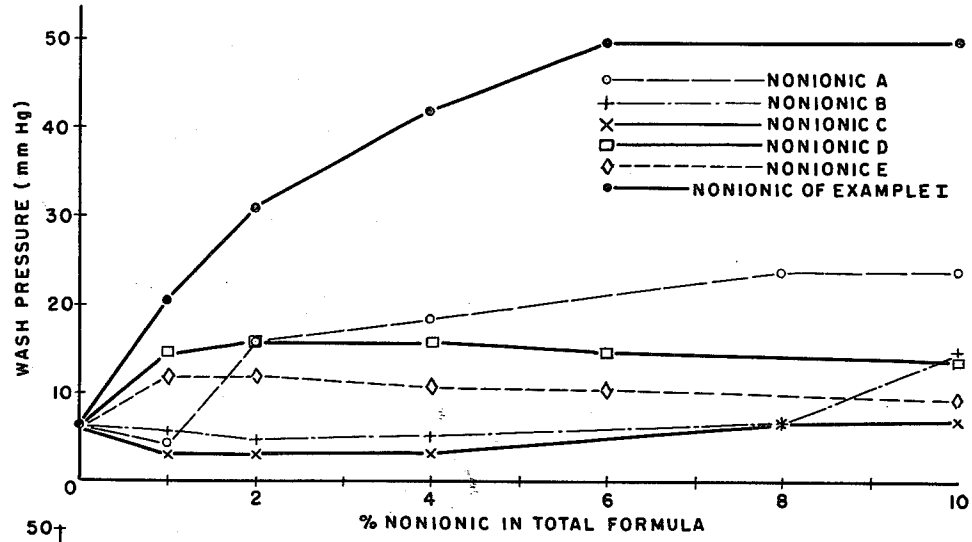
Aug. 7, 1962 A. T. MARTIN ETAL 3,048,548

DEFOAMING DETERGENT COMPOSITION

Filed May 26, 1959

FIG. 4



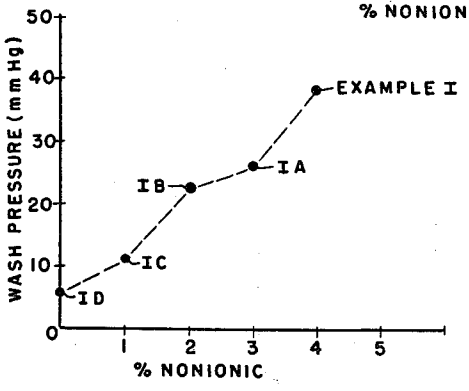


FIG. 1

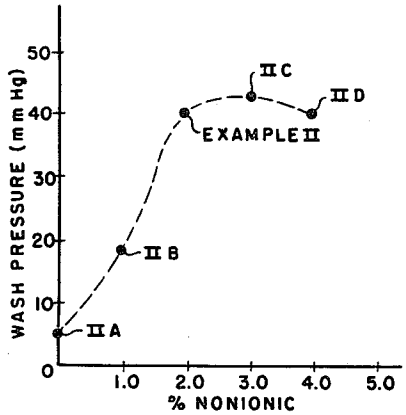


FIG. 2

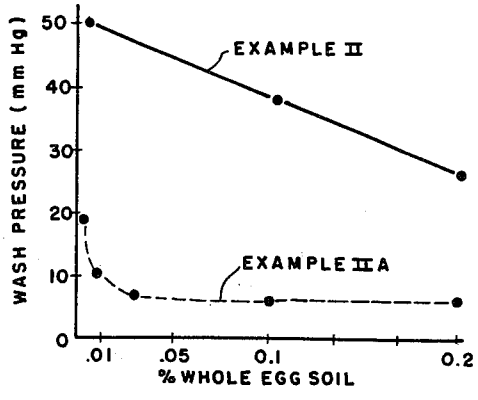


FIG. 3

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DEFOAMING DETERGENT COMPOSITION

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This invention relates to detergent compositions and in particular to detergent compositions for use in machine dishwashing.

