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(54) Hard surface cleaning composition.

(57) A liquid, aqueous highly alkaline cleaning composition for removing organic soils, including burnt-on grease, from kitchen hard surfaces which exhibits no or minimal corrosion effects on aluminum and stainless steel comprises from about 0.1 to 0.5 wt-% alkali metal metasilicate; about 1 to 10 wt-% of an alkanolamine selected from mono-, di and tri-ethanolamine; from about 1 to 5 wt-% of an organic anionic surfactant selected from an alkali metal alkylbenzene sulfonate, an alkali metal alkyltoluene sulfonate and an alkyl ether sulfate; from about 1 to 10 wt-% of an organic solvent selected from a monohydric aliphatic alcohol having from 1 to 4 carbon atoms, and a monoalkyl ether of an alkylene, dialkylene or trialkylene glycol where alkyl has from 1 to 4 carbon atoms and alkylene has from 2 to 3 carbon atoms; and the remainer to 100 wt-% water.

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The invention relates to highly alkaline aqueous hard surface cleaning compositions for cleaning industrial and kitchen surfaces soiled with burnt-on grease and other organic soils, more particularly to such compositions wherein the corrosive effect on metals such as aluminum and stainless steel normally encountered during cleaning thereof with highly alkaline cleaning compositions is significantly minimized.

The use of cleaners having high alkalimity for removing burnt-on grease and other organic soils from kitchen appliances and utensils is well known. High alkalinity is required in such cleaners in order to convert burnt-on grease and other organic soils, through saponification of fats comprising them, into materials which are readily emulsifiable and removable by components of the cleaner, e.g., surfactants, water, etc. However, despite their effectiveness in grease and other organic soils removal, such cleaners tend to be corrosive to certain metals employed in kitchen utensils and appliances such as aluminum and stainless steel. A need exists, therefore, for a highly alkaline cleaner which is not only effective in removing burnt-on grease and other organic soils but which exhibits minimal corrosive properties for aluminum and stainless steel.

U.S. Patent 3,935,129 discloses a "system" of aqueous liquid cleaning compositions which include five basic ingredients - urea, glycerin, triethanolamine, an organic anionic detergent and an organic nonionic detergent -and one ingredient, an alkali metal silicate, which may or may not be present, wherein the concentration of each of the five basic ingredients is defined in terms of the concentration of the silicate. Compositions of varying cleaning utilities are described including a hard surface cleaner (Example 2 of the patent) having a pH of 12 and consisting of sodium silicate, the five defined basic ingredients and water wherein one of two anionic detergents employed is dodecyl benzene sulfonate and the amount of the silicate exceeds substantially the amount of triethanolamine.

U.S. Patent 4,540,505 describes germicidally effective aqueous pump spray cleaning compositions comprising a quaternary ammonium compound, a nonionic surfactant, d-limonene, an alkali builder which may be sodium metasilicate, a monoether of an aliphatic glycol, water and, optionally a lower aliphatic alcohol in which the glycol monoether functions to stabilize the composition against the otherwise destabilizing effect of the d-limonene as well as to enhance soil and stain removal from hard surfaces.

U.S. Patent 4,202,800 disclosed liquid laundry detergent compositions comprising one or more alkanolamines, sodium carboxymethylcellulose, a nonionic surfactant, water and, optionally, a brightener, a perfume, a dye and/or a solvent, which may be certain glycol ethers, for stabilizing the compositions.

U.S. Patent 4,539,133 discloses that in the art of manufacturing detergents, alkali metal silicates are widely used in order to achieve corrosion inhibition, buffering and building properties and describes neutral or low alkaline aqueous liquid detergent compositions comprising from 1 to 10% by weight of an alkali metal silicate such as a di- or tri-silicate in an aqueous detergent base.

U.S. Patent 3,625,854 discloses that strong caustic is effective as an oven cleaning composition because it saponifies fat in the oven deposits to produce a material which is removable from the oven and that similar effects are observed with silicates, ammonia and amines. Oven cleaning compositions are described which do not irritate the skin and can be formulated either as a paste or an aerosol consisting essentially of a copolymer of styrene and maleic anhydride reacted with a caustic material such as an alkali metal oxide or hydroxide, an alkali metal silicate, or an alkanolamine, and water.

