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[54] **AUTOMATIC DISHWASHING
COMPOSITIONS CONTAINING RINSE
AGENT**

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Related U.S. Application Data

[63] Continuation-in-part of Ser. No. 133,338, April 12, 1971, Pat. No. 3,701,735.

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[58] Field of Search 252/99, 95, 135; 8/108

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[57]

ABSTRACT

A cleaning composition particularly adapted for washing dishes, glasses and silverware in mechanical devices such as automatic dishwashers and capable of reducing spotting and filming thereof, and essentially free of halide bleaching compounds, containing as the essential ingredients about 1–20% sucrose, 0.5–10% of an enzyme and 40–95% of at least one water-soluble organic and/or inorganic builder salt.

16 Claims, No Drawings

AUTOMATIC DISHWASHING COMPOSITIONS CONTAINING RINSE AGENT

The present invention is a continuation-in-part of co-pending application Ser. No. 133,338 now U.S. Pat. No. 3,701,735 and relates in general to cleaning compositions and in particular to the provision of cleaning compositions beneficially adapted for use in connection with the spot and film-free cleaning of tableware.

Many of the cleaning compositions heretofore recommended for use in connection with the cleaning of tableware have been subject to one or more significant disadvantages. Perhaps the paramount difficulty involved relates to the tendency of such compositions to leave undesirable spots and streaks on the washed tableware. As will be recognized, aesthetic considerations rather than purely functional criteria are often of overriding importance as regards the suitability of a given cleaning composition and especially when contemplated for use in connection with the cleaning of tableware. Without intending to be bound by any theory, it has nevertheless been hypothesized in explanation of the spotting and filming phenomenon that the presence of polyvalent metals such as calcium, magnesium, etc. normally found in tap water, precipitate out in the presence of the strongly alkaline cleaning solutions and deposit on the tableware. In addition, the presence of high food soil concentrations may cause excessive foaming, due to saponification of fatty food soils in the alkaline cleaning solutions, which interferes with the mechanical cleaning action by reducing the pressure at which the washing fluid is impelled against the tableware in the machine.

In an effort to overcome or otherwise ameliorate the foregoing and related difficulties, considerable research activity has been necessary in the development of cleaning compositions specifically and advantageously adapted to minimize the spotting and filming problem and yet capable of providing the requisite measure of cleaning activity. Thus, much of the methodology heretofore promulgated involves as an essential expedient the use of one or more additives which purportedly function as rinse additives in the final rinse as a separate and distinct operation in the mechanical washing of tableware. In this regard, a final and separate rinse has been recommended by the prior art after a clear water rinse (to rid the solution of the alkali found in the wash stage), which contain a water-soluble starch degradation product and/or a sugar; or an ester of a sugar and a fatty acid; or a low foaming organic polyethenoxy non-ionic surfactant and a polyoxyalkylene glycol mixture; etc. Although a final rinse with a composition has proved somewhat effective in overcoming the spotting and filming problem, the necessity of utilizing a separate rinse additive is cumbersome, inconvenient and an added expense in the use of automatic machine dishwashers.

Accordingly, it has now been discovered that the inclusion of both sucrose and an enzyme directly in the detergent formulation surprisingly effects a reduction in the spotting and filming of tableware without adversely affecting its cleaning efficacy, and completely eliminates the separate rinsing step heretofore found necessary. In addition, the total elimination of the halide bleach from the dishwasher detergent has rendered the product less corrosive and consequently more ef-

fective in film and spot removing of metallic utensils. While the proportion of sucrose in a detergent formulation may be varied, a desirable range is from about 1% to 20% by weight of the total formulation, a preferred range being from approximately 2% by weight to approximately 10% by weight of the total formulation. The enzyme content may vary between 0.5 to 10% by weight, depending on the specific enzyme or combination of enzymes utilized.

Thus, a primary object of the present invention resides in the provision of cleaning compositions capable of providing essentially spot-free tableware.

Another object of the present invention resides in the provision of cleaning compositions capable of providing superior cleaning activity, in the absence of a halide bleaching agent.

Still another object of the present invention resides in the provision of cleaning compositions capable of providing essentially film-free tableware.

