United States Patent Office 3,829,387
Patented Aug. 13, 1974

3,829,387

CAUSTIC CLEANER COMPOSITION

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No Drawing. Filed June 22, 1972, Ser. No. 265,404
Int. Cl. C11d 7/06, 7/12
U.S. Cl. 252—156 11 Claims

ABSTRACT OF THE DISCLOSURE

A caustic containing cleaner composition is described which comprises an alkali, a non-ionic surfactant, water and from about 3 to about 20% by weight of a solvent comprising a mixture of two different phenyl glycol ethers of ethylene glycol, diethylene glycol or triethylene glycol. The composition, which may optionally include a secondary or tertiary aliphatic amine and one or more other organic solvents, is useful for removing grease and other deposits from soiled surfaces such as oven walls.

This invention relates to novel caustic cleaning compositions useful for removing grease, fat, etc. from ovens, pots, barbecue equipment, etc.

When foods are roasted or baked in an oven, various amounts of fat, gravy, pie fillings, etc., spatter on the top and sides and run down on the bottom of the oven. The heat of the oven surfaces then dehydrates these substances and causes them to oxidize and undergo other chemical changes which produce highly insoluble products. These adhere tightly to the oven surfaces and are extremely difficult to remove. In addition, roasting pans, grills, cooking utensils and the like acquire coatings of various foodstuffs.

These tightly adherent soils could, in the past, be removed only by arduous and tedious means. Against such highly insoluble materials, detergents and other common cleaning compounds are substantially ineffective even with prolonged soaking. The use of abrasive powders roughened the surface being cleaned. This not only had a deleterious effect on the appearance of the surfaces, but caused subsequent deposits of soil to adhere still more tightly, thus resulting in an ever increasing cleansing problem. Metallic scouring pads were somewhat more effective, but again were very laborious to use and again tend to damage the surfaces.

For many years, alkaline paste cleaners have been used with some degree of success. These contain large concentrations of lye, which hydrolyzes the fats to soluble soaps and thus facilitates their removal. However, paste cleaners must be laboriously painted on the oven surfaces and just as laboriously removed. Since they contain high concentrations of caustic, of the order of 8%, rubber gloves must be worn, and the caustic neutralized with vinegar during removal.

In recent years, combinations of alkalis and solvent have gained wide acceptance. These are frequently packaged in the form of aerosols. The solvent dissolves greases, thereby making the deposits more porous and permitting more intimate contact of the alkali with the insoluble soil. However, water is required in order to activate the alkali and, consequently, the soiled surface must be prewetted prior to application of the cleaner. Other such cleaning mixtures incorporate the water into the formulation. This has the advantage that the water helps to flush away the saponified greases and the soils loosened by the solvent and saponifying action of the other ingredients.

With the combination of alkali and solvent, the concentration of alkali required is only about half that in the pastes. Consequently, the products are safer to use and require no neutralization. Commonly used solvents are lower aliphatic alcohols, glycols and glycol ethers.

When an oven is used repeatedly without being cleaned, the deposits are repeatedly heated and become more and more difficult to remove. Consequently, even the more efficient alkali-solvent oven cleaners do not completely remove the heavily baked-on soils. In some cases, improved cleaning can be obtained by applying the oven cleaner at elevated temperatures. However, this tends to produce noxious fumes and involves a hazard from burns.

It is, therefore, an object of this invention to provide cleaning compositions which are exceptionally effective in removing both the easily removable fats, greases, sugars, etc. and the more heavily baked-on soils from the surfaces of ovens, broiler pans, cooking utensils, etc. without the necessity of heat.

It has surprisingly been found that a caustic oven cleaner composition based on an alkali component, a solvent system and water is particularly effective for removing heavily baked-on soils where such composition is formulated as described hereinafter.

