

1

3,817,869

DISHWASHER DETERGENT COMPOSITION
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7 Claims

ABSTRACT OF THE DISCLOSURE

An automatic dishwasher detergent composition comprising an ionizable salt as a major portion thereof, an alkali metal silicate, a chlorine-yielding bleach and a water-soluble synthetic organic nonionic detergent. The ionizable salt is selected from the group consisting of alkali metal sulfates and the alkali metal salts of acetic acid and propionic acid. The detergent composition of this invention, despite being substantially sequestant-free, cleans well and is non-filming and non-spotting.

BACKGROUND OF THE INVENTION

This invention relates to a substantially sequestant-free automatic dishwasher detergent composition. The granular detergent composition is a very efficient detergent composition especially useful for the washing of tableware and kitchenware.

Prior known dishwasher detergent compositions generally contain an alkaline sequestant builder salt, sodium silicate for its china protection ability, a chlorine bleach for the purpose of breaking up food particles into more soluble forms, and a water-soluble synthetic organic detergent for its cleaning and water-sheeting ability.

The alkaline sequestant builder salts that have found widespread use in the dishwasher detergent compositions above described are usually employed as a major component of the composition, i.e. ranging from about 25% to 75% by weight of the total composition. This ingredient is a primary cleaning component of the composition and, additionally, possesses the ability to sequester hardness-impacting ions found in water. It has been theorized that the hardness ions either interact with food soils causing their removal from kitchenware to be more difficult or interact with the organic detergent thereby making it less effective. Partly for these reasons, builders of the sequestering type have been used to sequester hardness ions. The sequestants most commonly used are the phosphorous-containing compounds, e.g. sodium tripolyphosphate. However, because some studies have indicated that detergent compositions containing phosphates could lead to an ecological problem, attempts have been made to formulate a phosphorous-free detergent composition.

One area of endeavor has been the inclusion of precipitating type builders, e.g. sodium carbonate in dishwasher detergent compositions. However, such builders form an insoluble precipitate with the hardness ions. This insoluble precipitate can then be deposited on tableware with the result being that the washed and dried tableware possesses an unsightly film.

Because of the interaction between the components of a dishwasher detergent composition, a suitable replacement for phosphorous-containing sequestants normally found in such compositions has been difficult to discover. That is, any material that is included in a detergent formulation must not only perform the function of the replaced sequestant builder, it must also be compatible with the remaining detergent composition components.

An object of this invention is to formulate a detergent composition that performs satisfactorily.

2

Another object of this invention is to formulate a substantially sequestant-free detergent composition.

A still further object of this invention is to formulate a substantially sequestant-free automatic dishwasher detergent composition that cleans efficiently and is non-filming and non-spotting.

These and other objects and advantages of the invention will become apparent from the following description.

As used herein, all percentages are by weight unless otherwise specified.

SUMMARY OF THE INVENTION

A substantially sequestant-free automatic dishwasher detergent composition consisting essentially of:

- (a) from 50% to 80% of an ionizable salt selected from the group consisting of alkali metal sulfates and the alkali metal salts of acetic acid and propionic acid;
- (b) from 15% to 35% of an alkali metal silicate having a SiO_2 :alkali metal oxide ratio of from 3.6:1 to 1:2;
- (c) a chlorine-yielding bleach in an amount sufficient to give the composition an available chlorine content of from 0.5% to 10%; and
- (d) from 2.5% to 10% of a water-soluble synthetic organic nonionic detergent.

DESCRIPTION OF THE INVENTION

This invention relates to a substantially sequestant-free dishwasher detergent composition comprising an ionizable salt, an alkali metal silicate, a chlorine-yielding bleach and a nonionic synthetic detergent. The composition of this invention is characterized by its ability to clean well, be non-filming and non-spotting, and not harmful to china.

As used herein, the term "substantially sequestant-free" is defined to mean that the sequestant content of the total composition is less than 5% by weight. Sequestants are those compounds capable of sequestering hardness ions found in water by forming a soluble complex with said ions. Preferably, the detergent composition is sequestant-free.

