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(71) Applicants:

• **UNILEVER PLC**

**London EC4P 4BQ (GB)**

Designated Contracting States:

**GB IE CY**

• **UNILEVER N.V.**

**3013 AL Rotterdam (NL)**

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(72) Inventors:

• **Frank, Christian**

**75858 Paris Cedex 17 (FR)**

• **Sanderson, Alastair Richard**

**Bebington, Wirral, Merseyside, CH63 3JW (GB)**

• **Tomlinson, Alan Digby,**

**Unilever Res. Vlaardingen**

**3133 AT Vlaardingen (NL)**

(74) Representative:

**Elliott, Peter William et al**

**Unilever plc**

**Patent Division**

**Colworth House**

**Sharnbrook**

**Bedford MK44 1LQ (GB)**

(54) **A machine dishwashing kit**

(57) A mechanical dishwashing kit comprises an amount of packaged detergent composition and an amount of packaged rinse aid composition, wherein the amount of rinse aid provided is directly proportional to the amount of detergent provided. The or each of the rinse aid and the detergent are formulated to create conditions within the machine during a washing/ rinse cycle that obviate the need for a separate ion exchange regenerating salt.

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## Description

### Technical Field

[0001] The present invention is in the field of machine dishwashing. More specifically, the invention encompasses a machine dishwashing kit.

### Background of the Invention

[0002] To wash articles in a commercially available dish washing machine entails using three product types. Salt is added to the salt compartment to soften the water, a dishwashing formulation is used to clean the articles and a rinse aid is used to ensure that the articles are rinsed with no streaks or smears.

[0003] Heretofore, all of the three components have been sold separately, with each component being sold in different volumes and having different concentrations of active ingredients and different dosage instructions. Thus, when a consumer buys all three components at the same time, it is inevitable that the different components will need replacing at different times, which is an inconvenience for the consumer. Further, it is not immediately apparent when rinse aid needs to be replaced. This is primarily due to the fact that the bottle of rinse aid is generally emptied completely into a rinse aid reservoir in the machine, from which reservoir the rinse aid is automatically dosed into the machine. Thus, the consumer cannot use the bottle of rinse aid to gauge how much product remains, and must revert to checking the level of rinse aid remaining in the reservoir. As such reservoirs tend to be within the machine, this is not an ideal situation. A partial solution to this problem has been provided by some machine manufacturers with the incorporation of a warning light into the machine, which lights when the reservoir is nearly empty. However, this solution relies on the consumer noticing and heeding the warning light and acting accordingly, which in many cases simply does not happen. Furthermore, many machines do not have such warning systems.

[0004] It is an object of the invention to overcome at least some of the above problems. It is a particular object of the invention to provide a machine dishwashing kit which is formulated to provide a greater level of convenience for the consumer.

### Description of the Invention

[0005] According to the invention there is provided a machine dishwashing kit comprising equivalent amounts of rinse aid and detergent. Thus the kit may comprise:

- an amount of packaged rinse aid composition sufficient to provide X number of rinse cycles; and
- an amount of packaged detergent composition suf-

ficient to provide X/Y number of washes, wherein X is greater than or equal to Y, X and Y are whole numbers, X/Y is equal to a whole number, and Y is between 1 and 3.

[0006] In a preferred embodiment of the invention, Y is equal to 1. With this embodiment, the amount is rinse aid in the kit is directly proportional to the amount of detergent in the kit, and as such, when the detergent has been used up, a user knows that the rinse aid reservoir needs to be replenished. Thus a user simply buys the kit of the invention, empties the rinse aid into an empty rinse aid reservoir in the machine, and then uses the detergent according to the dosage instructions until no detergent remains, at which point the rinse aid reservoir will also be empty, whereby a user purchases a further kit and repeats the process. Furthermore, as the rinse aid and detergent can be formulated to be otherwise compatible, use of the kit should result in improved cleaning of dishes as opposed to the combination of products not provided in the form of a specifically designed kit.

[0007] Generally, the rinse aid and detergent are separate components which are ideally packaged separately.

[0008] In an alternative embodiment of the invention, one or both of the rinse aid and detergent composition are formulated to create conditions within the machine during a washing/rinse cycle that obviate the need for a separate ion exchange regenerating salt. Thus, the pH of the rinse aid is lowered ideally by formulating it such that it comprises 20wt% or greater of a water-soluble acid builder or salt thereof. Typically, the acid is a carboxy acid such as, for example, carboxy acid. Thus, the kit according to the invention effectively provides, in addition to the detergent and rinse aid, the effects of a dishwashing salt.