Other objects and advantages of the present invention will become more apparent hereinafter as the description proceeds.

In accordance with the present invention, a water-soluble alkaline detergent composition for automatic dishwashing essentially free of halide bleaching compounds, comprises about 40-95% by weight of at least one water soluble organic and/or inorganic builder salt; about 1-20% by weight sucrose, and about 0.5-10% by weight of at least one enzyme.

It is an essential feature of this invention that the composition be free of halide bleach, i.e., compounds capable of releasing hypohalite ions such as hypochlorite chlorine and/or hypobromite bromine on contact with aqueous media. It has been found that said halide bleaches are incompatible with and deactivate the enzyme constituents. However, oxygen bleach such as peroxygen compounds, more specifically sodium perborate and persulfate (oxone), are compatible with the enzymes and enhance stain removal activity especially coffee and tea stains. Accordingly, oxygen bleach may be used as an additional constituent, although not an essential ingredient of instant composition in amounts up to 20% by weight of the total composition, and preferably in amounts of about 5-10% by weight thereof.

The sucrose contemplated for use in the practice of the present invention and capable of substantially reducing both spotting and filming of tableware is water-soluble, and may be either fine or granulated. Sucrose is a disaccharide composed of D-glucose and D-fructose, having the chemical formula $C_{12}H_{22}O_{11}$ and also known as saccharose and saccharobiose. Commercially, sucrose is known as sugar, and is produced from cane sugar (ordinary table sugar), beet sugar, maple sugar, and sorghum sugar. The type and amount of sugar utilized is dependent on availability, cost and compatibility with the other ingredients of the detergent composition. However, the granulated form of sugar has been found preferable because of the ease with which it can be blended with the other ingredients. It has been found that amounts as low as 1% sucrose by weight are effective in obtaining superior inhibition of spotting and filming of tableware washed in a mechanical dishwasher, although the preferred range is 2 to 10% by weight of the total detergent composition.

The water soluble builder salts utilized in the instant detergent composition comprise one or more inorganic

and/or or organic basic and neutral water soluble salts. The builder salts are employed in amounts ranging up to about 95%, i.e. 40-95% by weight with a range of from about 60% to about 90% by weight of the composition being preferred. Suitable inorganic builders include without necessary limitation, trisodium phosphate, tetrasodium pyrophosphate, sodium acid pyrophosphate, sodium tripolyphosphate hexahydrate, sodium monobasic phosphate, sodium dibasic phosphate, sodium hexameta phosphate, sodium silicates, $\text{SiO}_2/\text{Na}_2\text{O}$ of 1/1 to 3.2/1 (sodium metasilicate), sodium carbonate, sodium sulfate, borax, etc. Suitable organic builders include salts of organic acids and, in particular, the water soluble salts of aminopolycarboxylic acids and hydroxycarboxylic acids. The alkali metal salts such as sodium, potassium and lithium; ammonium and substituted ammonium salts such as methylammonium, diethanolammonium and triethanolammonium; and amine salts such as mono, di and triethanolamine, methylamine, octylamino, diethylenetriamine, triethylenetetramine and ethylenediamine are efficacious. The acid portion of the salt can be derived from acids such as nitrilodiacetic; N-(2-hydroxyethyl) nitrilodiacetic acid, nitrilotriacetic acid (NTA), ethylenediamine tetracetic acid, (EDTA); N-(2-hydroxyethyl) ethylene diamine triacetic acid; 2-hydroxyethyl iminodiacetic acid; 1, 2-diaminocyclohexanediamic acid; diethylenetriamine penta-acetic acid, citric acid and the like. The builder salt is preferably employed in amounts sufficient to yield a pH in water of from 9.5 to 12 preferably from 10 to 11 in order to obtain optimum detergency performance.

The cleaning compositions described herein are further provided with one or more enzymes which may in general be defined as encompassing compounds capable of degrading soil materials such as starch, carbohydrates and proteins.