The ionizable salt is included in the composition of this invention at a level of from 50% to 80% by weight of the total composition. Such salts are selected from the group consisting of alkali metal sulfates and the alkali metal salts of acetic acid and propionic acid. Specific examples of the ionizable salts include sodium sulfate, sodium acetate and sodium propionate. While other salt-forming cations may be used, the above-exemplified salts are preferred. In a preferred embodiment of the present invention, from 50% to 70% of the total composition, comprises the ionizable salt. It has been found that the inclusion of the above-specified ionizable salts in a detergent composition at the stated weight level results in a product that cleans satisfactorily and leaves tableware washed therewith substantially filmless and spotless. While sodium sulfate has been included in some prior art detergent compositions at a relatively low level, e.g. up to 25% by weight, as a filler material or processing aid, it was quite surprising that detergent compositions containing it as a major portion thereof performed so satisfactorily. When levels of the ionizable salts of this invention are used at a level below 50% satisfactory cleaning, spotting and filming performance is not obtained. Levels above 80% are avoided due to the need to have included in the detergent composition the other necessary components of the detergent composition, namely the alkali metal silicate, chlorine-yielding bleach and non-ionic detergent.

Most surprising has been the fact that the compositions of this invention, despite being substantially sequestant

free, perform so well. Heretofore it has been thought that a substantial amount of a sequestrant was necessary for the proper performance of an automatic dishwasher detergent composition. Equally surprising is the fact that the ionizable salts of this invention when included in the composition as a major portion thereof (as opposed to some prior art suggestions of the use of sodium sulfate and acetate as minor additives) perform so satisfactorily in terms of making the resultant composition an acceptable product. While the alkali metal sulfate and the alkali metal salts of acetic acid and propionic acid possess the common characteristic of being ionizable, it has been discovered that similar ionizable salts, e.g. sodium chloride, sodium fluoride and sodium nitrate do not result in a satisfactory dishwasher detergent composition.

Another component that must be included in the composition of this invention is an alkali metal silicate. The alkali metal silicate is employed primarily as a corrosion inhibitor as well as (1) a cleaning ingredient; (2) a source of alkalinity; and (3) a protector of over-glazed patterns on china and tableware.

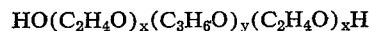
Alkali metal silicates perform the above functions when included in the composition at a level of from 15% to 35% by weight, preferably from 20% to 35% by weight. The ratio of SiO_2 :alkali metal oxide is from 3.6:1 to 1:2, preferably from 3:1 to 1:1. Sodium is the preferred cation of the silicates of this invention.

The chlorine-yielding bleach component of the present invention is included in the composition at a level sufficient to provide an available chlorine content of from 0.5% to 10% by weight of the total composition. The function of the bleach compound is to break up food particles into a form that is more soluble and, hence, more easily washed away. Additionally, the bleach aids in the proper performance of the nonionic synthetic detergent as hereinafter explained. As used herein, the term "available chlorine" indicates the amount of chlorine in the composition which is equivalent to elemental chlorine in terms of oxidizing power. "Active chlorine" is oftentimes used instead of "available chlorine." The same type of chlorine is designated by the two terms, but when expressed quantitatively "active chlorine" indicates the chlorine actually present. The numerical value for available chlorine content is twice that for active chlorine. Available chlorine contents below 0.5% fail to give proper cleaning performance, while amounts in excess of 10% do not result in any added cleaning ability. Preferably 1% to 5% available chlorine by weight of the total composition is found in the detergent composition of this invention.

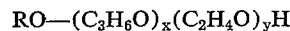
Examples of known chlorine bleaches that are used in the present detergent composition are as follows: dichlorocyanuric acid and its salts, salts of chlorine substituted cyanuric acid; 1,3-dichloro-5,5-dimethylhydantoin, N,N'-dichlorobenzoylene urea, paratoluene sulfodichloroamide, trichloromelamine, N-chloroammelene, N-chlorosuccinimide, N-chloroacetyl urea, N,N'-dichlorobiuret, chlorinated dicyandiamide, sodium hypochlorite, calcium hypochlorite, and lithium hypochlorite. Sodium and potassium dichlorocyanurate are the preferred bleaching compounds of this invention.