Patents of interest in that they disclose liquid detergents containing one or more of the ingredients which are or may be employed in the present invention as more fully described hereinbelow or in that they show the state of the art relating to liquid detergents for cleaning baked on, hard to remove soils from housewares, etc. are as follows: U.S. Patents 2,836,566; 3,272,753; 3,328,309; 3,579,455; 4,070,309; 4,421,680; 4,501,681; 4,581,161; and 4,725,319.

SUMMARY OF THE INVENTION

As noted hereinbefore, although highly alkaline cleaners for kitchen hard surfaces are particularly effective for removing burnt-on grease, they have the disadvantage that they can be corrosive to metal surfaces such as aluminum and stainless steel.

It now has been discovered that when combinations in critical ratios of alkanolamine to metasilicate are formulated with certain other essential ingredients, highly alkaline hard surface cleaners can be obtained which deliver optimum cleaning efficacy without the usual corrosive effects of high alkalimity on metal surfaces.

Thus the invention provides a liquid, aqueous hard surface cleaning composition comprising:

(a) from about 0.1 to about 0.5 percent by weight of an alkali metal metasilicate;

(b) from about 1 to about 10 percent by weight of an alkanolamine selected from the group consisting

of monoethanolamine, diethanolamine and triethanolamine;

(c) from about 1 to about 5 percent by weight of an organic anionic surfactant selected form the group consisting of alkali metal salts of alkylbenzene and alkyltoluene sulfonic acids where alkyl has from about 9 to about 15 carbon atoms, and alkyl ether sulfates of the formula $RO(CH_2CH_2O)_nSO_3M$ where R is alkyl or alkenyl having from about 10 to about 20 carbon atoms, n is 1 to 30 and M is a water-soluble cation;

(d) from about 1 to about 10 percent by weight of a water-soluble organic solvent selected from the group consisting of a monohydric aliphatic alcohol having from 1 to 4 carbon atoms, and a monoalkyl ether of an alkylene, dialkylene or trialkylene glycol where alkyl has from 1 to 4 carbon atoms; and alkylene has from 2 to 3 carbon atoms; and

(e) the remainder to 100 percent by weight water; wherein the weight-ratio of component (b) to component (a) is from about 5.5 to 1 to about 28 to 1; and the pH of the composition is from about 10.5 to about 12.5

The compositions of the invention have utility as cleaners for hard surfaces in industrial, restaurant and household kitchen environments. They are highly effective for removing burnt-on grease and other organic soils and exhibit no or minimal corrosive effects on aluminum and stainless steel surfaces.

DETAILED DESCRIPTION INCLUSIVE OF THE PREFERRED EMBODIMENTS

The compositions of the invention comprise five essential components: a metasilicate, an alkanolamine, an organic anionic surfactant, a water-soluble organic solvent and water; and may contain certain other ingredients as discussed more fully hereinbelow.

Metasilicate

The metasilicates employed are the alkali metal silicates such as sodium and potassium metasilicate which may be either in the anhydrous or hydrated form. Mixtures of the metasilicates may be employed. The metasilicate functions as a cleaning agent and as a buffer which maintains a high pH thereby facilitating its function as a cleaning agent. Based on the anhydrous metasilicate, the concentration in the composition of the alkali metal metasilicate should be from about 0.1 to 0.5 percent by weight.

Alkanolamine

The alkanolamine also functions as a cleaning agent and the combination thereof with the metasilicate is the primary alkalizer in the composition. It is selected from monoethanolamine, diethanolamine, triethanolamine and mixtures thereof, monoethanolamine being preferred. The concentration employed should be from about 1 to 10 percent by weight of the composition.