The cleaning compositions of the present invention comprise (1) about 2 to about 6% by weight of a caustic material, preferably about 3.5 to about 4.5% by weight; (2) about 55 to about 90% by weight of water, preferably about 75 to about 85% by weight; (3) a mixture consisting of about 55 to about 90% by weight of $X—\phi—(OCH_2CH_2)_n—OH$ and about 45 to about 10% by weight of $X—\phi—(OCH_2—CH_2)_p—OH$, wherein X is selected from the class consisting of hydrogen and lower alkyl having 1 through four carbon atoms; n is a whole number from 1 through 3, and p is a whole number which is $n+1$; (4) from 0 to 15% by weight of an organic solvent selected from the class consisting of a lower alkylene glycol or glycol ether containing 5 to 11 carbon atoms, preferably at least about 1% by weight of such solvent and such solvent being further characterized by having a flash point not less than 200° F. as determined by the "Tag Open Cup" method; (5) at least about 0.2% by weight of a water soluble, alkali-stable thickener material, preferably comprising not more than about 1.5% by weight of the composition. The weight ratio of the mixture defined in (3) to the organic solvent defined in (4), if the latter is present in the composition, being preferably in the range of about 3:1 to about 1:3, and the total weight of the components defined by (3) and (4) being about 3 to about 20% by weight of the composition. The foregoing "percents by weight" are based on the total weight of the composition, excluding any liquid propellant that would be used in an aerosol formulation.

The symbol ϕ used through the specification means "phenyl."

Compounds defined by $X—\phi—(CH_2CH_2O)_n—OH$ and $X—\phi—(CH_2CH_2O)_p—OH$ are either commercially available or are described in the literature such as in U.S. Pats. 2,889,297 and 3,449,088.

Additionally, the compositions of the present invention may contain one or more additional ingredients generally used in commercial oven-cleaner compositions such as surfactants, humectants, foam stabilizers, viscosity modifiers, perfumes, non-caustic inorganic cleaners, and one or more organic amines which act as hygroscopic agents and form amine salts with the fatty acid residues which have not reacted with the caustic material in the composition.

The caustic material used in the cleaner composition can be an alkali hydroxide such as sodium hydroxide, potassium hydroxide, etc.

The surfactant used in the present compositions preferably comprises about 0.01 to about 5% by weight of the

total composition and is chosen to provide a stable foam which helps to maintain a deposit of the composition upon the site sought to be cleaned and to assist in penetration of the cleaning composition into the soil. The surfactant may be a non-ionic surface active agent or an anionic material such as a soap. These non-ionic and anionic surfactants, which are selected for use in the compositions of the present invention, are materials which are compatible with alkalis and which are not hydrolyzed by alkalis, are exemplified by the following classes: aliphatic or aromatic polyethers such as C_9—C_{18} alkylphenoxypolyethyleneoxy ethanols: C_9—C_{18} alkylpolyethyleneoxy ethanols; alkylarylpolyglycol ethers; alkali metal salts of alcohol sulfates; ether terminated polyethoxy ethanols such as described in U.S. patent 3,281,475, the disclosure of which incorporated herein by reference.

The preferred non-ionic surfactants are represented by the formula:

$$R^3—O(CH_2CH_2O)_x—R^4$$

wherein R^3 is selected from the class consisting of a C_8—C_{18} alkyl radical, either straight chain or branch chain and an alkyl phenyl radical wherein the alkyl radical is C_8—C_{18} straight or branch chain. Illustrative of R^3 are p-t-octylphenyl, p-nonylphenyl, p-dodecylphenyl, n-dodecyl, n-octadecyl, tridecyl, etc.; R^4 is selected from the class consisting of tertiary C_4—C_{12} alkyl groups and an acyclic radical of the formula C_{10}—H_{17} derived from monoterpenes. Illustrative of R^4 is t-butylisobornyl; x is a number from about 7 to 50, preferably 9 to 35. R^3 is preferably p-nonylphenyl. Other surfactants known in the art to be useful in oven cleaner compositions are set forth in U.S. patents 3,296,147 and 3,031,408, the disclosures of which are incorporated herein by reference.