Machine dishwashing is used in connection with practically all commercial and institutional dining facilities as well as in a rapidly increasing proportion of private homes. In commercial machines, the dishes to be washed are introduced into a zone where detergent solution is sprayed over them, the detergent solution being recycled and used repeatedly and fortified and replenished intermittently. In home machines the detergent is used for only one load of dishes and is then discarded although it too is recirculated during the washing operation. Hence in both types of machines, food soil concentrations in the wash solution of 0.05 to 0.1% or higher are considered to be moderate under average conditions.

It has been the practice in formulating machine dishwashing detergents to use in the main various combinations of inorganic sodium and potassium salts, such as polyphosphates, silicates, carbonates and basic materials such as sodium and potassium hydroxides. It has not been possible to use effective amounts of well-known organic detergents such as the alkyl aryl sulfonates, alkyl sulfonates, alkanol amides or alkyl aryl polyethers in spray-type mechanical dishwashing detergents because of the foam these materials develop during the washing operation. This foam causes overflow and loss of the wash solution, impairs the mechanical operation of the machine, and lowers the pressure at which the washing fluid is impelled against the utensils to be cleaned. The inorganic materials do not foam themselves and, at low concentrations of food soil (less than 0.01%), perform satisfactorily in mechanical dishwashers. However, with increase in food soil concentration to greater than about 0.1%, foaming becomes a serious problem even with the use of purely inorganic detergent systems. This is because the inorganic detergent systems, being alkaline, can cause some saponification of fatty food soils. This, plus the natural foaming properties of protein food soils, tends to produce foam in the wash tank.

Recently, certain low foaming, organic, nonionic detergents have been made available commercially which can be incorporated in small amounts with inorganic materials in mechanical dishwashing formulations without seriously increasing their foaming tendency. These materials add somewhat to the detergency efficiency of the compound formulation. No known compounds of this type, however, have a pronounced effect of inhibiting foam where heavy food soil loads are present, or in maintaining internal wash pressure at a high level under these conditions.

Wash pressure is defined herein as the pressure registered on a manometer or pressure gauge by a Pitot tube set at the outlet of the wash nozzle. The force of the wash spray against a dish surface is directly proportional

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to this wash pressure. Since it has been shown that the wash action of the wash spray contributes most to gross soil removal, maintenance of the original wash pressure built into the machine is very important.

Excessive foaming in machine dishwashing has long been a recognized problem and, although billowing foam is an obvious indication of trouble, a real wash pressure problem may exist even without this obvious symptom. For example, an "aerated wash solution," though not so easily detected, may be as serious a problem from the standpoint of washing efficiency as billowing foam. An "aerated wash solution," as used herein, is defined as a liquid with many small air occlusions or bubbles dispersed in it as contrasted with "foam" which, as used herein, is defined as a colloidal dispersion of air in liquid floating on top of the wash solution.

The detergent compositions of this invention, when employed in wash solutions in machine dishwashing, have been found to be especially effective in maintaining a high wash pressure by inhibiting foaming and/or aeration or both, of the wash solution in the presence of food soil even at high concentrations. The unique properties of the detergent compositions of this invention are apparently due to the incorporation into conventional detergent systems of a small proportion of a polyalkylene glycol mixture consisting of a product which statistically represented has a plurality of alternating hydrophobic and hydrophilic polyoxyalkylene chains or segments, the hydrophilic chains (segments) consisting of oxyethylene radicals linked one to the other and the hydrophobic chains (segments) consisting of oxypropylene radicals linked one to the other, said statistically represented product having five such chains (segments) comprising three hydrophobic chains (segments) linked by two hydrophilic chains, the central hydrophobic chain (segment) constituting 30% to 34% by weight of the product, the terminal hydrophobic chains (segments) together constituting 31% to 39% by weight of the product, the linking hydrophilic chains (segments) constituting 31% to 35% by weight of the product, the intrinsic viscosity of the product being from about 0.06 to 0.09 and the molecular weight of the product being from about 3000 to 5000.

