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RINSE AID COMPOSITIONS

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8 Claims

ABSTRACT OF THE DISCLOSURE

The invention disclosed is directed to a rinse aid for use in mechanical dishwashing machines and includes prescribed amounts of an alkali metal or ammonium salt of an alcohol sulfate of the formula ROSO_3H where R is an alkyl group having about 5 to 9 carbon atoms, and prescribed amounts of a defined nonionic surfactant. The rinse aid may further include materials such as defoaming agents, solvents, ingredients to precipitate hard water salts, and the like.

This application is a continuation of application Ser. No. 571,989, filed Aug. 12, 1966, now abandoned.

This invention relates to compositions suitable for use as a rinse aid in mechanical dishwashing machines.

Practically all larger restaurants and commercial and institutional food handling installations are equipped with one or more mechanical dishwashing machines. There is, furthermore, an increasing market for the home dishwashing machine. In the larger institutional type of machine the dishes and utensils are placed on racks or a belt and conveyed through various cycles and/or chambers of the dishwashing machine. The stages or cycles usually include a pre-rinse of warm water at about 110° to 120° F., a spray wash at about 140° to 160° F. using approximately a 0.2 percent aqueous solution of detergent, a warm water rinse at about 170° to 190° F. and a final rinse at about 180° to 200° F. Normally, the pre-rinse, wash and water rinse chambers of the machine contain a tank to hold the liquid, a pump and spray nozzles arranged parallel to the belt so that the dishes are sprayed from the top and bottom as they are conveyed through the machine so that all areas of the dishes and utensils are reached by the liquid sprays. The final rinse is a high pressure mist-type spray which is normally perpendicular to the direction of travel of the dishes. The final rinse time is typically about 5 to 10 seconds. The final rinse temperature is usually about 180° to 200° F. as a sanitation measure and to speed drying time.

As is known in the art, the final rinse water contains a very small amount (approximately 200 parts per million) of a surface active rinse aid composition to promote wetting and to produce a sheet flow, thereby reducing water spotting, increasing the run off speed of the water and reducing the drying time.

In all mechanical dishwashing equipment, a serious problem results from aeration and foaming of the washing solution or rinsing water. The foam is produced primarily by the accumulation of protein food soils (such as egg solids and milk solids) during the various cycles as the dishes are washed. These materials have a natural tendency to foam. Also, since most dishwashing detergents are composed of inorganic alkaline salts (e.g., carbonates, silicates, phosphates and hydroxides), the fatty food soils become saponified in the hot solution and produce copious foam in the machine, even though the inorganic dishwashing detergents do not foam in

themselves. The foam not only causes the machines to overflow but also, and more importantly, reduces the pressure of the sprays and cleaning efficiency. Such foaming has been known to burn out pump motors because of overload.

It is known in the art that addition of a small amount (usually 0.5 to 4 weight percent of nonionic, high molecular weight polyoxyalkylene) glycols or high molecular weight alcohols to the inorganic detergent formulation will decrease the foaming effect of food soils. However, the use of a rinse aid in the final rinse spray produces a major undesirable counteraction. Due to splash and/or physical construction of the machine, a portion of the final rinse spray carries back into the rinse section, the wash section or the pre-rinse section of the machine. The low-foaming or non-foaming surfactants best suited for use in the final rinse spray at 180° to 200° F. frequently contribute to foaming in the other sections or cycles of the dishwashing machine, which operate at lower temperatures. Moreover, all commercial surfactants used for defoaming food soil, produce relatively very poor sheet flow in the final rinse, and leave streaks and residue on glassware and dishware. They frequently congeal when injected into the 180° to 200° F. final rinse water and form spots and streaks on glassware. They have been known to congeal and clog the small diameter injection lines and nozzles in the final rinse spray system.

It is an object of this invention to provide an improved rinse aid composition which is not subject to the above limitations.

Another object of this invention is to provide a final rinse aid composition which gives good sheet flow and little or no residue (and consequent spotting) and which also, at the same time, does not contribute to foaming in the preceding sections or cycles of mechanical dishwashing machines.