The thickener material is selected to provide a composition (excluding propellant) having a viscosity of between about 300 and 1500 cps., preferably 400 to about 900 cps. as determined using a Brookfield LVT viscometer, No. 2 spindle at 12 r.p.m. Exemplary of useful thickening agents are colloidal magnesium aluminum silicate, alginates, carboxymethyl cellulose, hydroxyethyl cellulose, bentonite and other well-known materials such as described in U.S. Pat. 3,296,147. A humectant may be present in the composition to aid in slowing the evaporation of the water present in the composition and may provide a solvent effect in removing grease. Exemplary of useful humectants are the glycols (propylene glycol and polyethylene glycol) and glycerol.

The abrasives are added to provide additional cleaning power to aid in removing stubborn stains; additionally, certain abrasives serve to increase viscosity and to absorb the emulsifier and propellant in pressurized aerosol systems. Exemplary of abrasives producing all the above properties is a silica such as "Cab-O-Sil M5" or "Aerosil 200."

A foam stabilizer may be added in the amount of about up to 0.5% by weight of the composition, preferably at least 0.05% by weight to increase the adherence of the composition to the walls of the oven and is preferably a paraffin wax having a melting point in the range of 100° to 130° F., containing not more than 1.5% oil and having a needle penetration at 100° F. of between 160 and 180. The wax is added in pellet or liquid form to the composition prior to addition of the propellant.

Illustrative of specific additional solvents as previously described which comprise up to 15% by weight of the composition are hexylene glycol, monoethyl ether of diethylene glycol, monobutyl ether of ethylene glycol, monomethyl ether of triethylene glycol, monobutyl ether of diethylene glycol, 2-methyl-2,4-pentanediol.

The amines useful in the compositions are non-toxic primary, secondary or tertiary amines, which may be either aliphatic, aromatic or heterocyclic, preferably aliphatic having a molecular weight below 300. While the amine is an optional ingredient, preferably 1 to 10% of at least one organic amine is present in the composition.

The preferred amines of the aliphatic type are represented by the alkylol amines of the formula:

$$(HO—R^1)_m—N—(R)_r$$

wherein R is selected from the class consisting of hydrogen and lower alkyl having 1 through three carbon atoms; R^1 is lower alkylene having 2 through 4 carbon atoms; m is a whole number from 1 through 3; and r is a number represented by $3-m$. However, other amines having a molecular weight below 300 may be used such as morpholine, ethylamine, benzylamine, diethylene-triamine and others as illustrated in U.S. Pats. 3,625,854 and 3,079,284.

Additional non-caustic inorganic cleaners that may be included in the compositions described herein are selected from the alkali metal or ammonium salts of carbonic, phosphoric, boric and silic acids. Illustrative compounds are sodium, potassium or ammonium carbonates, phosphates such as trisodium phosphate, tripotassium phosphate, trilithium phosphate, sodium metapolyphosphate, etc.; silicates such as sodium disilicate, potassium disilicate, lithium disilicate and the corresponding orthosilicates, sesquisilicates and metasilicates. The corresponding borates are also useful such as sodium borate, etc.

The preferred compositions of the present invention are those in which (1) the composition contains a mixture of the phenyl ether of ethylene glycol and the phenyl ether of diethylene glycol; (2) the caustic material is sodium hydroxide or potassium hydroxide; (3) hexylene glycol is present in a weight ratio of about 1:1 to 3:1 based on the weight of the foregoing mixture of phenyl glycol ethers and the weight of the solvents defined by (1) and (3) is between about 8 and 12% by weight of the total composition; (4) a paraffin wax as previously described is present; (5) a non-ionic surfactant is present; (6) a thickener material is present and (7) an alkylol amine is present.