The polyalkylene glycol mixture is prepared by condensing propylene oxide with water or propylene glycol to form a polypropylene glycol, condensing ethylene oxide with the polypropylene glycol, and then condensing propylene oxide with the oxyethylated polypropylene glycol. The preparation must be carried out in the above order to yield products having the required alternating hydrophobe hydrophile structure.

Conventional machine dishwashing detergent systems originally were dry, inorganic systems and consisted entirely of mixtures of alkaline salts. The detergent system is required to perform three essential functions: (1) soften the water so that the detersive action can take place more effectively; (2) remove the soil from the dishes thoroughly, completely and rapidly; and (3) leave the dish surface in a state where the water drains in a continuous film without breaking into little hanging drops or streams. Many of the alkaline salts act as both water softeners and

soil removers but will be discussed on the basis of their primary function.

Sodium carbonate, although it is among the least effective water-softening agents, together with its sesquicarbonate, is almost universally used as a component in dishwashing compounds, because of its low cost. The detergent compositions of this invention can contain from 0–99% by weight sodium or potassium carbonate.

The best and most efficient water-softening ingredients are the condensed polyphosphates, including the tripolyphosphates and the pyrophosphates. The detergent compositions of this invention can contain from 0–70% by weight sodium or potassium polyphosphates. Other sequestering agents, including organic materials such as ethylenediamine-tetraacetic acid and sodium gluconate, can also be employed in compositions of this invention, particularly in formulations for dairy use containing high percentages of caustic.

Polyphosphates have been shown to promote corrosion of certain metal parts of dishwashing machines but this corrosive effect can be overcome by including a relatively large proportion of a silicate in the composition. In this connection, metasilicate is important, not only from the standpoint of the machine itself, but also from the standpoint of the utensils washed. For instance, regardless of whether polyphosphate is present in a solution or not, highly alkaline dishwashing detergents containing no silicates can attack, etch, and darken aluminum utensils. Some of these formulations also have a destructive action on the over-the-glaze dish patterns. Suitable proportions of silicates in the formulation help overcome these difficulties.

The soil-removing ingredients commonly employed in dishwashing compounds include borates and carbonates, which are relatively ineffective, and orthophosphates and metasilicates, both of which are highly effective. The detergent compositions of this invention can include 0–70% by weight of trisodium or tripotassium phosphate and 0–50% by weight of sodium or potassium meta-silicate.

More recently small amounts of synthetic organic surfactants or wetting agents have been incorporated into machine dishwashing formulations to promote smooth drainage drying, i.e., to prevent water break. Some formulations include from 1% to 5% or more of a low foaming, polyethenoxy type nonionic surfactant. The detergent compositions of this invention can include 0–50% by weight of such synthetic, organic, low foaming polyethenoxy type nonionic surfactants.

Conventional machine dishwashing compositions employed for glass and bottle washing normally contain caustic soda as the major cleaning ingredient. Alkalies tend to attack glass surfaces but this can be inhibited by zincates, beryllates, or aluminates. As stated above, sodium gluconate and ethylenediaminetetracetic acid can be used as sequestering agents for high caustic content solutions. The detergent compositions of this invention can include 0–99% sodium or potassium hydroxide.

Hence the conventional detergent systems into which the polyoxyalkylene glycol mixture is incorporated contain as the principal detersive agent widely varying proportions of sodium or potassium polyphosphates, i.e., 0–70%, sodium or potassium silicates, i.e., 0–50%, sodium or potassium carbonates, i.e., 1–99%, sodium or potassium hydroxides, i.e., 0–100% and trisodium or tripotassium phosphate, i.e., 0.70%. The amount of the polyoxyalkylene glycol mixture ordinarily constitutes about 0.5 to 10% by weight of the final detergent composition.