[0009] Optionally, or in addition, the detergent composition comprises greater than 20wt% of a bicarbonate salt and a silica or silicate material. Typically, the detergent composition further comprises a polymer or copolymer of acrylic acid. Ideally, a 1% aqueous solution of the detergent composition, at a temperature of 25°C, has a pH from 8.5 to 10.

[0010] In one embodiment of the invention, the detergent comprises a plurality of unit doses such as tablets, in which each tablet ideally provides sufficient detergent for a single wash cycle. Alternatively, the detergent composition is in a particulate form, wherein the kit further includes means for dispensing an accurate and consistent dose of the detergent composition, such as for example, a pourspout. The rinse aid is for the most part in the form of a liquid, however other forms are envisaged such as for example gels.

[0011] In one embodiment of the invention, the packaged detergent and rinse aid compositions are enclosed within a secondary pack. In one particularly

preferred embodiment of the invention, the kit may comprise a plurality of detergent tablets, each tablet packed in an individual pack such as a flow wrap, and a liquid rinse aid composition in a bottle, the kit further including a secondary pack having a first compartment for the wrapped tablets and a second compartment for the bottle of rinse aid.

**[0012]** In a further arrangement, the detergent composition is packaged within a first receptacle, and the rinse aid is packaged within a second receptacle, wherein the first and second receptacles engage in a retro fit manner, and ideally also in a tamper evident manner. Typically, the rinse aid receptacle engages a lid means of the detergent receptacle.

**[0013]** The invention also describes the use of a machine dishwashing kit according to the invention, wherein the rinse aid reservoir of a washing machine is drained of any residual rinse aid before the rinse aid of the kit is added to the reservoir. Preferably, the rinse aid reservoir is set such that it delivers an appropriate dose of rinse aid. Ideally the dosage of rinse aid is 3mls.

### **Detailed Description of the Invention**

#### **Dish Washing Composition**

##### **Builder material**

**[0014]** The detergency builder system is preferably water-soluble and more preferably comprises a bicarbonate salt, preferably sodium or potassium bicarbonate most especially sodium bicarbonate. Bicarbonate salts are particularly preferred as builders as they also have a buffering capacity. It is preferable if the bicarbonate is present at a level greater than 20 wt% of the total composition, more particularly at least 24 wt% of the total composition.

**[0015]** It is preferable if the builder further comprises a carboxylate or polycarboxylate builder containing from one to four carboxy groups, particularly selected from monomeric polycarboxylates or their acid forms, homo or copolymeric polycarboxylic acids or there salts in which the polycarboxylate comprises at least two carboxylic radicals selected from each other by not more than two carbon atoms. Preferred carboxylates include the polycarboxylate materials described in US-A-2,264,103, including the water-soluble alkali metal salts of mellitic acid and citric acid, dipicolinic acid, oxydisuccinic acid and alkenyl succinates. The water-soluble salts of polycarboxylate polymers and copolymers, such as are described in US-A-3,308,067 are also be suitable for use with the invention. Of the builder materials listed in the above paragraph, the preferred polycarboxylates are hydroxycarboxylates containing up to three carboxy groups per molecule, especially citric acid or its salt, particularly sodium citrate. It is preferable if the carboxylate builder is present at a level of at least 20 wt% of the total formulation,

more preferably at a level greater than 30 wt%.

**[0016]** It is preferred if the weight ratio of polycarboxylate builder to bicarbonate builder is at least 1:1, preferably greater than 3:2

**[0017]** Further soluble detergency builder salts which can be used with the present invention are poly-valent inorganic and poly-valent organic builders, or mixtures thereof. Non-limiting examples of suitable water-soluble, inorganic alkaline detergency builder salts include the alkali metal carbonates, borates, phosphates, polyphosphates, triphosphates, phosphonocarboxylates. Specific examples of such salts include the sodium and potassium tetraborates, carbonates, triphosphates, orthophosphates and hexameta-phosphates. However it is preferable if the detergent formulation is free or only has low levels (5% or less) of builder salts which precipitate during the wash in the presence of calcium, an example of such a salt is sodium triphosphate.

**[0018]** In preferred builder systems the weight ratio of alkali metal bicarbonate to alkali metal carbonate is greater than 1:1, preferably greater than 2:1 in particularly preferred systems the builder does not comprises a alkali metal carbonate.