In the preferred form of the invention the enzyme comprises a proteolytic enzyme which is active upon protein matter and catalyzes digestion or degradation of such matter when present on tableware in a hydrolysis reaction. Generally, the enzymes are effective in a pH range of about 4-12, and are effective even at moderately high use temperatures. They are also effective at ambient temperature and temperatures of about 10° C. Particular examples of proteolytic enzymes which may be used in the instant invention include pepsin, trypsin, chymotrypsin, papain, bromeline, collagenase, keratinase, carboxylase, amino peptidase, elastase, subtilisin and aspergillopeptidase A and B. Preferred enzymes are subtilisin enzymes manufactured and cultured from special strains of spore forming bacteria, particularly *Bacillus subtilis*.

Proteolytic enzymes such as Alcalase (1.5 and 4.0 Anson Units), Maxatase, 300,000, 330,000 and 500,000, Protease AP10X, Protease ATP40, Protease ATO 120, Protease L-252, Protease L-423, Protease ATP 360, Alkaline Protease No. 1, Proteinase GV, Protease 2200 C, Protease A 300, Protein AS 7, Enzyme P and Biopraxe AL 15 are among those enzymes derived from strains of spore forming *Bacillus*, such as *Bacillus subtilis*.

Different proteolytic enzymes have different degrees of effectiveness in aiding in the removal of stains from tableware. Particularly preferred as stain removing enzymes are subtilisin enzymes.

Metalloprotease which contain divalent ions such as calcium, magnesium or zinc bound to their protein chains are also of interest.

The enzyme preparations are generally extremely fine powders. In a typical powdered enzyme preparation the particle diameter generally ranges from 0.01 mm to 0.15 mm, e.g. about 0.1 mm, and as much as 75% of the material may pass through a 100 mesh (U.S. Standard) sieve. On the other hand the spray dried granules are usually of very much larger particle size, with the major portion of the granules being from about 0.2 mm to 2.0 mm in diameter.

The commercial enzyme preparations are generally diluted with inorganic salts, e.g., alkali metal and alkaline earth metal salts. Typically the enzyme comprises from 1% to 80% by weight of the enzyme preparation. For example, a typical Alcalase enzyme material analyzes (by weight) 6.5% enzyme, 4% water, 70% sodium chloride, 15.5% sodium sulfate, 3.5% calcium sulfate, and 0.5% organic impurities. Chemically they are typically stable in the pH range of 5 to 12. Generally, they are effective against various types of soil in an aqueous medium having a temperature of about 20°C to about 80°C. Naturally, different proteolytic enzymes have different degrees of effectiveness in aiding in the removal of specific stains from tableware.

Instead of, or in addition to, the proteolytic enzyme, an amylase may be present such as a bacterial amylase of the alpha type (e.g. obtained by fermentation of *B. subtilis*). One very suitable enzyme mixture contains both a bacterial amylase of the alpha type and an alkaline protease, preferably in proportions to supply about 10,000 to 400,000 Novo alpha-amylase units per Anson unit of said alkaline protease.

On a solids basis, i.e., a water-free basis, the enzyme preparation content of the granules or beads can be varied widely and generally will be in the range of 2% to 50% by weight of enzyme preparation or 0.1% to 5% by weight of active enzyme. When the particulate enzyme preparation has an alkaline protease content of 1.5 Anson units per gram, this range of course represents some 3 to 75 Anson units per 100 grams of granules or beads. The invention finds its greatest utility, however, for the manufacture of granules or beads which are relatively high in enzyme preparation content, containing at least 8% by weight of the enzyme preparation (corresponding to say at least 12 Anson units per 100 grams of the granules) and preferably at least 10% by weight. In the final washing product, made for example by blending the enzyme containing granules or beads with other granular material (such as spray-dried hollow beads or spongy low density granules), the content of powdered enzyme preparation is much lower, e.g., in the range of about 0.1% to 5.0 %.

Water soluble organic detergents, i.e. surface active components may be employed, such materials being well known in the prior art, the term detergent comprehending species of the anionic, cationic, amphoteric and zwitterionic types. In formulating an automatic dishwasher product, it is preferred to utilize a low foaming detergent such as the non-ionics.

Nonionic surface active agents include those surface active or detergent compounds which contain an organic hydrophobic group and a hydrophilic group which is a reaction product of a solubilizing group such as carboxylate, hydroxyl, amido or amino with ethylene

oxide or with the polyhydration product thereof, polyethylene glycol.