Still another object of this invention is to provide a method for decreasing the foam production in mechanical dishwashers resulting from the rinse aid compositions used in the final rinse section or cycle while retaining desired good sheet flow and low residue.

Further objects and the many advantages of this invention will become apparent to those skilled in the art after considering the following more detailed disclosure.

It has been discovered that the objectives of this invention can be achieved by a rinse aid composition containing a unique blend of surface active agents including, as essential ingredients, an alkali metal or ammonium salt (e.g., the sodium salt) of an alcohol sulfate having the formula ROSO_3H , wherein R is an alkyl group having about 5 to 9 carbon atoms (which group may be either straight or branched chain) and a non-ionic surfactant which is a poly (oxyalkylene) condensate with an active hydrogen-containing organic precursor.

Examples of suitable alcohol sulfate salts are sodium n-octyl sulfate, sodium n-hexyl sulfate, sodium 2-ethyl-1-hexyl sulfate, and sodium 2-ethyl-4-methyl-1-phenyl sulfate. The said alcohol sulfate salts provide excellent sheet flow, reduced water spotting, little or no residue, high cloud point, and fast wetting properties in the final rinse. They do tend to contribute to foaming in the other cycles or sections of the mechanical dishwashing machine and, because of their excellent wetting, tend to hinder the desired fast drying. To overcome these undesirable effects the alcohol sulfate salts used in the rinse aid compositions of this invention are blended with the commercially available low foaming nonionic poly (oxyalkylene) condensates with active hydrogen-containing organic compounds which have previously been used, per se, as the surface active agent in final rinse aid compositions.

Typical examples of suitable nonionic wetting agents used as the second essential ingredient in the rinse aid compositions of this invention are the following commercially available materials which are identified by the respective manufacturers as indicated:

- (a) Igepal CO-210, -430, -520, -610, -630, -633, -710, -730 and -850 [nonylphenoxypoly(ethyleneoxy)ethanol];
- (b) Pluronic L 42, L 43, L 44, L 61, L 62, L 63, L 64, L 72, L 92 and L 101 (condensate of ethylene oxide with a hydrophobic base formed by condensing propylene oxide with propylene glycol);
- (c) Plurafac RA-10 (polyoxyalkylene block copolymer);
- (d) Surfonic LF-6 and LF-7 (alkyl polyoxyalkylene ethers);
- (e) Triton CF-10, and CF-21 (alkylaryl polyether);
- (f) Triton N-100, -101, and N-128 (nonyl phenyl polyethoxy ethanol);
- (g) Tergitol NP-33, -35, -40 and NP-44 (nonyl phenyl polyethylene glycol ether);
- (h) Igepal LO-210, -430, -530, -610, -630, -710, -720 and LO-730 [straight chain nonphenoxypoly(ethyleneoxy)ethanols];
- (i) Antarox BL330 and BL340 (alifatic (sic) polyether);
- (j) Plurafac A 16, A 25, A 26, B 16, and B 26 (oxyethylated straight chain alcohols);
- (k) Biosoft EA-10 and EA-12 (ethoxylated fatty alcohol);
- (l) Makon NF-5 and NF-12 (polyalkoxylated aliphatic base);
- (m) Tergitol 15-S-3 and 15-S-9 (polyethylene glycol ether of linear secondary alcohol);
- (n) Surfonic LF-16 and LF-17 (alkyl polyoxyalkylene ethers);
- (o) Sterox MJ-b (alkyl phenol ethylene oxide adduct); and
- (p) Surfactant DF 12 and DF 14 (polyethoxylated straight chain alcohol).

It is highly desirable that the surface active agents be biodegradable and for this reason, the rinse aid compositions most preferably contain as the essential ingredients a biodegradable alcohol sulfate salt such as sodium n-hexyl or sodium n-octyl sulfate and a biodegradable nonionic surfactant such as those included in items (h) through (p) in the foregoing listing of suitable nonionic surfactants.