Anionic Surfactant

The organic anionic surfactant provides detergency and is an emulsifier for good soils. It should have good foaming properties and be stable at the high pH of the compositions. Suitable anionic surfactants are those selected from the following commercially available classes:

(a) alkali metal salts, e.g., sodium and potassium salts, of alkylbenzene and alkyltoluene sulfonic acids where alkyl has from about 9 to about 15 carbons atoms; and

(b) alkyl ether sulfates of the formula $RO(C_2H_4O)_n$-SO_3M wherein R is alkyl or alkenyl having from about 10 to about 20 carbon atoms, n is 1 to 30 and M is a water-soluble cation, e.g., ammonium or an alkali metal such as sodium and potassium. A preferred class is the linear alkylbenzenesulfonates, dodecylbenzenesulfonate being especially preferred. The concentration of the organic anionic surfactant in the compositions should be from about 1 to 5 percent by weight.

Solvent

The solvent functions to dissolve or aid in the dissolution of cooking oil soils and organic materials resulting form the saponification of greases by the compositions. Suitable are water-soluble, organic solvents selected from monohydric aliphatic alcohols having from 2 to 4 carbon atoms such as methyl alcohol, ethyl alcohol and isopropyl alcohol; or a monoalkyl ether of an alkylene, dialkylene or trialkylene glycol where alkyl has from 1 to 4 carbon atoms and alkylene has from 2 to 3 carbon atoms such as ethylene glycol butyl ether, propylene glycol methyl ether, diethylene glycol butyl ether, dipropylene glycol methyl ether and tripropylene glycol methyl ether. The concentration of the solvent in the composition is determined by several factors such as the desired efficacy and the effect on such properties as toxicity and viscosity as will be readily apparent to those skilled in the art. Generally the concentration of the solvent in the composition will be from about 1 to 10 percent by weight.

In order to eliminate or minimize the corrosive effects to metals such as aluminum and stainless steel usually associated with the use of highly alkaline cleaners, it is critical that the ratio of the alkanolamine to metasilicate be controlled within certain specific limits. Thus the ratio of alkanolamine to metasilicate, based on anhydrous metasilicate, should be from about 5.5 to 1 to about 28 to 1 with a ratio of about 12 to 1 to about 13 to 1 being preferred. For effective removal of burnt-on grease and other organic soils from hard surfaces, the compositions of the inventions must be highly alkaline, i.e., must have a pH of from about 10.5 to 12.5. As disclosed hereinbefore, the combination of metasilicate and alkanolamine is the primary alkalizer in the composition of the invention and a pH of about 10.5 to 12.5 is achieved by the use of appropriate amounts of metasilicate and alkanolamine within the hereinbefore defined weight-percent concentrations and weight-ratios relative to each other.

The compositions of the invention may include certain optional ingredients in order to impart thereto additional desirable properties and/or aesthetic appeal.

Thus, for aesthetic purposes, optional ingredients may be included such as dyes, fragrances and opacifiers.

Although the compositions enjoy good physical stability at temperatures at which they are stored in homes and on store shelves, i.e., at normal room temperatures, physical stability can be a problem at temperatures substantially below normal room temperatures such as may be encountered during wharehouse storage. Therefore, the compositions optionally may and preferably do contain small amounts of a nonionic surfactant as a physical stabilizer. The nonionic surfactant also serves to solubilize any fragrance which optionally may be included in the composition. Nonionic surfactants which are suitable for this purpose are as follows:

(a) the polyethylene oxide condensates of alkyl and dialkyl phenols, having a straight or branched alkyl of from about 8 to about 9 carbon atoms, with ethylene oxide wherein the amount of ethylene oxide present is from about 9 to about 15 moles per mole of alkyl and dialkyl phenol; and the benzyl ether of such alkyl phenols; and

(b) the condensation products of aliphatic alcohols with ethylene oxide of the formula $RO(C_2H_4O)_nH$ wherein R is straight or branched alkyl having from about 12 to about 15 carbon atoms and n is 3 to 15. The nonionic surfactant selected will generally be employed in the composition at a concentration of from about 0.1 to 1 percent by weight.

