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3,799,879

METHOD FOR CLEANING DISHES AND THE LIKE
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6 Claims

ABSTRACT OF THE DISCLOSURE

This invention relates to a method for cleaning dishes and the like, and comprises applying to the dishes an aqueous solution of a dishwashing composition containing an amylolytic enzyme prepared from bacteria or fungi together with a detergent surfactant and a water-soluble builder salt. The composition has a pH of 7 to 9 at a concentration of 3 g. per litre in aqueous solution.

This application is a continuation-in-part of our earlier filed application Ser. No. 228,235, filed Feb. 22, 1972, and now abandoned, which is a continuation of our earlier application Ser. No. 886,720, filed Oct. 15, 1969, now abandoned, which in turn is a continuation-in-part of our earlier application Ser. No. 856,902, filed Sept. 4, 1969, now abandoned, which is a streamlined continuation of Ser. No. 683,004, filed Nov. 14, 1967, now abandoned.

BACKGROUND OF THE INVENTION

Field of the invention

The present invention relates to a method for cleaning dishes and the like, comprising applying to the dishes an aqueous solution of a dishwashing composition comprising enzymes. More specifically the present invention relates to a method for cleaning dishes and the like, comprising applying to the dishes an aqueous solution of a dishwashing composition having a pH of 7-9 at a concentration of 3 g. per litre in aqueous solution, said composition consisting essentially of 0.5-90% by weight of a detergent selected from the group consisting of an anionic synthetic detergent, a nonionic synthetic detergent and an alkali metal soap, from 1-80% by weight of a water-soluble alkali metal builder salt, and amylolytic enzymes prepared from bacteria or fungi in an amount such that the composition has an amylolytic activity of 10^4 - 10^6 maltose units per kg.

Description of the prior art

In the cleaning of dishes, plates, pots, pans, cups, etc., the removal of organic soil plays an important part. In particular the satisfactory removal of food residues adhering to the dishes presents considerable difficulties, the more so when these food residues have dried up. In mechanical and manual dishwashing a soaking step is often included in order to assist removal of these food residues. However, even after soaking the removal of starch-containing food residues such as those from potatoes, pudding, and of protein-containing food residues such as those from eggs, milk, etc., is still not satisfactory in most cases without applying a scrubbing or agitation step. Moreover, the preliminary soaking is time-consuming.

Commercial dishwashing compositions are normally highly alkaline, the pH being in the order of 11. Such a high alkalinity, however, suffers from several drawbacks. For example, objects of soft metals, such as aluminium,

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are often subject to attack by such highly alkaline cleaning compositions, which may etch aluminium to a considerable extent. These highly alkaline cleaning compositions also tend to attack the surface of objects made of glass, which results in etched, unsightly surfaces. Highly alkaline cleaning compositions can also cause skin irritation when used for hand dishwashing, particularly on prolonged immersion. The high alkalinity was, however, considered necessary to obtain a satisfactory cleaning action.

The use of enzymes for general cleaning purposes is well known in the art. Thus, for example, in British patent specification 265,024 it is stated that dirt, found on human clothing, domestic articles and the like, which dirt generally consists largely of albuminous and fatty materials, is far more easily and rapidly removed by cleansing media in the presence of enzymes, that is tryptic enzymes. These cleansing media, however, are highly alkaline, and suffer therefore from the above-mentioned drawbacks. Incorporation of amylolytic enzymes in these cleansing media is not taught in this specification, and as will be shown later on, the use of amylases in such cleansing media does not yield a beneficial dishwashing effect.

In U.S. patent specification 1,716,347 a method of washing fabrics with an aqueous detergent-containing liquid in the presence of urea and urease is disclosed, and in U.S. patent specification 1,970,578 the use of particular nonionic synthetic detergents together with amylases for desizing textile goods is disclosed. None of these publications, however, disclose or teach the use of amylolytic enzymes in a cleaning composition with a pH of 7-9 as a dishwashing composition.