The final rinse aid compositions of this invention include from about 5 to about 40 parts, by weight, of the alcohol sulfate salt and from about 5 to about 40 parts, by weight, of the nonionic poly (oxyalkylene) condensate surfactant. The weight ratio of sulfate salt to the nonionic surfactant may range from about 0.5 to about 5.0 but preferably ranges from about 0.75 to about 1.5.

The improved final rinse aid compositions may be, but are not necessarily, prepared in the form of solutions suitable for use, as is, by the ultimate user. The most suitable solvent is water where this is appropriate. Occasionally, depending upon the particular materials chosen for formulation into the improved rinse aid compositions, a minor proportion of a co-solvent such as ethanol, isopropanol or butyl Cellosolve (defined in The Merck Index 7th Ed. at page 180 to be ethylene glycol monobutyl ether) is used to assure complete dissolution of the rinse aid ingredients. Typically this will involve, when desired, the use of a solvent comprising water and up to about 25 percent by weight (based on total weight) of a co-solvent, e.g., isopropanol. Specific ranges for any particular case will, of course, depend upon the specific ingredients to be dissolved and their relative proportions. Routine empirical testing and/or the specific examples presented hereinafter will suffice to show those skilled in the art the general and preferred ranges of co-solvent proportions. In all cases the solvents chosen should

provide stable solutions at temperatures ranging from ambient temperature up to at least about 140° F. This temperature stability is important for purposes of shipment under various weather conditions and also to preclude clouding or precipitation from solution in the reservoir of the dispensing equipment for the rinse aid composition, which is usually mounted on or closely adjacent to the mechanical dishwasher.

In addition to the essential ingredients described above, the final rinse aid compositions of this invention may include, as optional additional ingredients any one, or a combination of, a defoaming agent, an acidifying material which serves to inhibit precipitation of water hardness salts, and an anionic wetting agent to increase wetting and decrease residue.

Suitable defoaming agents for the compositions of this invention include high molecular weight (from about 3,000 to 5,000) poly(oxyalkylene)glycols and higher aliphatic monohydric alcohols such as those containing from about 8 to about 10 carbon atoms. The defoaming agents, when used, typically comprise from a small amount up to about 10 percent of the total weight of the rinse aid compositions.

The acidifying agents which may be used to inhibit precipitation of hard water salts may be either inorganic or organic acids. Suitable inorganic acids are hydrochloric and phosphoric acids. Examples of organic acids which may be used are glycolic, tartaric, citric, lactic and glyconic acids. These ingredients, when used, typically comprise from a small amount up to about 10 percent of the total weight of the rinse aid compositions.

A wide variety of other anionic wetting agents may be used in the practice of this invention. In general, it has been observed that although they exhibit excellent wetting and frequently show very little residue, they also have the undesirable features of foaming in the final dishwasher rinse as well as contributing to production of copious foam in the wash and rinse compartments or cycles of the dishwasher. In addition they also lead to slow run off and drying time. Preferably these additional optional ingredients will not be used in the compositions of this invention. If their presence is found desirable for some special purpose, the concentration is kept as low as possible, typically on the order of from a small amount up to not more than 5 percent of the total weight. Suitable additional anionic surfactants which may be used include sodium lauroyl sarcosinate; sodium dihexyl sulfosuccinate; sodium di-octyl sulfosuccinate; dodecyl and tridecyl benzene sulfonic acid; sodium aliphatic phosphate esters, and alkyl naphthylene sodium sulfonate.

The invention is further shown by the following specific non-limiting examples.

EXAMPLES

The following are representative specific examples of final rinse aid compositions within the scope of the present invention. Each has been found, in laboratory and preliminary field testing, to be eminently suitable for the intended purposes. Each was found to produce either slight or no foam in the wash section and the water rinse sections or cycles of mechanical dishwashing machines in which they were tested. All exhibited fast drying time on glassware, on china and plastic dishes and on silverware with a minimum of residue and streaking.