Thickening agents also may and preferably are included in the compositions. As described hereinbefore, when burnt-on grease is to be cleaned from a hard surface, the compositions after application to the surface should remain in contact with the grease for about 5 to 10 minutes. Therefore, when vertical surfaces such as oven walls require cleaning, it is advantageous in order to improve adherence of the composition to the surface to include in the composition a thickening agent. The thickening agent should be one that is stable in and compatible with the various components of the composition. A thickening agent which was found to be particularly effective is an acrylate copolymer sold by Rohm & Haas Company under the tradename Acrysol ICS-1 for which the C.T.F.A. adopted name is acrylates/steareth-20 methacrylate copolymer. This thickener is employed in the composition at a concentration of about 1.5 to 2 percent by weight.

The compositions can be used, without dilution, for cleaning hard surfaces in industrial, household and restaurant kitchens such as oven surfaces, stove top surfaces, drip pans and heating elements, pots and pans. They are highly effective for removing burnt-on grease and other organic soils without the need for scrubbing with such harsh scrubbing devices as stainless steel or copper scouring pads. In use, an effective amount of the composition is applied to the surface to be cleaned and, where burnt-on grease or other organic soil is to be removed, is allowed to remain in contact with the grease or other organic soil for from

about 5 to 10 minutes depending on the tenacity and severity of the soil. The surface then is rubbed with a sponge, cloth, soft scrubber or the like to dislodge the soil, rinsed and dried, e.g., with a paper towel. If the soiled surface to be cleaned does not contain burnt-on grease, the surface can be rubbed with a sponge, cloth or soft scrubber immediately after application of the composition, rinsed and dried.

The compositions can be packaged in any of the well known liquid dispensers such as squeeze bottles fitted with suitable dispensing tops and containers fitted with trigger-pump spray devices, the latter being preferred because of the wide angle of application provided by such devices. The compositions may also be formulated as aerosols in accordance with well known and standard procedures.

The compositions of the invention are conveniently prepared by mixing the ingredients at room temperature as follows:

1. A mixing tank equipped with a variable speed agitator is charged with the formula amount of water and agitation is commenced at a speed which will avoid excessive aeration.

2. The solvent, anionic detergent and any optional nonionic surfactant are added to the water and allowed to dissolve completely.

3. Any optional fragrance and/or optional thickener then is added. Addition of a thickener will result in a milky solution.

4. The silicate and alkanolamine then are added slowly resulting in clearing and thickening of the solution.

5. Finally, any optional dye and/or optional opacifier are added to complete the formulation.

The compositions of the invention are illustrated by examples of specific formulations described below without, however, being limited thereto.

All formulations described below were prepared by the general procedure described hereinbefore. The indicated weight-percent of the ingredients is based on 100% active material.

		Weight-Percent		
	Example:	1	2	3
Ingredient				
Sodium metasilicate		0.22	0.22	0.44
Monoethanolamine		2.7	2.7	2.48
Sodium dodecylbenzenesulfonate		2.10	2.10	2.10
Tripropylene glycol methyl ether		2.90	2.90	2.90
Nonylphenoxypoly(ethyleneoxy)ethanol[(a)]		0.7	0.7	0.7
Thickening agent[(b)]		1.90	1.90	1.90
Opacifier[(c)]		0.05	-	-
Lemon fragrance		0.2	-	-
Dye - FD&C Yellow No. 5		0.004	-	-
Tap water		q.s. to 100 wt-%		
pH		11.20	11.50	12.23
Amine/metasilicate ratio		12:1	12:1	5.6:1

(a) Igepal CO-730 available from GAF Corporation - a nonionic surfactant containing an average of 15 ethylene oxide units having the formula $R\text{-}C_6H_4O(CH_2CH_2O)_nH$ where R is nonyl and n is 15 (C.T.F.A. adopted name: nonoxynol-15).

(b) Acrysol ICS-1 available from Rohm and Haas Company, Inc.; an acrylates/steareth-20 methacrylate copolymer; steareth-20 has the general formula $CH_3(CH_2)_{16}CH_2(OCH_2H_2)_nOH$ where n has an average value 20.

(c) Witcopaque 25 (Latex) available from Witco Chemical Corporation - a styrene/acrylate copolymer.