As examples of nonionic surface active agents which may be used there may be noted the condensation products of alkyl phenols with ethylene oxide, e.g., the reaction product of isooctyl phenol with about 6 to 30 ethylene oxide units; condensation products of alkyl thiophenols with 10 to 15 ethylene oxide units; condensation products of higher fatty alcohols of monoesters of hexahydric alcohols and inner ethers thereof such as sorbitan monolaurate, sorbitol mon-oleate and mannitan monopalmitate, and the condensation products of polypropylene glycol with ethylene oxide.

Further suitable detergents are polyoxyalkene esters of organic acids, such as the higher fatty acids, resin acids, tall oil, or acids from the oxidation of petroleum, and the like. The polyglycol esters will usually contain from about 8 to about 30 moles of ethylene oxide or its equivalent and about 8 to 22 carbon atoms in the acyl group. Suitable products are refined tall oil condensed with 16 or 20 ethylene oxide groups, or similar polyglycol esters of lauric, stearic, oleic and like acids.

Additional suitable non-ionic detergents are the polyalkylene oxide condensates with higher fatty acid amides, such as the higher fatty acid primary amides and higher fatty acid mon- and di-ethanol-amides. Suitable agents are coconut fatty acid amide condensed with about 10 to 30 moles of ethylene oxide. The fatty acyl group will similarly have about 8 to 22 carbon atoms, usually about 10 to 18 carbon atoms in each product. The corresponding sulphonamides may also be used if desired.

Other suitable polyether non-ionic detergents are the polyalkylene oxide ethers of higher aliphatic alcohols. Suitable alcohols are those having a hydrophobic character, and preferably 8 to 22 carbon atoms. Examples thereof are iso-octyl, nonyl, decyl, dodecyl, tridecyl, tetradecyl, hexadecyl, octadecyl and oleyl alcohols which may be condensed with an appropriate amount of ethylene oxide, such as at least about 6, and preferably about 10-30 moles. A typical product is tridecyl alcohol, produced by the Oxo process, condensed with about 12, 15 or 20 moles of ethylene oxide. The corresponding higher alkyl mercaptans or thioalcohols condensed with ethylene oxide are also suitable for use in compositions of the present invention.

Examples of other suitable wetting agents include low foaming anionic materials such as dodecyl hydrogen phosphate, methyl naphthalene sulfonate, sodium 2-acetamido-hexadecane-1-sulfonate, and mixtures thereof. Mixtures of the foregoing wetting agents may also be employed, and if desired, foam-reducing additive may be added as appropriate to minimize undesirable foaming tendencies of these wetting agents under conditions of use.

The detergent material is employed in concentrations ranging from about 0.5% to about 5% by weight of total composition with a range of 1% to 3% being particularly preferred.

Thus, a relatively minor amount of nonionic type detergent, that is, about 2-4% is especially beneficial inasmuch as it acts as a foam depressant as well as a deterrent agent in an automatic dishwashing solution.

Minor amounts of other additives which do not interfere with the cleaning properties of instant composition may be added such as pigments, dyes, perfume, fillers, extenders, suds builders, suds depressors, anti-

redeposition agents, polyelectrolytes which function as soil suspending and/or peptizing agents including polycarboxylates, polyaminomethyl phosphonate, maleic anhydride-acrylic acid polymer, starch degradation products, polymethyl vinyl ether/maleic acid, and the like, overglaze protectors including aluminum acetate, aluminum formate, sodium and aluminum phosphate, alkali aluminate, zincate, berylliate, perfumes, boric oxide, boric anhydride, etc. In some instances it may be commercially feasible to add said ingredients to render them more attractive to the consumer.

The following examples are given for purposes of illustration only and are not to be considered as necessarily constituting a limitation on the present invention.