EXAMPLE 1

	Weight percent
Water -----	40.0
Sodium 2-ethylhexyl sulfate -----	25.0
Polyalkoxylated aliphatic base (Makon NF-5) ---	20.0
70% phosphoric acid -----	10.0
Anionic surfactant (aliphatic phosphate ester) ----	5.0

5

EXAMPLE 2

	Weight percent
Water	47.0
Polyalkoxylated aliphatic base (Makon NF-5)	8.0
Sodium 2-ethyl hexyl sulfate	35.0
50% aqueous lactic acid	10.0

EXAMPLE 3

Water	52.0
Sodium n-octyl sulfate	20.0
Poly(oxyethylene) glycol ¹	5.0
50% aqueous lactic acid	10.0
Aliphatic polyether (Antarox BL330)	13.0

¹ Molecular weight between 3,000 and 5,000.

EXAMPLE 4

Water	44.5
Isopropanol	5.5
Sodium 2-ethyl hexyl sulfate	30.0
Polyethoxylated alcohol (surfactant DF-12)	20.0

EXAMPLE 5

Water	50.0
Polyalkoxylated aliphatic base (Makon NF-12)	20.0
Sodium 2-ethyl hexyl sulfate	30.0

EXAMPLE 6

Water	45.4
Isopropanol	9.0
Sodium n-octyl sulfate	25.0
Sodium lauroyl sarcosinate	1.8
Sodium di-hexyl sulfosuccinate	3.5
Poly(oxyalkylene) glycol ¹	1.8
Aliphatic polyether (Antarox BL-340)	13.8

¹ Molecular weight between 3,000 and 5,000.

EXAMPLE 7

Water	49.64
Aliphatic polyether (Antarox BL-330)	13.50
Sodium lauroyl sarcosinate	2.00
Sodium di-hexyl sulfosuccinate	1.00
Sodium n-hexyl sulfate	20.00
Polyoxy(alkylene) glycol ¹	4.86
Isopropanol	9.00

¹ Molecular weight between 3,000 and 5,000.

EXAMPLE 8

Water	63.50
Aliphatic polyether (Antarox BL-330)	15.00
Sodium n-octyl sulfate	15.00
Polyoxy(alkylene) glycol ¹	6.00
Di-octyl ester of sulfosuccinic	0.50

¹ Molecular weight between 3,000 and 5,000.

EXAMPLE 9

Water	51.0
Isopropanol	10.0
Alkyl polyoxyalkylene ether (Surfonic LF-16 or LF-17)	15.4
Sodium n-octyl sulfate	17.7
Polyoxy(alkylene) glycol ¹	5.9

¹ Molecular weight between 3,000 and 5,000.

EXAMPLE 10

Water	57.0
Isopropanol	10.0
Aliphatic polyether (Antarox BL-330)	13.0
Sodium n-octyl sulfate	15.0
Polyoxy(alkylene) glycol ¹	5.0

¹ Molecular weight between 3,000 and 5,000.

The following are specific examples of final rinse aid compositions found in laboratory testing to be unsuitable for the intended purposes.

6

EXAMPLE 11

	Weight percent
Water	75.0
Igepal LO 630	25.0

5 This composition caused high foaming in the machine.

EXAMPLE 12

	Weight percent
Water	41.0
Sterox MJ-6	22.0
Makon NF-5	37.0

Poor sheet flow, residue on glassware, and excessive foaming in the machine were observed.

EXAMPLE 13

	Weight percent
Water	35.0
Sodium xylene sulfonate	15.0
Makon NF-5	50.0

20 Poor sheet flow, residue on glassware, and excessive foaming in the machine were observed.

EXAMPLE 14

	Weight percent
Water	55.0
Tergitol 15-S-9	7.5
Tergitol 15-S-3	13.5
Makon NF-5	24.0

30 Blotchy sheet flow and residue on glassware was observed.

EXAMPLE 15

	Weight percent
Water	50.0
Triton CF 32 ¹	25.0
Peronic L61	25.0

¹ Amine polyglycol condensate.

40 Blotchy sheet flow and residue on glassware was observed.

EXAMPLE 16

	Weight percent
Water	75.0
Antarox BL 330	25.0

45 Blotchy sheet flow and residue on glassware was observed.

EXAMPLE 17

	Weight percent
Water	50.0
Triton CF-14	45.0
Biosoft EA-10	5.0

Residue on glassware was observed.