Two cleaning compositions were prepared for purposes of comparison in cleaning and corrosion tests with compositions of the invention. One comparative composition (Example A) was similar to the composition of Example 2 except that the ration of monoethanolamine to the metasilicate was adjusted to 1:1, the combined weights of these ingredients being the same as for Example 2. The other comparative composition (Example B) differed from that of Example 2 in that it contained no monoethanolamine and the

metasilicate was increased to an amount equal to the combined weights of monoethanolamine and metasilicate in Example 2.

Details of the comparative compositions are as follows:

Ingredient	Example:	Weight-Percent A	Weight-Percent B
Sodium metasilicate		1.46	2.92
Monoethanolamine		1.46	-
Sodium dodecylbenzene sulfonate		2.10	2.10
Tripropylene glycol methyl ether		2.90	2.90
Nonylphenoxypoly(ethyleneoxy)ethanol[(a)]		0.7	0.7
Thickening agent[(b)]		1.90	1.90
Tap water		q.s. to 100 wt-%	
pH		13.5	14.0
Amine/metasilicate ratio		1:1	-

(a) Igepal CO-730
(b) Acrysol ICS-1

In order to determine the compatibility of the compositions of Examples 2,3, A and B with aluminum and stainless steel substrates and evaluate their cleaning effectiveness for burnt-on greasy particulate soil, these compositions were subjected respectively to a corrosion test and cleaning test as follows:

Corrosion Test

(1) Materials

Aluminum pot (Mirro) or equivalent aluminum substrate
Stainless steel pot (Revere Ware) or equivalent
stainless steel substrate
Isopropyl alcohol

(2) Procedure

The test surface was cleaned with isopropyl alcohol to remove any oily film from brand new pots. The 2 drops (approximately 1 gram) of the test composition was applied to the verticle surface of the pot at room temperature and allowed to remain in contact with the uncovered surface at room temperature for 24 hours. The treated surface then was washed with tap water and wiped dry. The contact area then was evaluated visually for corrosion according to the following scale:

None = Unchanged
Slight = An outline or ring similar to a water spot
Moderate = a dull spot on the surface
Severe = A dull white powder or etching

Cleaning Test

(1) Materials	
Lean ground beef	90g
Flour	15g
Tomato sauce	57g
Egg	one whole
Water	200g
Aluminum pan (Mirro)	

(2) Procedure

The soil was prepared by blending the above ingredients in the indicated amounts for about 5 minutes and was then applied to the pan in aliquots of 2 grams as round spots of approximately $\frac{1}{2}$ inch diameter. The soiled pan was then subjected to 105° C for 2 hours in an oven. The pan was allowed to cool to room temeprature and the test composition was applied to the burnt-on soil spots as a film. After 10 minutes contact time, the treated areas were wiped with a damp sponge using 5 passes of the sponge, wiped dry with a paper towel and evaluated visually in accordance with the following scale:

Excellent = complete removal of soil
Good = small spots of soil remaining
Fair = about 50% removal of soil
Poor = less than 50% removal of soil

Test Results

Corrosion Test		
	Result	
Example	Aluminum	Stainless Steel
2	None	None
3	Slight	None
A	Moderate	Moderate
B	Moderate	Moderate

Cleaning Test	
Example	Result
2	Good
2	Good
A	Good
B	Good

From the above test results it can be seen that although both the compositions of the invention and the comparative compositions exhibited good cleaning of burnt-on grease, only the compositions of the invention were accept able with respect to corrosion in that only a slight effect was noted in one instance, i.e., in the case of Example 3 on aluminum, there having been no visible corrosive effects on stainless steel with either Examples 2 and 3 and on aluminum with Example 2. On the other hand, the comparative

compositions of Examples A and B exhibited moderate corrosive effects in both instances.