In U.S. patent specification 3,519,570 a process for making free-flowing, enzyme-containing detergent granules is described, in which the surfaces of base carrier detergent granules are rendered glutinous with a low melting, liquefiable nonionic surface-active agent, and subsequently powdered enzymes are conglutinated with said glutinous surfaces. These enzymes include proteases, derived from micro-organisms, and amylases, the source of which is not further specified in this specification. According to this U.S. patent specification, amylases function primarily in acid to neutral systems. In as far as the effective date of this U.S. patent specification is concerned, it discloses the use of the detergent compositions revealed therein in all cleaning operations, especially in removing soil and foreign materials from textiles and fabrics. It does not disclose, however, dishwashing with a composition which has a pH at 3 g./l. in aqueous solution of 7-9, a system which is from neutral to alkaline, nor does it disclose the use of amylolytic enzymes, derived from bacteria and fungi. The latter, in contrast with amylases from vegetable or animal origin, are more sensitive to calcium-complexing agents like sodiumtripolyphosphate, and consequently it is surprising that, nevertheless, the amylases of bacteria and fungi in the compositions of the invention, which contain calcium-complexing builder salts, are particularly efficacious in a method for cleaning dishes with an aqueous solution thereof.

SUMMARY OF THE INVENTION

In accordance with this invention it has been found that the above-mentioned disadvantages can be significantly reduced, and a significant improvement in soil removal can be obtained by cleaning the dishes and the like with an aqueous solution of a dishwashing composition that consists essentially of a detergent selected from the group consisting of an anionic synthetic detergent, a nonionic synthetic detergent and an alkali metal soap, a water-soluble alkali metal builder salt and amylolytic enzymes,

derived from bacteria and fungi, which composition has a pH of 7-9 at a concentration of 3 g. per litre in aqueous solution. The attack of highly alkaline dishwashing compositions on e.g. glass surfaces is thereby significantly reduced, and in many cases unsightly surfaces of glass articles, cleaned with such a highly alkaline dishwashing composition may be cleaned with a composition of the invention, whereby the appearance of the glass surface is greatly improved.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

In a specific embodiment our invention may be exemplified by a method for cleaning dishes and the like, comprising applying to the dishes an aqueous solution of a dishwashing composition having a pH of 7-9 at a concentration of 3 g. per litre in aqueous solution, said composition consisting essentially of 0.5-90% by weight of a detergent selected from the group consisting of an anionic synthetic detergent, a nonionic synthetic detergent and an alkali metal soap, 1-80% by weight of a water-soluble alkali metal builder salt and amylolytic enzymes derived from bacteria and fungi, in an amount such that the composition has an amylolytic activity of 10^4 - 10^6 maltose units per kilogram. The aqueous solution comprising the above dishwashing composition can be applied to the dishes in manual dishwashing operations or in machine dishwashing operations.

In manual dishwashing the temperature of the wash liquor will normally be from room temperature to a temperature of about 50° C. The concentration of the dishwashing composition in a wash liquor for manual dishwashing depends on the physical form of the composition, whether liquid or powdered, and generally varies from 2 to 5 g./l. In machine dishwashing the aqueous solution with the dishwashing composition can be applied to the dishes during a pre-soaking step, a soaking step or during the main washing step. In general in a machine dishwashing operation the wash liquor containing the dishwashing composition is either heated from room temperature to about 70° C., generally to 55-65° C., with a rate of 1-4 degrees Celsius per minute, normally about 2° C./minute, or the wash liquor is made up from water of a temperature of 50-70° C., usually 60° C., to which the dishwashing composition is added directly.

In general the concentration of dishwashing composition in the aqueous solution is from 1-10 g./l., usually about 5 g./l., in machine dishwashing. The washing operation in general may take from 1 minute to about an hour, and is generally from 20-45 minutes.

The detergent in the dishwashing composition can be an anionic synthetic detergent, a nonionic synthetic detergent, or an alkali metal soap.