All parts and percentages given are by weight unless otherwise indicated. The compositions are prepared usually by dry-blending the ingredients to form a dry, particulate product such as a free-flowing granular composition or powder. For purposes of ascertaining the capacity of the various compositions exemplified to reduce spotting and filming of tableware, the method of the Chemical Specialties Manufacturers Association (CSMA) is employed, such method being described in detail in "Soap and Chemical Specialities", 33, (9), 60, 1957. This method is designed for testing formulations for use in dishwashers to show spotting and film build-up on glass tumblers and/or photographic plates in the presence of a standard soil comprising 80% margarine and 20% starlac by equally loading a dishwasher with five glass tumblers and five photographic plates on the upper rack and six large dinner plates plus smaller plates on the bottom rack; adding the standard soil to the dishwasher; placing 30 grams of detergent in each cup for a 0.3% concentration; introducing tap water at 140° F and running the machine through a complete cycle. The contents are cooled to 75° F and visually rated in the presence of good light in accordance with the following scale:

1. glass spotless or film-free
2. spots at random or barely perceptible film
3. one-fourth of glass covered with spots or apparent film
4. one-half glass covered with spots or moderate film
5. glass completely covered with spots or heavy film

Utensils of stainless steel, silverware, copperware and aluminum ware may also be included for testing purposes.

EXAMPLE 1

This example illustrates the applicability of the present invention to the preparation and use of cleaning compositions specifically adapted for use in connection with dishwashing operations. The following composition is prepared:

Ingredients	%
Sodium tripolyphosphate hexahydrate	64.45
Sodium metasilicate, anhydrous	20.0
Sodium sulfate, anhydrous	5.63
Non-ionic detergent	1.5
Color	0.10
Water	0.30
Perfume	0.02
Alcalase	2.0
Sucrose	6.0

The non-ionic detergent is the product obtained by the condensation of about three moles of propylene oxide with the condensation product of one mol of a mixture of essentially straight chain, primary fatty alcohols in the C₁₀-C₁₈ range with about .6 moles of ethylene oxide.

EXAMPLE 2

Ingredient	%
Na tripolyphosphate-6H ₂ O	40.0
Na metasilicate	15.0
Na sulfate, anhydrous	10.0
Nonionic of Example 1	2.0
H ₂ O	0.28
Perfume	0.02
Sucrose	6.0
Na citrate	24.6
Alcalase	2.0
Color	0.1

Results of evaluations of the tableware are tabulated below as an average of four washes. (Rating scale: 1—no spotting or filming to 5— heavy spotting or filming). The bleach — no sugar nor enzyme formula is a control containing 2% potassium dichlorocyanurate and equivalent to Ajax automatic dishwasher detergent.

Formula		Bleach — spotting (s)	No Sugar or enzyme filming (f)	No Bleach, Sugar & Enzyme (Ex. 2)	
				(s)	(f)
Glass	(1)	1.7	1	2	1
Tumblers	(2)	1.7	1.7	2	1
	(3)	2	2.2	2.5	1.2
	(4)	1.5	1.7	2.2	1
	(5)	2	2.2	2.2	1.2
Glass	(1)	1.7	2.5	2.7	1
Photo	(2)	1.7	2.5	2.2	1
Plates	(3)	2	2.7	2.5	1
	(4)	1.7	2.7	2.5	1
	(5)	2	2.7	3	1
Stainless		slight spotting		OK	
Silverware		filming & spotting		slight spotting	

As the above data makes manifestly clear, instant formulation provides a substantial improvement in the elimination of filming of tableware inclusive of stainless steel, silverware, glass tumblers and plates. The control composition without the sugar and enzyme exhibited filming of silverware, stainless steel, plates and glassware.

EXAMPLE 3

Ingredients	%
Sodium tripolyphosphate hexahydrate	61.5
Sodium metasilicate, anhydrous	20.0
Sodium sulfate, anhydrous	5.6
Non-ionic detergent of Ex. 1	1.9
Alcalase	2.0
Sucrose	6.0
Sodium acid aluminum phosphate (overglaze protector)	3.0

In addition to yielding substantially spot and film free tableware, this composition exhibited superior overglaze protection when the sucrose and enzyme are present, i.e., a synergistic effect in overglaze protection

of fine china is produced by the combination of overglaze protecting agent, sucrose and enzyme.