The herein disclosed compositions are useful in cleaning ovens when applied to cold (ambient room temperature) or hot (up to 300° F.) soiled ovens and allowed to remain on the soiled surfaces until the grime is softened, followed by wiping away the composition, preferably with a damp cloth or sponge. Extremely high temperatures impede cleaning action due to the fast evaporation of the water present in the composition. Where the composition is used on a hot oven, the composition is applied to an oven preheated to 150–200° F., which is ideally maintained at that temperature range during the entire cleaning procedure (i.e. not turned off). The composition is allowed to remain on the heated oven surfaces for about ten to about thirty minutes depending on degree of soiling, followed by removal with a damp cloth or sponge.

In the preferred form, the oven cleaning compositions are supplied in self-contained valve-controlled aerosol units which provide a fine spray of foam upon activation of the valve. The aerosol container unit consists of a pressure-tight aerosol container having a valve-controlled opening and containing a composition as set forth herein and from about 2.00% to about 25.00% of a propellant, preferably about 3 to about 10% by weight. Propellants are selected from the well-known compatible propellants such as isobutane, isobutane/propane, dichlorodifluoromethane (Freon 12), trichlorofluoromethane (Freon 11), dichlorotetrafluoroethane (Freon 114), and 1,1,2,-trichlorotrifluoroethane (Freon 113) or mixtures thereof. The propellant should be effective at atmospheric temperature and not adversely react with any components of the composition.

The following examples are illustrative of the compositions of the present invention:

EXAMPLE 1

Ingredients:	Percent by weight
Sodium hydroxide (50% solution)	8.20
Complex colloidal magnesium aluminum silicate	0.60
A mixture of 30% phenyl CARBITOL and 70% phenyl CELLOSOLVE	5.00
Hexylene glycol	5.00
Triethanolamine	5.00
"Triton CF 54"	0.02
Water (deionized)	71.03
Petroleum wax (Wax Arco 3230)	0.15
Isobutane (aerosol grade)	5.00

The foregoing composition is prepared as follows:

Solution A

Into a stainless steel container is placed 194 gm. of deionized water. The water is rapidly agitated with a high speed stirrer and 6 gm. of colloidal magnesium aluminum silicate is added slowly. The temperature is then raised to 160–165° F. and agitation continued for 45 minutes.

Solution B

To a second container the following ingredients are added slowly in succession with moderate agitation: 43.8 gm. of a 50% solution of sodium hydroxide in water, 276.1 gm. of deionized water, 26.7 gm. of triethanolamine, 53.4 gm. of the mixture of 8.0 gm. of phenyl CARBITOL and 18.7 gm. of phenyl CELLOSOLVE and 26.7 gm. of hexylene glycol and 0.1 gm. of "Triton CF 54."

In a third vessel is placed 316 gm. of solution B. The solution is agitated rapidly and 84 gm. of solution A is added slowly over a period of 15 min. Agitation is continued for 15 min. more. 228.6 gm. of this product is placed in a standard aerosol can. To this is added 0.35 gm. of paraffin wax. 15" of vacuum is applied, and a standard aerosol valve is sealed on by the usual method known to the trade. Through the valve is added under pressure 12.0 gm. of isobutane.

EXAMPLE 2

A cleaning composition is prepared in the same manner as Example 1 containing the same percent tby weight of each ingredient except that the hexylene glycol is omitted and 10% by weight of the mixture of phenyl CARBITOL and phenyl CELLOSOLVE is used.

EXAMPLE 3

A cleaning composition is prepared in the same manner as in Example 1 containing the same percent by weight of each ingredient except that the "Triton CF 54" is replaced by tridecyloxypoly (ethyleneoxy) ethanol available from GAF as "Emulphogene BC-610."

EXAMPLE 4

A commercial prior art formulation is prepared as described in Example 1 having the same ingredients as described in that example and in the same percent by weight except that such commercial formulation contains 10% by weight of the monomethyl ether of tripropylene glycol in place of the hexylene glycol and mixture of phenyl carbitol and phenyl CELLOSOLVE of the present invention.