Examples of anionic synthetic detergents are alkali metal salts of alkyl sulphonic or alkyl sulphuric acids having from 8 to 20 carbon atoms in the alkyl chain; of alkylaryl sulphonic acids with a C_8 - C_{18} alkyl chain and in which aryl is benzene; of sulphonation products of C_8 - C_{20} α -olefins that have been hydrolyzed and neutralized; of hydroxy alkyl methyl taurides wherein alkyl is C_8 - C_{20} . Further examples of suitable anionic synthetic detergents can be found in Schwartz, Perry and Berch, "Surface Active Agents and Detergents," vol. II, 1958, under the heading "Anionic Surfactants," which is hereby incorporated by way of reference.

Examples of nonionic synthetic detergents are ethylene oxide condensation products of fatty alcohols with C_{12} - C_{18} alkyl groups, of alkyl phenols with C_8 - C_{18} alkyl groups, of propylene glycol condensed with propylene oxide, etc. Further suitable examples of nonionic synthetic detergents can be found in the above cited reference Schwartz, Perry and Berch under the heading "Nonionic Surfactants."

Examples of alkali metal soaps are the sodium soaps of C_{12} - C_{22} fatty acids, such as coconut oil, palm oil, fish oil fatty acids, etc. The fatty acids may be natural or synthetic. Further examples can be found in Schwartz, Perry and Berch under the heading "Soaps."

In general from 0.5% up to 90% of detergent may be present depending upon the physical state of the composition (powder, aqueous liquid or non-aqueous liquid). For powders and aqueous liquids the amount may be up to 50%, whereas for non-aqueous liquids a higher amount of up to 90% may be used.

The compositions to be used in the present invention contain water-soluble alkali metal builder salts in an amount of up to 80%.

Water-soluble builder salts form complexes with the water-hardness ions and increase the level of detergency of detergents. Suitable examples of water-soluble builder salts are alkali metal tripolyphosphates, pyrophosphates, alkali metal salts of amino polycarboxylic acids such as ethylene diamine tetra-acetic acid, nitrilo triacetic acid, etc. Other suitable water-soluble builder salts can be found in Schwartz, Perry and Berch under the heading "Inorganic and Organic Builders."

The composition to be used in the present invention further comprises amylolytic enzymes, derived from bacteria and fungi.

Suitable examples of amylases, derived from bacteria are those produced by the *Bacillus* species, in particular by strains of *B. subtilis*. Such amylases are commercially available, e.g. α -amylase ex Novo Industri A/S, Copenhagen, Denmark; Maxamyl® ex Royal Fermentation Industries, Delft, Netherlands; bacterial α -amylase ex Wallerstein Co., New York. Suitable examples of amylases, derived from fungi are those derived from *Aspergillus oryzae*, *Aspergillus niger*, *A. alliaceus*, *A. wentii*, *Penicillium glaucum* and the like. Preferably α -amylases, derived from bacteria and fungi, are used in the present invention. Alpha-amylase has proved to be especially suitable for incorporation in compositions to be used in the method according to the present invention; its addition significantly improves and accelerates the removal of food residues from soiled surfaces.

The amount of amylolytic enzymes incorporated in the compositions to be used in the present invention is dependent upon their activity. In general such an amount is incorporated that an activity is obtained of 10^4 - 10^6 maltose units (M.U.) per kilogram of final product. The amylolytic activity can be determined by the method as described by P. Bernfeld in "Methods in Enzymology," vol. I, 1955, p. 149.

For machine-dishwashing a low-sudsing composition is often desired. In that event the composition may contain from 2-10% of a nonionic synthetic detergent, from 40-60% of an alkaline condensed phosphate, and from 5-15% of an alkaline silicate. If a medium-sudsing or high-sudsing composition is to be used, an anionic synthetic detergent or a mixture of an anionic and a nonionic synthetic detergent may be employed.

It has also been found that a further improvement in the cleaning of soiled dishes is achieved by applying an aqueous solution of a dishwashing composition which contains a mixture of amylolytic enzymes derived from bacteria and fungi and proteolytic enzymes. Soil which also contains protein is thus more effectively removed.

The invention additionally provides a method for cleaning dishes, comprising applying an aqueous solution of a dishwashing composition containing a mixture of amylolytic enzymes, derived from bacteria and fungi, and proteolytic enzymes.