The water-soluble synthetic organic nonionic detergent included in the composition of this invention is any low-foaming nonionic organic detergent. Such compounds aid in the rinsing and draining of the tableware and kitchenware and thus enhance the performance of the detergent composition by reducing the amount of water and other materials remaining on the washed aforementioned articles. Such a "water sheeting" phenomenon is most effective when the bleach has cleaned properly. That is, if even minute particles of soil remain on the tableware and/or kitchenware, droplets of rinse water will be formed there regardless of the presence of the detergent. The ultimate result of this droplet formation is that as the droplet dries, there will be formed an unsightly spot.

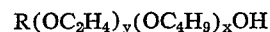
Examples of suitable nonionic organic detergents are the following polyoxyalkylene nonionic surfactants: C_8 - C_{22} normal fatty alcohol ethylene oxide condensates, i.e. condensation products of one mole of a fatty alcohol containing from 8 to 22 carbon atoms with from 3 to 20 moles of ethylene oxide; polyoxypropylene—polyoxyethylene condensates having the formula



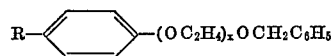
where y equals at least 15 and $(\text{C}_2\text{H}_4\text{O})_{x+x'}$ equals 20–90% of the total weight of the compound; alkyl polyoxypropylene—polyoxyethylene condensates having the formula



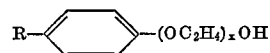
where R is a C_1 - C_{15} alkyl group and x and y represent an integer from 2 to 98; polyoxyalkylene glycols having a plurality of alternating hydrophobic and hydrophilic polyoxyalkylene chains, the hydrophilic chains consisting of linked oxyethylene radicals and the hydrophobic chains consisting of linked oxypropylene radicals, said product having three hydrophobic chains, linked by two hydrophilic chains, the central hydrophobic chain constituting 30% to 34% by weight of the product, the terminal hydrophobic chains together constituting 31% to 39% by weight of the product, the linking hydrophilic chains together constituting 31% to 35% by weight of the product, the intrinsic viscosity of the product being from 0.06 to 0.09 and the molecular weight being from about 3000 to 5000 (all as described in U.S. Pat. 3,048,548); butylene oxide capped alcohol ethoxylates having the formula



where R is a C_8 - C_{18} alkyl group and y is an integer from about 3.5 to 10 and x is an integer from about 0.5 to 1.5; benzyl ethers of polyoxyethylene condensates of alkyl phenols having the formula



where R is a C_8 - C_{20} alkyl group and x is an integer from 5 to 40; and alkyl phenoxy polyoxyethylene ethanols having the formula



where R is a C_8 - C_{20} alkyl group and x is an integer from 3 to 20. Other detergents are suitable for use in the herein disclosed dishwashing compositions and it is not intended to exclude any detergent possessing the desired attributes. The amount of nonionic detergent that is effectively employed in the detergent composition is from 2.5% to 10% by weight of the total composition. Preferably 5% to 7.5% by weight of the total composition is the nonionic detergent.

Other optional ingredients such as perfumes, suds depressants, dyes, fillers, anticaking agents, special material protection ingredients and enzymes can be included in the present formulation.

A small amount of water may also be included in the compositions of this invention. Generally, water forms from 0% to 35% by weight of the composition.

In producing compositions of this invention, it is preferred to admix all the components of the composition to produce the final product. Other processing methods may be used, e.g. pan agglomerating, slurring or moistening of the components followed by a drying procedure and other known methods.

The following examples illustrates the preparation and use of the detergent compositions of this invention.