The compositions of the present invention are highly efficacious in removing heavy baked-on soils from the surfaces of ovens, broiler pans, cooking utensils, etc. at ambient temperatures as well as at elevated temperatures. The efficiency of the compositions of the present invention over the prior art formulation of Example 4 and other formulations is most dramatic under ambient temperature conditions thereby eliminating the necessity of having to heat an oven to remove heavy deposits which heretofore resisted removal without use of conditions (i.e. elevated temperatures) that presented certain hazards and undesirable effects such as noxious fumes and greater risk of caustic burns due to spattering.

To determine the cleaning efficicacy of the compositions of Examples 1, 2 and 4, tests were run as described hereinafter using as substantially identical conditions as possible. Eighty-four grams of beef tallow was heated until melted. To this was added eight grams of confectioner's sugar and eight grams of flour. The mixture was stirred until uniform and allowed to cool. 1.6 gram portions of this soil were placed on four 5" x 6" porcelainized steel plates and brushed into uniform coatings. The plates were heated in an oven for 30 minutes at 500° F. in order to make the soil difficult to remove. Each plate was then allowed to cool to ambient temperature. Each plate was held vertically. One half was sprayed with composition of Example 1 until uniformly coated, and the other half was sprayed with composition of Example 4. After 20 minutes, the plates were rinsed with cold water, wiped gently with a sponge to remove lightly adhering soil and again rinsed. For each plate, the percentage of soil removed on each side of the plate was estimated by a panel of 3 people. The average percent of soil removed with composition of Example 1 was substantially greater than with the composition of Example 4, the latter removing only a small portion of soil. Repeating the foregoing experiment with the composition of Example 2 in place of the composition of Example 1, the composition of Example 2 also shows a substantially greater cleaning efficacy than the prior art composition of Example 4. As between the compositions of Examples 1 and 2, the former resulted in about a 20% greater cleaning efficacy.

It is to be understood that variations in the exemplified embodiments are possible within the scope of the present invention. For example, larger quantities of caustic material could be used but are not preferred because of obvious safety reasons. The combination of other ingredients in the composition can be varied to modify certain properties such as flow rate of the composition on a soiled surface. Different combinations of surfactants can be used to achieve variations in the rate of foam formation and stability.

What is claimed is:

1. A composition having a viscosity between about 300 and 1500 cps. useful for removing cooking deposits from surfaces soiled with such deposits which comprises (1) about 2 to about 6% by weight of a caustic alkali material; (2) a mixture consisting of about 55 to about 90% by weight of phenyl—$(OCH_2CH_2)_n$—OH and about 45 to about 10% by weight of phenyl—$(OCH_2CH_2)_p$—OH; n is a whole number from 1 through 3 and p is a whole number which is $n+1$; (3) from 0 to 15% by weight of an organic solvent selected from the class consisting of a lower alkylene glycol having 5 through 11 carbon atoms and a lower alkylene glycol ether having 5 through 11 carbon atoms, said solvent being further characterized by having a flash point of at least 200° F. as determined by the Tag Open Cup method; (4) up to about 5% by weight of at least one low foaming non-ionic surfactant not hydrolyzed by alkali; (5) about 55 to about 90% by weight of water; and (6) about 0.2 to about 1.5% by weight of a water soluble, alkali stable thickening agent; the total weight of said mixture defined in (2) and said organic solvent defined in (3) being about 3 to about 20% by weight of the composition and the ratio of said mixture defined in (2) to said organic solvent defined in (3) being no less than about 1:3.

2. A composition according to claim 1 which additionally includes about 1 to about 10% by weight of an alkylol amine of the formula:

$$(HO—R^1)_m—N—(R)_r$$

wherein:

R is selected from the class consisting of hydrogen and lower alkyl having 1 through 3 carbon atoms; R^1 is lower alkylene having 2 through 4 carbon atoms; *m* is a whole number from 1 through 3 and *r* is a number represented by 3—*m*.

