.

Example II

A heavy duty spray cleaner was made by blending the following:

	Percent by weight
Sodium orthosilicate	89
Sodium tripolyphosphate	10
Nonyl phenol-ethylene oxide condensate	0.7
2-ethyl hexyl-polyoxyethylene phosphate ester, described hereinabove	0.3

This composition was used in aqueous solution, at a concentration of 2 oz./gal. and a temperature of about 160° F., to spray-clean heavily soiled sheet steel. The solution did not foam. Soil removal, as compared with simple silicate cleaners, was greatly improved.

Example III

	Percent by weight
Tetrasodium pyrophosphate	79
Actidip[1] salts	20
Nonyl phenol-ethylene oxide condensate	0.7
2-ethyl hexyl-polyoxyethylene phosphate ester, described hereinabove	0.3

[1] Trademark for an activating compound consisting of a titanium-disodium phosphate, complex for use prior to phosphatizing, made in accordance with Patent No. 2,310,239. In the present composition, the compound may be present in amounts of from 5 to 25%.

This composition, at a dilution of one oz./gal. and a temperature of 160° F., was employed as a cleaning and activating spray treatment to prepare metal for phosphating. The run-off was collected and recirculated in order to get full use from the relatively expensive ingredients, an expedient made much simpler by the absence of foam. At the same time the increased wetting, penetrating and cleaning properties of the solution was highly advantageous, increasing the speed and efficiency of the process, which was part of an assembly-line.

Following are further examples of low foaming alkaline cleaning compositions formulated in accordance with the present invention.

Example IV

	Percent by weight
Caustic soda	99.65
Nonyl phenol-ethylene oxide condensate	0.25
2-ethyl hexyl-polyoxyethylene phosphate ester, described hereinabove	0.10

Example V

Anhydrous sodium metasilicate	76
Sodium carbonate	10
Sodium tripolyphosphate	10
Nonyl phenol-ethylene oxide condensate	3
2-ethyl hexyl-polyoxyethylene phosphate ester, described hereinabove	1

Example VI

Potassium hydroxide	54.4
Potassium silicate (14.2% K_2O, 26.7% SiO_2, 59.1% H_2O)	45.0
Nonyl phenol-ethylene oxide condensate	0.5
2-ethyl hexyl-polyoxyethylene phosphate ester, described hereinabove	0.1

Example VII

Sodium carbonate	70
Tetrasodium pyrophosphate	29
Nonyl phenol-ethylene oxide condensate	0.6
2-ethyl hexyl-polyoxyethylene phosphate ester, described hereinabove	0.4

Example VIII

Sodium metasilicate pentahydrate	89
Sodium carbonate	10
Octyl phenol-ethylene oxide condensate	0.7
2-ethyl hexyl-polyoxyethylene phosphate ester, described hereinabove	0.3

Example IX

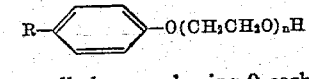
Caustic soda	95
Nonyl phenol-ethylene oxide condensate	4.5
2-ethyl hexyl-polyoxyethylene phosphate ester, described hereinabove	0.5

It will be understood that the present invention is applicable to many types of cleaning operations, and is not limited to those applications which require a cleaning composition which does not foam. The complete absence or rapid dissipation of foaming in the compositions of the present invention is an added advantage which, together with their greatly increased detergent power, makes these compositions highly versatile and effective in a wide range of applications.

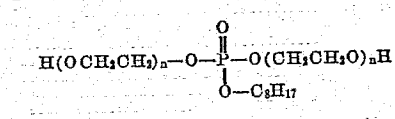
This application is a continuation-in-part of my copending application Serial No. 553,686, filed December 19, 1955, and now abandoned.

Having thus described my invention, I claim:

1. A non-foaming alkaline cleaning composition comprising a major proportion of an inorganic alkaline material, from 0.05% to 5% by dry weight of the composition of an organic detergent, and from 0.01% to 1% by dry weight of the composition of a defoamer, said inorganic alkaline material being selected from the class consisting of caustic soda, caustic potash, sodium carbonate, sodium bicarbonate, alkali metal silicates, alkali metal phosphates, and mixtures thereof, said organic detergent being an alkyl phenol-ethylene oxide condensation product having the formula:



wherein R is an alkyl group having 9 carbon atoms and where n has a value of from 8 to 10 and said defoamer being a phosphate ester of the formula:



wherein the C_8H_{17} radical is a 2-ethyl hexyl group and where n has a value of approximately 4 to 6.

2. A non-foaming alkaline cleaning composition in accordance with claim 1 in which said condensation product is present in an amount of about 0.25 to 5% and said phosphate ester is present in an amount of about 0.05 to 1% by dry weight of said composition.

3. A non-foaming alkaline cleaning composition in accordance with claim 1 in which said inorganic alkaline material is sodium hydroxide.

4. A non-foaming alkaline cleaning composition in accordance with claim 1 in which said inorganic alkaline material is sodium orthosilicate.

5. A non-foaming alkaline cleaning composition in accordance with claim 1 in which said inorganic alkaline material is sodium metasilicate.

6. A non-foaming alkaline cleaning composition in accordance with claim 1 in which said inorganic alkaline material is tetrasodium pyrophosphate.

7. A non-foaming alkaline cleaning composition in accordance with claim 1 in which said inorganic alkaline material is a mixture of sodium orthosilicate and sodium tripolyphosphate, said orthosilicate being present in said composition in an amount of about 90% by dry weight.

8. A non-foaming alkaline cleaning composition in accordance with claim 1 in which said inorganic alkaline material is a mixture of sodium metasilicate pentahydrate, sodium carbonate, sodium bicarbonate and sodium tripolyphosphate and wherein said metasilicate is present in an amount of at least about 50% by dry weight of said composition.

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