Claims

1. A liquid, aqueous hard surface cleaning composition comprising:

(a) from about 0.1 to about 0.5 percent by weight of an alkali metal metasilicate;

(b) from about 1 to about 10 percent by weight of an alkanolamine which is monoethanolamine, diethanolamine and/or triethanolamine;

(c) fro about 1 to about 5 percent by weight of an organic anionic surfactant which is an alkali metal salt of an alkylbenzene or alkyltoluene sulfonic acid where alkyl has from about 9 to about 15 carbon atoms, and/or an alkyl ether sulfate of the formula $RO(CH_2CH_2O)_nSO_3M$ where R is alkyl or alkenyl having from about 10 to about 20 carbon atoms, n is 1 to 30 and M is a water-soluble cation;

(d) from about 1 to about 10 percent by weight of a water-soluble organic solvent which is a monohydric aliphatic alcohol having from 1 to 4 carbon atoms, and/or a monoalkyl ether of an alkylene, dialkylene or trialkylene glycol where alkyl has from 1 to 4 carbon atoms and alkylene has from 2 to 3 carbon atoms;

(e) the remainder to 100 percent by weight water; wherein the weight-ratio of component (b) to component (a) is from about 5.5 to 1 to about 28 to 1; and the pH of the composition is from about 10.5 to about 12.5.

2. A composition according to claim 1, wherein the alkanolamine is monoethanolamine.

3. A composition accoridng to claim 1 or 2, wherein the ratio of component (b) to component (a) is from about 5.5:1 to about 13:1.

4. A compositon according to any one of the preceding claims, which includes from about 1.5 to about 2 percent by weight of a thickening agent which is an acrylate/steareth-20 methacrylate copolymer.

5. A composition according to any one of the preceding claims, which additionally includes from about 0.1 to about 1 percent by weight of a nonionic surfactant which is a polyethylene oxide condensate of an alkyl or dialkyl phenol, wherein alkyl has from about 8 to about 9 carbon atoms, with ethylene oxide wherein the amount of ethylene oxide present is from about 9 to about 15 moles per mole of the alkyl or dialkyl phenol; the benzyl ether of said alkyl or dialkyl phenol; and/or a condensation product of an aliphatic alcohol with ethylene oxide of the formula $RO(C_2H_4O)_nH$ wherein R is alkyl having from about 12 to about 15 carbon atoms and n is 3 to 15.

6. A composition according to claim 5, wherein the nonionic surfactant is a polyethylene oxide condensate of an alkylphenol.

7. A composition according to any one of the preceding claims, wherein the anionic surfactant is an alkali metal salt of an alkylbenzene sulfonic acid or of an alkyltoluene sulfonic acid.

8. A composition according to claim 7, wherein the alkanolamine is monoethanolamine and the ratio of the monoethanolamine to the metasilicate is from about 5.5:1 to about 13:1.

9. A composition according to claim 8, comprising, based on the weight of the composition, about 0.22% sodium metasilicate; about 2.70% monoethanolamine; about 2.10% sodium dodecylbenzene sulfonate; about 2.90% tripropylene glycol methyl ether; about 1.90% acrylates/steareth-20 methacrylate copolymer; about 0.7% nonoxynol-15; and the remainder to 100% water.

European Patent Office

EUROPEAN SEARCH REPORT

Application Number

EP 90 10 0636

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
Y	EP-A-0 008 805 (HENKEL KOMMANDITGESELLSCHAFT) * page 3, lines 15-31; page 5, lines 3-7; examples 2-4; claims 1,2,5 *	1,2,5-7	C 11 D 17/00 C 11 D 3/00 C 11 D 3/30 C 11 D 3/20 C 11 D 3/08 C 11 D 3/43
Y	GB-A-1 297 782 (UNILEVER LTD) * page 2, lines 1-6; table 2, claims *	1,2,5-7	
A	US-A-4 167 488 (J.J. MURTAUGH) * abstract; column 4, lines 3-10, example I *	1,2	
A	EP-A-0 197 193 (PENNWALT CORPORATION) * claims *	1,2	
A	US-A-3 935 129 (W.J. JABALEE) * summary *	1,2	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)

C 11 D

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
BERLIN	11-04-1990	PELLI-WABLAT B

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
Y : particularly relevant if combined with another document of the same category
A : technological background
O : non-written disclosure
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T : theory or principle underlying the invention
E : earlier patent document, but published on, or after the filing date
D : document cited in the application
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& : member of the same patent family, corresponding document

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