The detergent compositions of this invention and their effectiveness in maintaining wash pressure in machine dishwashing operations in the presence of food soils are illustrated by the following examples. In these examples the polyoxyalkylene glycol product had an intrinsic viscosity of 0.0815, a molecular weight of 4620, and was prepared by condensing 2262 parts by weight of propylene

oxide with 76 parts by weight of propylene glycol to form a polypropylene glycol, then condensing 2301 parts by weight of ethylene oxide with the thus formed polypropylene glycol, then condensing 2436 parts by weight of propylene oxide with the thus formed oxyethylated polypropylene glycol. The central polypropylene hydrophobe segment thus constituted 32.8% by weight of the product, the two polyethylene hydrophile linking segments together constituted 32.6% by weight of the product, and the two polypropylene hydrophobe terminal segments constituted 34.4% by weight of the product. The remaining 0.2% was water. Such a product can be prepared by conventional oxyalkylation procedures as described immediately below.

To a 25 gallon autoclave equipped with a mechanical stirrer there is added 76 grams (1 mole) of propylene glycol and 7.5 grams of powdered caustic soda. The autoclave is then sealed, flushed with nitrogen, heated to 100° C., and placed under vacuum to remove any nitrogen and any moisture. The stirrer is started, the temperature is raised to 125°–130° C. and the propylene oxide is admitted to the autoclave. The temperature is maintained at 125°–130° C. and the pressure is kept at approximately 10 to 15 pounds per square inch. When the addition of 2262 grams of propylene oxide is completed and a vacuum noted on the autoclave, the addition of ethylene oxide is begun. When the addition of 2301 grams (52.3 moles) of ethylene oxide is complete and a vacuum again noted in the autoclave, the addition of propylene oxide is commenced again. When this propylene oxide addition is completed, the product is cooled under nitrogen, the caustic soda catalyst is neutralized with sulfuric acid, and the product is separated.

EXAMPLE I

A machine dishwashing detergent composition of this invention was prepared having the following formulation in weight percent.

36% light ash (sodium carbonate)
25% sodium tripolyphosphate
35% anhydrous sodium metasilicate
4% polyoxyalkylene glycol described above.

This detergent formulation was added to a wash solution, containing 0.1% by weight of whole raw egg as the soil load, in an AM–4 Model Hobart commercial dishwashing machine to provide a detergent concentration of 0.2% by weight. The dishwashing machine had a pitot tube fastened directly over the wash jet in the lower arm. This pitot tube was connected directly to an open end mercury manometer. The pressure developed by the force of the wash water coming out of the wash jet was then measured directly on the manometer.

Four additional formulations were prepared having the same inorganics in the same basic ratio as in the above formulation but having differing amounts of the polyoxyalkylene glycol described above, as follows:

Example I–A—3% polyoxyalkylene glycol
Example 1–B—2% polyoxyalkylene glycol
Example 1–C—1% polyoxyalkylene glycol
Example I–D—0% polyoxyalkylene glycol

These detergent formulations were tested in wash solutions under the same conditions of whole egg soil and detergent concentrations as was the detergent formulation of Example I. The results in terms of wash perssure are shown in FIGURE 1 of the accompanying drawing and indicate that the wash pressure is directly proportional to the amount of polyoxyalkylene glycol in the detergent composition.

EXAMPLE II

A machine dishwashing detergent composition of this

invention was prepared having the following formulation in weight percent.

21.13% light ash (sodium carbonate)
19.47% sodium hydroxide
21.65% dense ash (sodium carbonate)
21.65% sodium tripolyphosphate, granular
12.98% sodium pyrophosphate, granular
2.02% polyoxyalkylene glycol described above.

This detergent formulation was added to a wash solution, containing 0.3% of milk solids as the soil load, in an AM–4 Model Hobart commercial dishwashing machine to provide a detergent concentration of 0.2% by weight. The dishwashing machine was equipped with a pitot tube as described in Example I.

