United States Patent [19]

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[11] **3,855,139**

[45] **Dec. 17, 1974**

[54] **MACHINE DISHWASHING FORMULATIONS CONTAINING A METAL TETRACARBOXYLATE**

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[22] Filed: **Dec. 4, 1972**

[21] Appl. No.: **312,238**

[52] **U.S. Cl.** ..... **252/99,** 252/192, 252/538, 252/539, 252/187 C

[51] **Int. Cl.** **C11d 7/56**

[58] **Field of Search** ..... 252/95, 99, 164, 170, 192, 252/425, 538, 539, 187 C

[56] **References Cited**

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[57] **ABSTRACT**

Machine dishwashing composition containing a low foaming surfactant, a chlorine source, and tetra-alkali metal ethane-1,1,2,2-tetracaboxylate provide effective cleaning action.

7 Claims, No Drawings

MACHINE DISHWASHING FORMULATIONS CONTAINING A METAL TETRACARBOXYLATE

BACKGROUND OF THE INVENTION

Field of the Invention

This invention relates to novel machine dishwashing formulations of the type suited for use in conventional domestic mechanical dishwashers.

As is common knowledge mechanical dishwashers are now in widespread home use. In such devices, dishes, glasses, tableware, etc., are washed, rinsed and dried usually via timed, automatic cycles.

To be suitable for use in machine dishwashing, a cleansing composition must effectively clean the articles being washed and allow them to complete the drying cycle without excessive filming or spotting. The presently utilized dishwashing formulations commonly contain as essential ingredients a low-foaming surfactant, generally of the nonionic type, a chlorine source and an alkali metal tripolyphosphate. The alkali metal tripolyphosphate is a particularly important ingredient which is largely credited with the low-spotting, low-filming performance which has made home dishwashing machines a practical commercial success.

However, it has now been suggested by some researchers that the introduction of large amounts of alkali metal tripolyphosphates into lakes by sewage systems may, in some instances, accelerate the undesirable natural process of eutrophication. As a result, it has been suggested and, in some instances, legislation has been proposed to reduce or eliminate the alkali metal tripolyphosphate content of various cleansing compositions. Accordingly, much effort has been expended to develop suitable substitutes for alkali metal tripolyphosphates in various cleaning compositions. The task of finding suitable replacements for alkali metal polyphosphates is particularly difficult in that the manner in which such polyphosphates and potential substitutes therefor function is complex, not fully understood, and apparently different in different cleaning applications. Thus, not only is the selection of the replacement for polyphosphates in a particular application an empirical and unpredictable matter but the functionality of a particular material in one application cannot be considered as indication of its effectiveness in other applications. For example, the fact that a particular material exhibits some degree of utility in fabric washing cannot be considered as indicative of potential utility for the same material in machine dishwashing formulations. As illustrative of this fact, it is noted that the use of sodium carbonate, disodium oxidacetate, sodium gluconate and sodium gluco heptonate have been suggested as total or partial replacements for alkali metal tripolyphosphates in heavy duty laundry (fabric cleaning) formulations. Although these materials are found to exhibit detergency building action in fabric washing applications (although generally to a less effective degree than the alkali metal tripolyphosphate) it is found that these materials are not effective to prevent filming and spotting in machine dishwashing formulations.

Aside from current interests in developing machine dishwashing compositions of reduced phosphate content, the development of compositions characterized by improved performance remains, of course, a continued objective of the detergent industry.

SUMMARY OF THE INVENTION

It is an object of this invention to provide novel machine dishwashing formulations characterized by reduced phosphate content and improved performance.

The compositions of this invention which accomplish this object contain a low-foaming surfactant, a chlorine source and tetra alkali metal ethane-1,1,2,2-tetracarboxylate as hereinafter described. The invention will be understood from the following description of the preferred embodiments.

DESCRIPTION OF THE PREFERRED EMBODIMENTS

As indicated above, the essential components of the compositions of this invention are a surfactant, a chlorocyan-urate and tetra alkali metal ethane-1,1,2,2-tetracarboxylate.

The surfactants used in the compositions of this invention can be any of the low-foaming nonionic or anionic surfactants of the type conventionally employed in machine dishwashing formulations.

The term "low-foaming" surfactant conotes a surfactant which, in the test described below, reduces the revolutions of the washer jet-spray arm during the wash and rinse cycles less than 15%, preferably less than 10%.

In the test referenced above, 1.5 gms of surfactant is added to a 1969 Kitchen-Aid Home Dishwasher, Model No. KOS-16, manufactured by Hobart Manufacturing Company which is provided with means for counting revolutions of the washer jet-spray arm during wash and rinse cycles. The machine is operated using distilled water feed at a machine entrance temperature of 49°C. The number of revolutions of the jet-spray arm during the wash and rinse cycles is counted. The results are compared with those obtained by operating of the machine using no surfactant charge and percentage decrease in number of revolutions is determined.

The surfactant should, of course, be compatible with the chlorine containing component hereinafter discussed. Examples of suitable nonionic surfactants include ethoxylated alkyl phenols, ethoxylated alcohols (both mono- and di- hydroxy alcohols), polyoxyalkylene glycols, aliphatic polyethers and the like. The widely commercially utilized condensates of polyoxypropylene glycols having molecular weights of from about 1400 to 2200 with ethylene oxide (the ethylene oxide constituting 5 to 35 weight % of the condensate) are, for example, advantageously used in the formulations of this invention.

Suitable low-foaming anionic surfactants include alkyldiphenyl ether sulfonates such as sodium dodecyl diphenyl ether disulfonates and alkyl naphthalene sulfonates.