EXAMPLE 18

	Weight percent
Water	75.0
Sulfonic LR-70 ¹	25.0

¹ Ethylene oxide adduct of straight chain alcohols.

60 High foam in the machine and residue on glassware was observed.

EXAMPLE 19

	Weight percent
Water	55.0
Tergitol 15-S-3	22.5
Tergitol 15-S-9	22.5

Poor sheet flow and residue on glassware was observed.

EXAMPLE 20

	Weight percent
Water	55.0
Biosoft EA 10	22.5
Makon LF-5 ¹	22.5

75 ¹ Polyalkoxylated aliphatic base.

7

Poor sheet flow, residue on glassware and excessive foaming in the machine was observed.

EXAMPLE 21

	Weight percent
Water -----	75.0
Sterox MJ-B -----	25.0

Foaming in the machine was observed.

EXAMPLE 22

	Weight percent
Water and isopropanol -----	75.0
Hyonic PE-50 ¹ -----	25.0

¹ Alkyl phenoxy polyoxyethylene ethanol.

Poor sheet flow and foaming in the machine was observed.

Obviously, many modifications and variations of the invention as hereinabove set forth can be made without departing from the essence and scope thereof, and only such limitations should be applied as are indicated in the claims.

What is claimed is:

1. A composition suitable for use as a rinse aid in a mechanical dishwasher which consists essentially of:

(A) from about 5 to about 40 parts by weight of an alkali metal or ammonium salt of an alcohol sulfate having the formula ROSO_3H wherein R is an alkyl group having about 5 to 9 carbon atoms, and

(B) from about 5 to 40 parts by weight of a nonionic surfactant which is a poly(oxyalkylene) condensate with an active hydrogen containing organic precursor,

(C) the weight ratio of (A) to (B) ranging from about 0.5 to about 5.0.

2. The composition of claim 1 wherein the ratio of (A) to (B) is about 0.75 to about 1.5.

3. The composition of claim 1 which includes a solvent member of the group consisting of water and mixtures of water with a co-solvent selected from the group consisting of ethanol, isopropanol and ethylene glycol monobutyl ether; said water solvent being present in an amount from 40 percent to 63.5 percent by weight and said co-solvent being present in an amount from 5.5 percent up to about 25 percent by weight, all percentages based on the total weight of the composition.

4. The composition of claim 1 wherein said alcohol

8

sulfate is selected from the group consisting of sodium n-octyl sulfate, sodium n-hexyl sulfate, sodium 2-ethyl-1-hexylsulfate, and sodium 2-ethyl-4-methyl-1-pentyl sulfate.

5. The composition of claim 1 which includes from a small amount up to about 10 percent by weight of the total weight of the composition, of polyoxyalkylene glycol having a molecular weight of from about 2,000 to about 5,000 or aliphatic monohydric alcohol containing from about 8 to about 10 carbon atoms, as a defoaming agent.

6. The composition of claim 1 which includes from a small amount up to about 10 percent by weight of the total weight of the composition, of an acid selected from the group consisting of hydrochloric, phosphoric, glycolic, tartaric, citric, gluconic, and lactic acid and mixtures thereof to inhibit precipitation of hard water salts.

7. The composition of claim 1 which includes from 0.5 to 5 percent by weight of the total weight of the composition, of an anionic surfactant selected from the group consisting of sodium lauroyl sarcosinate, sodium dihexyl sulfosuccinate, sodium dioctyl sulfosuccinate, dodecyl- and tridecyl-benzene sulfonic acid.

8. The composition of claim 5 wherein said alcohol sulfate is sodium n-octyl sulfate in an amount of about 15 parts by weight, said nonionic surfactant is biodegradable and appears in an amount of about 13 parts by weight, said solvent is present in an amount of about 67 parts by weight formed of about 57 parts by weight water and about 10 parts by weight of isopropanol, and said deforming agent is present in an amount of about 5 parts by weight.

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