EXAMPLE 4

Example 3 is repeated except that the sodium acid aluminum phosphate is omitted and 6% boric anhydride added and the sodium sulfate reduced to 2.6%. The results obtained are similar to those of Example 3.

EXAMPLE 5

Example 3 is repeated except that 6% boric anhydride is added and the sodium sulfate is omitted and the phosphate content reduced to 61.1%.

EXAMPLE 6

Example 3 is repeated, but 3% boric anhydride is added and the sodium sulfate is reduced to 2.6%

EXAMPLE 7

Ingredients	%
Sodium citrate-2H ₂ O	45.0
Nonionic of Ex. 1	2.0
Alcalase	2.0
Sucrose	6.0
Sodium metasilicate, anhydrous, granular	10.0
Sodium carbonate, light granular	20.0
Sodium sulfate, anhydrous	8.35
Boric Acid	3.0
Boric Oxide	3.0
*Polyamino methyl phosphonate	0.5
Perfume	0.15

*obtained from Monsanto

EXAMPLE 8

Ingredients	%
Sodium nitrilotriacetate	35.0
Sodium ethylene-diaminetetracetate	2.0
Polyamino methyl phosphonate	0.5
Alcalase	1.5
Nonionic of Ex. 1	2.0
Sucrose	6.0
Sodium acid aluminum phosphate	3.0
Soda Ash	35.0
Sodium sulfate, anhydrous	15.0

EXAMPLE 9

Ingredients	%
Anhydrous sodium metasilicate	15.0
Anhydrous sodium sulfate	11.0
Nonionic	2.0
Alcalase	1.0
Nitriloacetic acid	40.0
Sodium citrate dihydrate	25.0
Sucrose	6.0

EXAMPLE 10

Ingredient	%
Na tripolyphosphate-6H ₂ O	40.0
Na metasilicate	15.0
Na sulfate, anhydrous	5.0
Na perborate	5.0
Nonionic of Example 1	2.0

-Continued

Ingredient	%
H ₂ O	0.28
Perfume	0.02
Sucrose	6.0
Na citrate	24.6
Alcolase	2.0
Color	0.1

EXAMPLE 11

Example 10 is repeated but the 5% sodium perborate is replaced by 8% sodium persulfate and the sodium sulfate content is reduced to 2%.

The above formulations yield essentially spot and film free tableware, irregardless of the type of builder salt or salts present; said superior results being a function of the combination of the enzyme and sucrose components in the presence of the highly alkaline medium and in the absence of halide bleach. Variations in the amount of sucrose, in the above formulae such as 2% and 9% sucrose, etc., also yield highly satisfactory results. Similarly the enzyme content may be increased to 5% and 9% and yield satisfactory results.

When the foregoing procedure is repeated but the sucrose and enzyme are omitted, undesirable spotting and filming is clearly evident. When the amount of sucrose and/or enzyme is increased substantially, such as to about 70% with a corresponding decrease in the amount of builder salts, then the level of spotting and filming of tableware becomes unacceptable, with greater spotting and filming in waters of increasing hardness.

In addition, the exemplified procedure make unavoidably clear that the compositions provided in accordance with the present invention are capable of superior cleaning activity, i.e., displaying an outstanding capacity to readily remove food deposits from a wide variety of glazed dishware and aluminum ware, without adversely affecting said glazed surfaces.

Effective industrial bottle cleaning compositions may be provided in accordance with the present invention by merely admixing with caustic alkali whereby to provide a highly alkaline composition preferably having a pH of about 12. Such compositions may be readily formulated in accordance with the parameters hereinbefore described.

Results similar to those described in the foregoing examples are obtained when the procedures delineated therein are repeated but employing in lieu of the specific non-ionic detergent identified a variety of materials selected from low-foaming nonionic, anionic, cationic, amphoteric and zwitterionic types. Moreover, nothing critical resides in the selection of the enzyme and accordingly, any of the materials hereinbefore recommended for such purposes may be readily employed to advantage. Similarly, any water soluble salt or combination of salts can advantageously be used inclusive of the organic and/or organic salts.