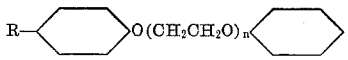
Four additional formulations were prepared having the same inorganics in the same basic ratio as in the above formulation but having differing amounts of the polyoxyalkylene glycol described above, as follows:

	Percent
Example II–A	0
Example II–B	1
Example II–C	3
Example II–D	4

These detergent formulations were tested in wash solutions under the same conditions of milk solids soil and detergent concentrations as was the detergent formulation of Example II. The results are shown in FIGURE 2 of the accompanying drawing and indicate that the wash pressure is related to the amount of polyoxyalkylene glycol in the detergent composition.

The formulations of Examples II and IIA were added to wash solutions, containing whole raw egg in varying amounts, as the soil load in an AM–4 Model Hobart commercial dishwashing machine to provide a detergent concentration of 0.2% by weight. The dishwashing machine was equipped with a pitot tube as described in Example I. The results are shown in FIGURE 3 of the accompanying drawing.

In order to compare the effect on wash pressure of the detergent compositions of this invention, containing the nonionic polyoxyalkylene glycol described above with detergent compositions containing well known commercial low foaming synthetic nonionic organic surfactants, five of such nonionic surfactants were used in varying amounts in preparing formulations having the same inorganics in the same basic ratio as in the formulation of Example I. These detergent formulations were added to a wash solution, containing 0.1% whole raw egg as the soil load, in an AM–4 Model Hobart commercial dishwashing machine to provide a total detergent concentration of 0.2% by weight. The dishwashing machine was equipped with a pitot tube as described in Example I and wash pressure was determined in each case. The detergent compositions tested and the wash pressure of each in solution are shown in the following Table I and are depicted graphically in FIGURE 4. Nonionic A is a material having the general formula



Nonionics B and C are nonylphenoxy polyoxyethylene ethanols containing approximately two and four ethoxy groups respectively. Nonionics D and E are oxyethylated polyoxypropylene glycols wherein the polyoxypropylene hydrophobe base has a molecular weight of 1750 and has been reacted with ethylene oxide to provide a polyoxyethylene hydrophile unit representing 10 and 20 percent respectively of the total molecule. As shown in Table I and graphically in FIGURE 4, the wash pressure obtained using the Example I nonionics was higher than that using any of the other nonionics.

Table I

Type Nonionic	Percent Nonionic in Total Formulation	Wash Pressure (mm. Hg)
Nonionic A	1.0	4
Do	2.0	16
Do	4.0	19
Do	6.0	14
Do	8.0	25
Do	10.0	25
Nonionic B	1	6
Do	2	5
Do	4	5
Do	8	7
Do	10	15
Nonionic C	1	3
Do	2	3
Do	4	3
Do	8	7
Do	10	
Nonionic D	1	15
Do	2	16
Do	4	16
Do	6	15
Do	10	14
Nonionic E	1	13
Do	2	12
Do	4	11
Do	6	11
Do	10	10
Example I	1	21
Do	2	32
Do	4	41
Do	6	49
Do	8	49
Do	10	49

EXAMPLE III

A machine dishwashing detergent composition of this invention having a high proportion of caustic soda and particularly useful for dairy applications was prepared having the following formulation:

7.5 grams sodium tripolyphosphate
2.0 grams heptagluconate
2.0 grams sodium gluconate
0.5 grams polyoxyalkylene glycol described above
88.0 grams sodium hydroxide, flake

The use of powdered tripolyphosphate helps protect the caustic from excessive moisture absorption. This formulation exhibited noticeably less foaming than a similar formulation, designated Example III–A having the same constituents, except the polyoxyalkylene glycol, in the same basic ratio. Foaming was checked by means of the following experimental procedure:

Two clean pint jars were filled with 150 ml. of water at 140° F. to 150° F. To one of the jars was added a sufficient quantity of the formulation of Example III to give a 1% solution. To the other jar was added the same amount of the formulation of Example III–A. Both jars were shaken until the solid material was dissolved. To each jar was then added 0.75% of non-fat dry milk solids. Both jars were then shaken vigorously 50 times. The jars were then set down and foam heights compared. The jar containing Example III had no foam, while the other jar had copious foam.