5

EXAMPLE I

The following composition was tested for spotting and filming:

	I
Sodium acetate	66.0
Sodium silicate solids (average SiO ₂ :Na ₂ O ratio of 2.0)	16.5
Potassium dichlorocyanurate	3.5
Sodium sulfate	5.3
Pluradot HA-433	5.0
Water	3.7

Pluradot HA-433 is a nonionic synthetic detergent containing 3% monostearyl acid phosphate and is produced by the Wyandotte Corporation. The available chlorine content of the above composition is 2.1%.

The above composition was tested in a commercial automatic dishwashing machine in the presence of a standard food soil (margarine/dry whole milk) at a usage level of about 25 grams. Glassware contained within the dishwashing machine was rated after each washing on the basis of the degree of spotting and filming on the glassware. A scale of 0-10 was used in this rating with 10 being the number assigned for the best possible appearance with respect to spotting and filming. The higher ratings are indicative of a more desirable product with respect to spotting and filming. Generally, ratings less than 6.5 are unsatisfactory. The following results for the composition were obtained:

Spotting	8.9
Filming	7.8

Cleaning as rated by a visual check is satisfactory.

EXAMPLE II

When sodium propionate is substituted for the sodium acetate of Example I at the same level and the composition tested under the same conditions with the exception of an 18 gram usage level, the following results were obtained:

Spotting	8.1
Filming	6.9

Cleaning performance of the composition is satisfactory.

EXAMPLE III

The following compositions were tested per the procedures of Example I:

	A	B
Sodium sulfate	71.3	56.6
Sodium silicate (average SiO ₂ :Na ₂ O ratio of 2.0)	16.5	28.4
Potassium dichlorocyanurate	3.5	3.5
Pluradot HA-433	5.0	5.0
Water	3.7	6.5

Results were as follows:

	Composition A	Composition B
Spotting	8.5	8.5
Filming	7.1	7.5
Cleaning	Satisfactory	Satisfactory

6

Substantially the same results are obtained in Examples I-III when other chlorine-yielding bleaches or nonionic detergents are substituted for the potassium dichlorocyanurate or Pluradot HA-433, respectively.

What is claimed is:

1. A substantially sequestrant-free automatic dishwasher detergent composition consisting essentially of:
 - (a) from 50% to 80% of an ionizable salt selected from the group consisting of alkali metal sulfate and the alkali metal salts of acetic acid and propionic acid;
 - (b) from 15% to 35% of an alkali metal silicate having a SiO₂:alkali metal oxide ratio of from 3.6:1 to 1:2;
 - (c) a chlorine-yielding bleach in an amount sufficient to give the detergent composition an available chlorine content of from 0.5% to 10%; and
 - (d) from 2.5% to 10% of a water-soluble polyoxy-alkylene synthetic organic nonionic detergent.
2. The detergent composition of claim 1 wherein the ionizable salt is an alkali metal sulfate.
3. The detergent composition of claim 1 wherein the ionizable salt is an alkali metal salt of acetic acid.
4. The detergent composition of claim 3 wherein the chlorine-yielding bleach is a salt of dichlorocyanuric acid.
5. The detergent composition of claim 4 wherein the synthetic organic nonionic detergent is a condensation product of a fatty alcohol containing from 8 to 22 carbon atoms with from 3 to 20 moles of ethylene oxide.
6. The detergent composition of claim 5 wherein the ionizable salt is an alkali metal salt of acetic acid present in an amount ranging from 50% to 70% of the total composition.
7. A sequestrant-free, automatic, dishwasher detergent composition consisting essentially of:
 - (a) from 50% to 70% of an alkali metal salt of acetic acid;
 - (b) as a corrosion inhibitor from 20% to 35% of an alkali metal silicate having a SiO₂:alkali metal oxide ratio of from 3:1 to 1:1;
 - (c) a chlorine-yielding bleach in an amount sufficient to give the total composition an available chlorine content of from 1% to 5%; and
 - (d) from 5% to 7.5% of a water-soluble polyoxy-alkylene synthetic organic nonionic detergent.

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MAYER WEINBLATT, Primary Examiner

U.S. Cl. X.R.

252-95, 187 C, 187 H