The proteolytic enzymes to be used in the method of the invention are preferably also derived from micro-organisms such as bacteria and fungi. Examples of suitable proteolytic enzymes are those produced by *Bacillus subtilis* and specific strains thereof. Such proteolytic enzymes are commercially available, e.g. under the trade

name Alcalase®, a serine protease, ex Novo Industri A/S, Copenhagen, Denmark and Maxatase® ex Royal Fermentation Industries, Delft, Netherlands. Other examples of proteases derived from fungi are those produced by *Aspergillus* species, e.g. *Aspergillus* peptidase.

The amount of proteolytic enzymes to be used according to the invention also depends upon their activity. In general the amount is such that the activity of the enzyme in the final product lies between 5 and 20 Anson units per kilogram of final product. An Anson unit is that amount of proteolytic enzyme, that degrades haemoglobin under the standard conditions as described by M. L. Anson in "Journal of General Physiology," vol. 22 (1938), p. 79, with such an initial velocity, that per minute an amount of degradation products is obtained which are not precipitable by trichloroacetic acid, which produces the same color intensity as 1 milliequivalent tyrosine with the phenol reagent.

When a mixture of amylolytic and proteolytic enzymes is used, the ratio in which these enzymes are used is dependent upon their activity. In general the activity of the individual enzymes should lie within the ranges defined above. The temperature at which the compositions may be used according to the invention is dependent upon the enzymes used. When alpha-amylase obtained from micro-organisms is used, the temperature may be as high as 90° C. before the benefit in respect of soil removal disappears.

The compositions to be used in the method of the invention may further contain the usual adjuvants such as sodium silicate, sodium sulphate, lather boosters, such as coconut ethanolamide, soil-suspending agents, such as sodium carboxymethylcellulose, alkaline or alkaline earth salts, such as sodium bicarbonate, borax, etc., solvents, such as alcohol, hydrotropes, such as urea, bleach precursors and per compounds, such as sodium perborate. Furthermore perfumes, coloring matter etc. may be added if desired.

The term "dish" where used in this specification is a general one, and is intended to cover other articles such as cups, saucers, pots and pans, and also other hard surfaces such as tiles.

The invention will now be further illustrated by the following examples; in these and elsewhere in the specification references to percentages are to percentages by weight. The amylase in all examples is α -amylase from *B. subtilis*.

EXAMPLE I

Beaker glasses were initially soiled with a mixture of milk, rice, flour and egg, and aged at 20° C. for 60 hours.

The beaker glasses were then filled with an aqueous solution containing 2.81 g./l. of the following composition:

	Percent
Nonyl phenol 14 EO	7.5
Sodium triphosphate	45
Sodium carboxymethylcellulose	1
Sodium sulphate	33
Water, perfume to 100% (pH=8.6).	

at temperatures of 20°, 40° and 60° C. respectively. The soil removal of this solution was compared with that of an identical solution which also contained 0.19 g./l. of alpha-amylase (16,000 M.U./g.).

The results after soaking for 1 hour are shown in the following table:

Standard solution	Temperature in.° C.		
	20°	40°	60°
Without enzyme.....	1	1	1
With enzyme.....	4	4	4

NOTE.—Scale: 1=25% of soil removed. 4=Soil completely removed.

EXAMPLE II

The following composition is suitable for use in dishwashing machines where low-sudsing is required.

	Percent
Tallow fatty alcohol 25 EO	6
Sodium triphosphate	45
Sodium carboxymethylcellulose	1
Sodium silicate	8
Sodium sulphate	30
Alpha-amylase (16,000 M.U./g.)	5
Water, perfume to 100% (pH=8.5).	

EXAMPLE III

The following composition is suitable for use in dishwashing where high-sudsing is required.

	Percent
Sodium dodecyl benzene sulphonate	50
Coconut fatty acid ethanolamide	5
Sodium triphosphate	20
Sodium sulphate	10
Urea	10
Alpha-amylase (16,000 M.U./g.)	5
Water, perfume to 100% (pH=7.6).	