Actually, the polyoxyalkylene glycol can be used alone with caustic soda or caustic potash with equally good results so far as foaming is concerned. The other constituents present in Example III are there for purposes other than foam control.

EXAMPLE IV

For cleaning formulations to be used in water containing appreciable amounts of hardness, detergent compositions containing phosphates in forms other than the ortho form are usually preferred because of the tendency of the orthophosphate to precipitate out hardness and give rise to hard water films on machines and utensils. As a straight water softening chemical, however, trisodium

orthophosphate is quite effective, and for many years formulations based on commercial trisodium orthophosphate were widely used for commercial dishwashing purposes. Furthermore, even today, formulations containing large percentages of trisodium orthophosphate are in use for many general cleaning purposes.

A machine dishwashing detergent composition of this invention for use in water containing considerable hardness and having a high proportion of trisodium orthophosphate was prepared having the following formulation:

50.0 grams trisodium orthophosphate
25.2 grams sodium tripolyphosphate
20.8 grams sodium metasilicate, pentahydrate
4.0 grams polyoxypropylene glycol described above.

When such a formulation is compared with a similar one in which the polyoxypropylene glycol is replaced by sodium tripolyphosphate under conditions which would normally give foam, the formulation of Example IV eliminates the foam completely while the formulation without the polyoxyalkylene glycol does not.

EXAMPLE V

Recently the use of orthophosphates containing available chlorine in commercial machine dishwashing formulations has become advantageous. Under some conditions where these formulations are employed, foaming is a problem. A machine dishwashing detergent composition of this invention including an orthophosphate containing available chlorine was prepared having the following formulation:

50.0 grams chlorinated trisodium orthophosphate
25.2 grams sodium tripolyphosphate
20.8 grams sodium metasilicate, pentahydrate
4.0 grams polyoxyalkylene glycol described above.

When such a formulation is compared with a similar one in which the polyoxypropylene glycol is replaced by sodium tripolyphosphate under conditions which would normally give foam, the formulation of Example V eliminates the foam completely while the formulation without the polyoxyalkylyene glycol does not.

There is a tendency for the chlorinated trisodium orthophosphate and the polyoxyalkylene glycol to react with each other during storage of formulations such as that of Example V, thereby dissipating the active chlorine and reducing the effectiveness of the polyoxyalkylene glycol in maintaining wash pressure. This reaction of the chlorinated trisodium orthophosphate and the polyoxyalkylene glycol can be inhibited, however, by coating the chlorinated trisodium orthophosphate with, for example, cetyl alcohol so that relatively stable detergent compositions can be prepared. Also, the inorganic components of formulations such as that of Example V can be stored separately from the organic component and can be admixed just prior to addition to the wash solution or can be separately added to the wash solution.

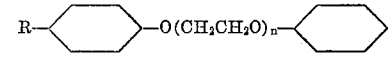
EXAMPLES VI–VIII

Conventional detergent systems for machine dishwashing are for the most part dry, solid systems. In concentrated liquid dishwashing formulations containing inorganic salts and nonionic surfactants, the constituents tend to salt out and separate. To obviate this, the nonionic surfactant can be admixed with the other portion of the liquid formulation just prior to addition to the wash solution or can be separately added to the wash solution. Viscous paste formulations can be prepared, however, and machine dishwashing compositions of this invention in the form of a viscous paste were prepared having the formulation set forth in Table II below:

Table II

Ingredients	Example VI	Example VII	Example VIII
Polyethylene glycol, Mol. wt. 400 grams	33	32	31
Polyoxyalkylene glycol described above, grams	1	5	10
Sodium tripolyphosphate, anhydrous, grams	24	23	22
Sodium metasilicate, anhydrous, grams	42	40	37