While the detergent composition of the present invention finds most efficacious utilization in connection with the washing of the dishes and the like in automatic dishwashers, naturally, the detergent may be utilized in other fashions as desired. Usually, however, the best mode of use will be in connection with automatic dishwashers which have the ability of dispensing the detergent of the present invention in one or more separate

wash cycles. Accordingly, the detergent compositions of the present invention is added to the two receptacles, if such are present, in an automatic dishwasher. When the dishwasher is set into operation, after the dishes have been suitably positioned therein, the automatic devices of the dishwasher permit the addition of sufficient water to produce a concentration of the detergent composition of approximately 0.15 to 0.5% by weight. The operation of the dishwasher results in treating, that is, washing of the dishes with the aqueous solution of the detergent composition. Usually, the sequence of operation in utilizing an automatic dishwasher results in one or more rinsing steps following the one or more washing cycles. In utilizing the detergent composition of the present invention it will be noted that the tableware is substantially spot- and film-free without resorting to a separate and distinct final rinse with rinsing aids. In addition, these detergent compositions are substantially non-corrosive to the overglaze on china and to aluminum ware.

It will be apparent that many changes and modifications of the several features described herein may be made without departing from the spirit and scope of the invention. It is therefore apparent that the foregoing description is by way of illustration of the invention rather than limitation of the invention.

What is claimed:

1. A water-soluble alkaline dishwasher detergent composition capable of substantially reducing the spotting and filming of tableware and essentially free of halide bleaching compounds consisting essentially of about 40-95% by weight of at least one water-soluble neutral to alkaline organic and/or inorganic builder salt; about 1-20% by weight of sucrose; and 0.5 to 10% by weight of enzyme capable of catalyzing digestion or degradation of protein matter.

2. A composition according to claim 1 including from about 0.5 to 5% of organic water-soluble nonionic, anionic, cationic, amphoteric or zwitterionic detergent.

3. A composition according to claim 1 wherein said enzyme is proteolytic enzyme or an amylase.

4. A composition according to claim 1 including water-soluble overglaze protector capable of inhibiting attack on the overglaze of fine china and dishware.

5. A composition in accordance with claim 1, which also includes up to 20% by weight of peroxygen bleach compound compatible with said enzyme.

6. A composition according to claim 1 wherein said enzyme is Alcalase.

7. A composition according to claim 1, wherein said builder is a mixture of sodium tripolyphosphate hexahydrate and sodium metasilicate.

8. A composition in accordance with claim 1, wherein the builder salt is sodium citrate.

9. A composition according to claim 2 wherein said detergent is low foaming nonionic material and constitutes from 1.3% by weight of composition.

10. A composition according to claim 2 wherein said detergent is the product obtained by the condensation of about 3 moles of propylene oxide with the condensation product of one mole of a mixture of essentially straight chain, primary C₁₀-C₁₆ fatty alcohols with 0.6 mole ethylene oxide.

11. A composition according to claim 3 wherein said proteolytic enzyme is selected from the group consisting of pepsin, trypsin, chymotrypsin, papain, bromeline, collagenase, keratinase, carboxylase, amino pepti-

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dase, elastase, subtilisin and aspergillopeptidase A and B.

12. A composition according to claim 4 wherein said overglaze protector is selected from the group consisting of sodium acid phosphate, boric acid, boron anhydride and mixtures thereof.

13. A composition according to claim 9 wherein said nonionic detergent is selected from the group consisting of condensation products of alkyl phenols with from about 6 to 30 moles of ethylene oxide, condensation products of alkyl thiophenols with 10 to 15 moles of ethylene oxide, condensation products of higher fatty alcohols of monoesters of hexahydric alcohols and inner ethers thereof, the condensation products of polypropylene glycol with ethylene oxide and the con-

densates of higher fatty acid amides or sulphonamides with about 10 to 30 moles ethylene oxide.

14. A method for treating glasses, dishes and like tableware to remove foreign bodies from the surfaces thereof in a spot and film-free condition comprising treating said tableware with a dilute aqueous solution of the composition defined in claim 1.

15. A method of cleaning tableware by washing with an aqueous solution of the composition defined by claim 8.

16. A method of safely cleaning fine china and other tableware by washing with an aqueous solution of the composition defined in claim 4.

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