Mixtures of suitable surfactants can be utilized, if desired.

The surfactant component will constitute from 0.5 to 5%, preferably from 1 to 4% by weight of the compositions of this invention.

To aid in cleaning action, rinsing characteristics and provide desirable germicide and sanitizer action, the compositions of this invention will contain from 0.5% to 5%, preferably 1% to 3% by weight of a chlorocyanurate or from 10% to 30% by weight chlorionated trisodium phosphate. The chlorocyanurate can be sodium

or potassium dichlorocyanurate; [(mono-trichloro) tetra-(monopotassium dichloro)] penta-isocyanurate; (mono-trichloro) (monopotassium dichloro) di-isocyanurate or mixtures thereof. The use of the dichlorocyanurates or the [(mono-trichloro) tetra-(monopotassium dichloro)] penta-isocyanurate is particularly preferred.

The remaining essential ingredient of the formulation will be tetra alkali metal ethane 1,1,2,2-tetracarboxylate, preferably tetrasodium ethane-1,1,2,2-tetracarboxylate which will constitute from 20% to 90%, preferably from 35% to 50% by weight of the formulation.

Such carboxylates can be prepared by treating diethyl bromomalonate with sodium carbonate followed by reaction of the resulting ester with an alkali metal hydroxide as described by Malachowski and Sienkiewiczowa, *Ber.*, 68, 33 (1935) and in *Organic Synthesis*, Coll. Volume II, page 273 (1943).

Desirable, the formulation will additionally contain from 5% to 30% by weight soluble sodium silicate having an SiO_2 to Na_2O mole ratio of from 1:1 to 3.2:1, preferably about 2.4:1 to inhibit corrosion of metal parts of dishwashing machines and provide overglaze protection to fine china.

The balance, if any, of the dishwashing formulation of this invention will be essentially conventional filler components such as soda ash, sodium chloride, sodium sulfate, water or mixtures thereof.

If desired, the formulation may also contain minor amounts of conventional additives such as anti-tarnish agents.

The formulations of this invention are further illustrated by the following examples wherein all percentages are by weight unless otherwise indicated.

EXAMPLE I

A machine dishwashing composition consisting of 50% tetrasodium ethane-1,1,2,2-tetracarboxylate; 35% of a 47% by weight aqueous solution of sodium silicate having an SiO_2 to Na_2O mole ratio of 2.4; 3% Pluronic L-62 (a nonionic surfactant marketed by Wyandotte Chemical Corp., which is an ethylene oxide condensate of a polyoxypropylene glycol); 1.2% potassium dichloro-cyanurate; and 10.8% sodium sulfate is prepared. The formulation is used to wash soiled dishes and glassware in a conventional automatic home dishwashing machine.

Excellent cleaning is obtained and, in particular, the glassware is found substantially free from filming and spotting.

EXAMPLE II

A machine dishwashing formulation identical to that of Example I except that Triton CF 10 (an alkyl aryl polyether surfactant manufactured by Rohm and Haas) is substituted for the Pluronic L-62 is prepared and tested as in Example I. Comparable results are obtained.

EXAMPLE III

A formulation identical to that of Example I with the exception that a condensate of an internal, vicinal, linear diol having an average chain length of about 16 carbon atoms with 3 molecular proportions of ethylene oxide is substituted for the Pluronic L-62 is prepared and tested. Comparable results are obtained in tests such as conducted in Example I.

EXAMPLE IV

A formulation identical to that of Example I with the exception that a condensate of n-decanol with 2-3 molecular proportions of ethylene oxide is substituted for Pluronic L-62 is prepared and tested as in Example I. Effective cleaning action is obtained.

EXAMPLE V

The dishwashing test of Example I is repeated with an otherwise identical formulation containing sodium decyl diphenyl ether disulfonate as surfactant. Comparable results are obtained.

What is claimed is:

1. A machine dishwashing formulation comprising

a. from 0.5 to 5% by weight of a surfactant selected from the group consisting of low-foaming anionic and nonionic surfactants and mixtures thereof,

b. an active chlorine providing material selected from the group consisting of potassium dichlorocyanurate; sodium dichlorocyanurate; [(mono-trichloro) tetra-(monopotassium dichloro)] penta-isocyanurate; (mono-trichloro) (mono-potassium dichloro) di-iso-cyanurate; and chlorinated trisodium phosphate, said active chlorine providing material constituting from 10 to 30% by weight of the formulation when said material is chlorinated trisodium phosphate and from 0.5 to 5% by weight of the formulation when said material is a chlorocyanurate, and

c. from 20% to 90% of a tetra alkali metal ethane-1,1,2,2-tetracarboxylate.

2. The formulation of claim **1** wherein the tetra alkali metal ethane-1,1,2,2-tetracarboxylate constitutes from 35% to 50% of the weight of the formulation.

3. The formulation of claim **2** wherein the tetra alkali metal ethane-1,1,2,2-tetracarboxylate is tetrasodium ethane-1,1,2,2-tetracarboxylate.

4. The formulation of claim **2** wherein said surfactant is a nonionic surfactant.

5. The formulation of claim **4** wherein said active chlorine providing material is potassium dichlorocyanurate.

6. The formulation of claim **4** wherein said surfactant is a condensate of polyoxypropylene glycol having a molecular weight of 1400 to 2200 with ethylene oxide said ethylene oxide constituting 5% to 35% of the weight of the condensate.

7. The formulation of claim **4** wherein said formulation additionally contains 5% to 30% by weight soluble sodium silicate having an SiO_2 to Na_2O mole ratio of from 1:1 to 3.2:1.

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