At the same time, formulations identical in all respects to Examples VI–VIII were prepared except that a nonionic surfactant of the general formula



was substituted for the polyoxyalkylene glycol and identified as Examples VI–A, VII–A, and VIII–A. Ten cycle wash tests were run on all these formulations in a typical home type dishwashing machine. The results were as follows:

Formulation	Detergency	Foaming Test
Example VI	Very good	Good.
Example VII	do	Very good.
Example VIII	Good	Do.
Example VI–A	do	Fair.
Example VII–A	do	Good.
Example VIII–A	Very good	Do.

For machine dishwashing purposes these paste formulations can be used in various concentrations but optimum concentrations are from 0.3% to 0.5% by weight of the wash solution.

In Examples I–VIII, the food soil employed was whole raw egg or milk solids since these soils tend to cause a greater decrease in wash pressure than do such soils as flour and oleomargarine. Moreover, tests in a typical commercial dishwashing machine, wherein a conventional dishwashing compound was employed at a concentration of 0.2%, show that such protein soils as egg and milk begin to affect wash pressure at the lowest concentrations. For example, at 0.1% soil concentration, egg and powdered milk reduced wash pressure by about 80%. Even 0.001% of these soils (equivalent to about 15 drops) reduced wash pressure by 60%.

Also in Examples I–VIII normal wash solution temperatures were employed. These are 140° F.–150° F. for home dishwashing machines and in the range of 180° F. for commercial machines. It is known, however, that foaming is related to wash temperature; that, in general, the lower the temperature, the greater the loss in wash pressure, and that wash pressure drops sharply at temperatures below about 110° F. This is true even when detergent compositions of the present invention are employed.

In addition to being effective in maintaining wash pressure, the compositions of this invention are good detergents and permit smooth drainage drying. Detergency tests run using Kitchen Aid, General Electric and Hotpoint home dishwashing machines show that the compositions of this invention, such as that of Example I, are equivalent or superior to similar formulations, differing only in that the 5 conventional low-foaming nonionics referred to in Table I were substituted for the polyoxyalkylene glycol in Example I, in terms of the number of prominent and faint spots which can be observed on the dishware after the washing operation.

In place of the particular polyoxyalkylene glycol employed in the formulations of Examples I–VIII, other polyoxyalkylene glycols having an intrinsic viscosity of

about 0.06 to 0.09 and a molecular weight of about 3000 to 5000 can be employed. Some polyoxyalkylene glycols together with their properties are set forth in Table III below.

Table III

Parts by Weight of Materials Used in Preparing Nonionics			Refractive Index	Cloud Point 1%, °F.	Surf. Ten. 0.1%, in H_2O at 25°, dynes/cm.	Specific Gravity	Wash Pressure [1]	Detergency [2]	Intrinsic viscosity	Mol. Wt.
Propylene Oxide Added in Step 1	Ethylene Oxide Added in Step 2	Propylene Oxide Added in Step 3								
2,262	2,288	1,450	1.4567	126	42.9	1.025	8	Only Fair	0.0686	3,350
2,262	2,288	2,030	1.4558	112	42.2	1.022	41	Good		
2,262	2,288	2,320	1.4560	106	42.3	1.022	39	Excellent	0.0768	4,130
2,262	2,288	2,610	1.4555	102–104	41.4	1.020	40	Good		
2,262	2,288	2,900	1.4553	96–98	41.0	1.019	39	Very good		
2,320	2,301	2,204	1.4568	103–104	39.0	1.019	33			
2,320	2,301	2,320	1.4562	99–101	39.3	1.020	29			
2,320	2,301	[3] 2,436	1.4560	86–90	39.3	1.018	37	Excellent	0.0815	4,620
2,320	2,301	2,204	1.4560	100–101	39.9	1.018	34			
2,320	2,301	2,320	1.4557	98–100	39.1	1.018	31			
2,320	2,301	2,436	1.4559	98	39.2	1.018	33	Very Good		