3. A composition according to claim 1 which additionally includes a paraffin wax having a melting point in the range of about 100 to about 130° F., containing not more than about 1.5% oil and having a needle penetration at 100° F. of between 160 and 180.

4. A composition according to claim 1 wherein the composition defined in (2) of said claim is a mixture of the phenyl ether of ethylene glycol and the phenyl ether of diethylene glycol.

5. A composition according to claim 4 wherein said organic solvent is hexylene glycol.

6. A composition for removing cooking deposits from soiled surfaces consisting essentially of (1) about 2 to about 6% by weight of a caustic material; (2) a mixture consisting of about 55 to about 90% by weight of the phenyl ether of ethylene glycol and 45 to 10% by weight of the phenyl ether of diethylene glycol; (3) about 1 to about 15% by weight of hexylene glycol, the ratio of said mixture of the phenyl ether of ethylene glycol and the phenyl ether of diethylene glycol to said hexylene glycol being about 3:1 to about 1:3, and said hexylene glycol and said mixture of the phenyl ether of ethylene glycol and the phenyl ether of diethylene glycol being about 3 to about 20% by weight of the total composition; (4) about 0.2 to about 1.5% by weight of a water soluble, alkali stable thickening agent; (5) about 0.1 to about 5% by weight of a low foaming, alkali stable, non-ionic surfactant; (6) about 0.05 to about 0.5% by weight of a paraffin wax having a melting point in the range of 100 to 130° F., containing not more than 1.5% oil and having a needle penetration at 100° F., of between 160 and 180 and (7) about 55 to 90% water, said composition having a viscosity between about 400 and 900 cps.

7. A composition according to claim 6 wherein said weight ratio of said phenyl ether of ethylene glycol to said phenyl ether of diethylene glycol is about 70:30 and the total combined weight of said phenyl ethers and said hexylene glycol in said composition is about 8 to about 12% by weight.

8. A composition according to claim 9 wherein said non-ionic surfactant is selected from the class consisting of a C_9 through C_{18} alkyl(polyethyleneoxy)ethanol, a C_9 through C_{18} alkyl phenoxy(polyethyleneoxy)ethanol and a compound of the formula:

$$R^3—O(CH_2CH_2O)_x—R^4$$

wherein:

R^3 is selected from the class consisting of C_8 through C_{18} alkyl and C_8 through C_{18} alkylphenyl; R^4 is selected from the class consisting of tertiary C_4 through C_{12} alkyl and an acyclic group of the formula $C_{10}H_{17}$ derived from a monoterpene.

9. A composition according to claim 8 packaged in combination with between about 2 and about 10% by weight of at least one compatible propellant.

10. A composition according to claim 6 which additionally includes about 1 to about 10% by weight of an alkylol amine of the formula:

$$(HO—R^1)_m—N—(R)_r$$

wherein:

R is selected from the class consisting of hydrogen and lower alkyl having 1 through 3 carbon atoms; R^1 is lower alkylene having 2 through 4 carbon atoms; *m is* a whole number from 1 through 3 and *r* is a number represented by 3—*m*.

11. A composition according to claim 10 wherein said alkylol amine is triethanolamine.

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U.S. Cl. X.R.

252—90, 156, 162, 544

PO-1050
(5/69)

UNITED STATES PATENT OFFICE
CERTIFICATE OF CORRECTION

Patent No. 3,829,387 Dated August 13, 1974

Inventor(s) Louis M. Wise and Edmund J. Bozek

It is certified that error appears in the above-identified patent and that said Letters Patent are hereby corrected as shown below:

Column 8 (claim 8, line 1) line 5, change "9" to
--7--

Signed and sealed this 10th day of December 1974.

(SEAL)
Attest:

McCOY M. GIBSON JR.
Attesting Officer

C. MARSHALL DANN
Commissioner of Patents