EXAMPLE IV

	Percent
Nonyl phenol 14 EO	7.5
Sodium triphosphate	45
Sodium carboxymethylcellulose	1
Sodium sulphate	33
Alpha-amylase (16,000 Anson units/g.)	10
Water, perfume to 100% (pH=8.6).	

Beaker glasses, soiled with aged soil, consisting of milk, rice, flour and egg, were treated with an aqueous solution containing 3 g./l. of the above composition at 40° and 60° C. for 1 hour. The soil was completely removed.

These beaker glasses were also treated under the same conditions with the same solution which, however, did not contain the enzymes. After soaking for 1 hour only 25% of the soil had been removed.

EXAMPLE V

Dishes and the like were cleaned with a composition of the invention (B) and with the same composition without enzymes (A), and the results obtained were compared

	Percent by weight	
	A	B
Sodium triphosphate.....	42	42
Sodium dihydrogenphosphate.....	13	13
Sodium sulphate.....	4.4	3.4
Sodium bicarbonate.....	37	36
A polyoxyethylene-polyoxypropylene glycol having an approximate molecular weight of 3,000 and containing 40-50 mol. percent of ethylene oxide	3.6	3.6
Benzotriazole.....	0.01	0.01
Perfume.....	0.03	0.03
Amylase (16,000 M. U./g.).....		1.0
Amylase plus protease (21,000 M. U./g.) plus 0.8 Anson unit/g.....		1.0

NOTE.—The pH of an aqueous solution of 3 g./l. of each of these compositions was 7.6.

The dishes and the like were cleaned in the following way.

In a "Bauknecht" dishwashing machine the following soiled tableware was cleaned:

- 4 tumblers, soiled with milk
4 cups, soiled with coffee and lipstick
6 cups, soiled with tea
6 plates, soiled with a food mixture containing starchy material
6 plates, soiled with a food mixture containing proteins
2 spoons, soiled with a food mixture containing proteins
2 forks, soiled with a food mixture containing proteins
2 knives, soiled with a food mixture containing proteins
2 silver spoons, soiled with a food mixture containing proteins.

The cleaning programme of the dishwashing machine was:

cold pre-rinsing for 1 minute
cleaning at 65° C. for 21 minutes (at 35° C. the dishwashing composition was added)
rinsing at 40° C. for 3 minutes
rinsing at 75° C. for 22 minutes
drying for 1 minute.

This was repeated ten times and the scores of the tests were determined using a scale of 1 to 12, in which the value 8 is the value for water:

1=ideal, spotless
2=very good
3=good
4=slightly soiled
5=for most purposes unacceptable
6=soiled and spotted
7=moderately soiled
8=value obtained with water.

The lowest and the highest score obtained in the ten tests were left out, and the average of the scores of the remaining 8 tests was determined. A difference of 0.1 was considered significant.

The compositions were used at a concentration of 5 g./l. in aqueous solution. The scores obtained in this way were:

	Composition	
	A	B
Score	4.1	3.0
Appearance of glasses	Blue	Not blue.

EXAMPLE VI

The same procedure as in Example V was used with the following compositions:

	Percent by weight	
	A	B
Sodium phosphate	43	43
Sodium dihydrogenphosphate	10	10
Sodium sulphate	8	7
Sodium bicarbonate	26	25
A polyoxyethylene-polyoxypropylene glycol having an approximate molecular weight of 3,000 and containing 40-50 mol percent of ethylene oxide	4	4
Sodium perborate	6	6
Sodium laurate	3	3
Perfume	0.03	0.03
Benztriazole	0.01	0.01
Amylase (16,000 M.U./g.)		1.0
Amylase plus protease (21,000 M.U./g.) plus 0.8 Anson units/g.		1.0

NOTE.—The pH of an aqueous solution of 3 g./l. of each of the compositions was 7.6.

The scores obtained were the following:

	Composition	
	A	B
Score	3.3	2.6
Appearance of glasses	Blue	Not blue.