[1] Wash pressure was determined by the pitot tube method described on Example I.
[2] Detergency was determined by 10 cycle wash tests in both General Electric and Hotpoint home dishwashing machines, using a synthetic food soil composed of 4 parts oleomargarine and 1 part milk solids in a concentration of 0.7%, wherein the indicated nonionic constituted 3.9% by weight of a composition also containing 50.6% sodium tripolyphosphate, 9.7% sodium carbonate, and 35.8% sodium meta silicate, using this composition in 0.3% total detergent concentration.
[3] Employed in Examples I–VIII.

We claim:

1. A machine dishwashing composition consisting essentially of an inorganic alkali metal detergent salt and a small amount sufficient to maintain wash pressure of a polyoxyalkylene glycol mixture consisting of a product which statistically represented has a plurality of alternating hydrophobic and hydrophilic polyoxyalkylene chains, the hydrophilic chains consisting of oxyethylene radicals linked one to the other and the hydrophobic chains consisting of oxypropylene radicals linked one to the other, said statistically represented product having five such chains comprising 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 about 0.06 to 0.09 and the molecular weight of the product being from about 3000 to 5000.

2. A machine dishwashing composition consisting essentially of an inorganic alkali metal detergent salt and from about 0.5 to 10% by weight, based on the total composition, of a polyoxyalkylene glycol mixture consisting of a product which statistically represented has a plurality of alternating hydrophobic and hydrophilic polyoxyalkylene chains, the hydrophilic chains consisting of oxyethylene radicals linked one to the other and the hydrophobic chains consisting of oxypropylene radicals linked one to the other, said statistically represented product having five such chains comprising 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 about 0.06 to 0.09 and the molecular weight of the product being from about 3000 to 5000.

3. A machine dishwashing composition consisting essentially of at least one detergent salt wherein the cation is selected from the class consisting of sodium and potassium and the anion is selected from the class consisting of carbonate, polyphosphate, orthophosphate, metasilicate and hydroxide and from about 0.5 to 10% by weight, based on the total composition, of a polyoxyalkylene glycol mixture consisting of a product which statistically represented has a plurality of alternating hydrophobic and hydrophilic polyoxyalkylene chains, the hydrophilic chains consisting of oxyethylene radicals linked one to the other and the hydrophobic chains consisting of oxypropylene radicals linked one to the other, said statistically represented product having five such chains comprising 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 about 0.06 to 0.09 and the molecular weight of the product being from about 3000 to 5000.

4. A machine dishwashing composition consisting essentially of, by weight, 30–40% sodium carbonate, 20–30% sodium tripolyphosphate, 30–40% sodium metasilicate and 2–6% of a polyoxyalkylene glycol mixture consisting of a product which statistically represented has a plurality of alternating hydrophobic and hydrophilic polyoxyalkylene chains, the hydrophilic chains consisting of oxyethylene radicals linked one to the other and the hydrophobic chains consisting of oxypropylene radicals linked one to the other, said statistically represented product having five such chains comprising 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 about 0.06 to 0.09 and the molecular weight of the product being from about 3000 to 5000.

5. A machine dishwashing compostion consisting essentially of, by weight, 35–45% sodium carbonate, 30–40% sodium polyphosphate, 15–25% of sodium hydroxide, and 1–5% of a polyoxyalkylene glycol mixture consisting of a product which statistically represented has a plurality of alternating hydrophobic and hydrophilic

polyoxyalkylene chains, the hydrophilic chains consisting of oxyethylene radicals linked one to the other and the hydrophobic chains consisting of oxypropylene radicals linked one to the other, said statistically represented product having five such chains comprising 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 about 0.06 to 0.09 and the molecular weight of the product being from about 3000 to 5000.

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