EXAMPLE VII

The following composition was tested in an identical manner as in Example V:

	Percent by weight
Sodium triphosphate	49
Sodium dihydrogenphosphate	13
Sodium sulphate	4
Sodium bicarbonate	17
Polyoxyethylene-polyoxypropylene glycol having an approximate molecular weight of 3000 and containing 40-50 mol percent of ethylene oxide	7

Percent by weight

Sodium perborate	6
Benztriazole	0.5
Sodium citrate	2.5
Protease (1.5 Anson units/g.)	0.75
Amylase (16,000 M.U./g.)	0.25 (pH=7.8).

The score was 2.9, the appearance of the glasses was not blue, the cutlery was fine.

EXAMPLE VIII

The following composition:

	Percent by weight
15 Sodium triphosphate	50
Sodium dihydrogenpyrophosphate	13
Sodium sulphate	3
Sodium bicarbonate	17
20 Polyoxyethylene-polyoxypropylene glycol with an approximate molecular weight of 3000 and containing 40-50 mol percent of ethylene oxide	7
Sodium perborate	6
Benztriazole	0.5
Sodium citrate	2.5
25 α-Amylase (16,000 M.U./g.)	1
(The pH of a 3% aqueous solution was 7.8).	

showed a score of 2.9 when tested according to Example V, the appearance of the glasses being not blue, and the cutlery being clean.

EXAMPLE IX

The same procedure as in Example V was applied to a highly alkaline dishwashing composition of the following composition:

	Percent by weight
50 Sodium triphosphate	41
Sodium orthophosphate	21
40 Sodium silicate 5 aq.	19
Polyoxyethylene-polyoxypropylene glycol with an approximate molecular weight of 3000 and containing 40-50 mol percent of ethylene oxide	1.6
Benztriazole	0.01
45 Sodium aluminate	0.4
(pH=11.6).	

The score was 3.4, the appearance of the glass was blue, the silver was badly tarnished, and the stainless steel objects were not spotless. The objects treated with this highly alkaline cleaner were then cleaned with the following composition in the same way as in Example V:

	Percent by weight
55 Sodium triphosphate	50
Sodium dihydrogenphosphate	13
Sodium sulphate	4
Sodium bicarbonate	19
60 Polyoxyethylene-polyoxypropylene glycol with an approximate molecular weight of 3000 and containing 40-50 mol percent of ethylene oxide	7
Benztriazole	0.5
Sodium citrate	2.5
65 Protease (1.5 Anson units/g.)	0.75
Amylase (16,000 M.U./g.)	0.25
(pH=7.8).	

The score was then 2.9, the glass was not blue any more, the silver was not tarnished and the stainless steel was spotless.

EXAMPLE X

In the manner as described in Example V various dishwashing compositions with amylolytic enzymes at dif-

ferent pH-values were tested. The compositions are given below:

	Composition				
	A	B	C	D	E
Percent by weight:					
Sodium triphosphate.....	41.2	41.2	41.2	44.1	24.5
Tetrasodium pyrophosphate.....	12.7	12.7	12.7		
Disodium dihydrogen pyrophosphate.....				9.8	29.4
Sodium sulphate.....	4.3	4.3	4.3	4.3	4.3
Sodium carbonate.....	36.3	18.1			
Sodium bicarbonate.....		18.1	36.3	36.3	36.3
Polyoxyethylene-polyoxypropylene glycol (approx. mol. weight 3000 and containing 40-50 mol. percent of ethylene oxide).....	3.5	3.5	3.5	3.5	3.5
Amylase (16,000 M.U./g.).....	2.0	2.0	2.0	2.0	2.0
pH (3 g./l. aqueous solution).....	11.0	10.0	9.0	8.0	7.0

The results of the tests were as follows:

	A	B	C	D	E
I:					
Average dishwashing efficiency.....	1.6	1.5	1.3	1.3	1.3
Removal of starch (pudding from dessert plates).....	3.1	2.1	1.7	1.7	1.9
Cleaning of cutlery (3 types of soil amylaceous paste).....	1.6	1.5	1.2	1.2	1.1
II—Iodine test (all porcelain items) (determination of residual starch on dishes by iodine test):					
Average value of residual starch.....	3.6	4.2	2.7	2.1	2.5
Efficiency residual starch (potatoes).....	2.0	1.9	1.7	1.3	1.4
Efficiency residual starch (pudding).....	5.2	6.3	3.7	2.8	3.6
Efficiency redeposited starch.....	1.7	1.5	1.2	1.2	1.3
III—Film formation (percent articles; glass and porcelain ware; measure of discoloration):					
No film.....	7	15	38	28	22
Film.....	93	85	62	72	78

From the results of these tests it is apparent that the dishwashing compositions of the invention are superior to those with a high pH.

EXAMPLE XI

A composition comprising 99.5 parts by weight of a dehydrated ordinary toilet soap having a fat content of 78% and 0.5 part by weight of dried pancreas extract according to British patent specification 265,024 was tested in an identical manner as in Example X. The results were as follows:

(I)

Average dishwashing efficiency.....	2.1
Removal of starch.....	4.7
Cleaning of cutlery.....	2.0

(II) Iodine test

Average value of residual starch.....	4.2
Efficiency residual starch (potatoes).....	2.1
Efficiency residual starch (pudding).....	6.3
Efficiency redeposited starch.....	2.1

(III) Film formation

	Percent
No film.....	9
Film.....	91

This clearly shows the superiority of the compositions of the invention over the composition of the prior art, not only with respect to cleaning efficiency, but also in particular with respect to discoloration of glass.

What is claimed is:

1. In a method for cleaning dishes, the steps comprising applying to the dishes an aqueous solution of a dishwashing composition having a pH of 7-9 at a concentration of 3 g. per litre in aqueous solution, said composition consisting essentially of 0.5-90% by weight of a detergent selected from the group consisting of an anionic synthetic detergent, a nonionic synthetic detergent and an alkali metal soap, from 1-80% by weight

of a water soluble builder salt selected from the group consisting of alkali metal salts of orthophosphates, pyrophosphates, polyphosphates, silicates and carbonates, and amylolytic enzymes derived from bacteria and fungi in an amount such that the composition has an amylolytic activity of 10^4 - 10^6 maltose units per kg.

2. The step according to claim 1, wherein the dishwashing composition contains in addition thereto proteolytic enzymes in an amount such that the composition has a proteolytic activity of 5-20 Anson units per kg.

3. In a method for cleaning dishes, the step comprising applying to the dishes an aqueous solution of a dishwashing composition having a pH of 7-9 at a concentration of 3 g. per litre in aqueous solution, said composition consisting essentially of 0.5 to 50% by weight of a detergent selected from the group consisting of an anionic synthetic detergent, a nonionic synthetic deter-

gent and an alkali metal soap, from 1-60 percent by weight of a water-soluble alkali metal builder salt selected from the group consisting of alkali metal salts of orthophosphates, pyrophosphates, polyphosphates, silicates and carbonates, and amylolytic enzymes derived from bacteria or fungi in an amount such that the composition has an amylolytic activity of 10^4 - 10^6 maltose units per kg.

4. The step according to claim 3, wherein the dishwashing composition contains in addition thereto proteolytic enzymes in an amount such that the composition has a proteolytic activity of 5-20 Anson units per kg.

5. In a method for cleaning dishes, the step comprising applying to the dishes an aqueous solution of a dishwashing composition having a pH of 7-9 at a concentration of 3 g. per litre in aqueous solution, said composition consisting essentially of 2-10% by weight of a nonionic synthetic detergent, from 40-60% of an alkali metal condensed phosphate, from 5-15% of an alkali metal silicate and amylolytic enzymes derived from bacteria or fungi in an amount such that the composition has an amylolytic activity of 10^4 - 10^6 maltose units per kg.

6. The step according to claim 5, wherein the dishwashing composition contains in addition thereto proteolytic enzymes in an amount such that the composition has a proteolytic activity of 5-20 Anson units per kg.

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WILLIAM E. SCHULZ, Primary Examiner

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