**[0019]** Other suitable detergency builders organic alkaline compounds such as water-soluble amino poly-acetates, e.g. sodium and potassium ethylenediamine tetraacetates, nitrilotriacetates and N-(2-hydroxyethyl)nitrilodiacetates; water-soluble salts of phytic acid, e.g. sodium and potassium phytates; water-soluble polyphosphonates, including sodium, potassium and lithium salts of ethane-1-hydroxy-1,1-diphosphonic acid; sodium, potassium and lithium salts of methylenediphosphonic acid and the like.

**[0020]** It is to be understood that, while the alkali metal salts of the foregoing inorganic and organic poly-valent anionic builder salts are preferred for use herein from an economic standpoint, the ammonium, alkanolammonium, e.g. triethanol-ammonium, diethanolammonium, and the like, water-soluble salts of any of the foregoing builder anions are useful herein.

**[0021]** Mixtures of organic and/or inorganic builder salts can be used herein.

**[0022]** While any of the poly-valent builder materials are useful herein, the compositions of the invention are preferably free of phosphate builders for environmental and ecological reasons.

**[0023]** Preferred builders for use in the invention are sodium citrate and sodium bicarbonate and mixtures thereof.

**[0024]** Alternatively the potassium salts of these acids may be used.

**[0025]** Preferably, the amount of builders in the composition is from about 30 to 80% by weight, more preferably from 40 to about 70% by weight.

## Silica material

**[0026]** Suitable forms of silica include amorphous silica, such as precipitated silica, pyrogenic silica and silica gels, such as hydrogels, xerogels and aerogels, or the pure crystal forms quartz, tridymite or cristobalite, but the amorphous forms of silica are preferred. Suitable silicas may readily be obtained commercially. They are sold, for example under the Registered Trade Name Gasil 200 (ex Crosfield, UK).

**[0027]** Preferably, the silica is in the product in such a form that it can dissolve when added to the wash liquor. Therefore, addition of silica by way of addition anti-foam particles of silica and silicone oil is not preferred.

**[0028]** The particle size of the silica material of the present invention may be of importance, especially as it is believed that any silica material that remains undissolved during the washing process, may deposit on the glass at a later stage. Therefore, it is preferred that silica material are used that have a particle size (as determined with a Malvern Laser, i.e. "aggregated" particles size) of at most 40  $\mu\text{m}$ , more preferably at most 30  $\mu\text{m}$ , most preferably at most 20  $\mu\text{m}$  provides better results in the wash. In view of incorporation in a cleaning composition, it is preferred that the particle size of the silica material is at least 1  $\mu\text{m}$ , more preferably at least 2  $\mu\text{m}$ , most preferably at least 5  $\mu\text{m}$ .

**[0029]** Preferably the primary particle size of the silica is in general less than about 30 nm, in particular less than about 25 nm. Preferably, elementary particles size are less than 20 nm or even 10 nm. There is no critical lower limit of the elementary particle size; the lower limit is governed by other factors such as the manner of manufacture, etc. In general commercial available silicas have elementary particle sizes of 1 nm or more.

**[0030]** Preferably, the silica material is present in the wash liquor at a level of at least  $2.5 \times 10^{-4}\%$ , more preferably at least  $12.5 \times 10^{-4}\%$ , most preferably at least  $2.5 \times 10^{-3}\%$  by weight of the wash liquor and preferably at most  $1 \times 10^{-1}\%$ , more preferably at most  $8 \times 10^{-2}\%$ , most preferably at most  $5 \times 10^{-2}\%$  by weight of the wash liquor.

**[0031]** Preferably, the level of dissolved silica material in the wash liquor is at least 80 ppm, more preferably at least 100 ppm, most preferably at least 120 ppm and preferably at most 1,000 ppm. It is noted that for the silica material to be effective, the lower level of dissolved silica material depends on the pH value, i.e. thus at pH 6.5, the level is preferably at least 100 ppm; at pH 7.0 preferably at least 110 ppm; at pH 7.5 preferably at least 120 ppm; at pH 9.5 preferably at least 200 ppm; at pH 10 preferably at least 300 ppm; at pH 10.5 preferably at least 400 ppm.

**[0032]** Preferably, the silica material is present in the cleaning composition at a level of at least 0.1%, more preferably at least 0.5%, most preferably at least 1% by weight of the cleaning composition and preferably at most 10%, more preferably at most 8%, most preferably at most 5% by weight of the cleaning

composition.

## Silicates

**[0033]** The composition optionally comprises alkali metal silicates. The alkali metal may provide pH adjusting capability and protection against corrosion of metals and against attack on dishware, including fine china and glassware benefits.

When silicates are present, the  $\text{SiO}_2$  level should be from 1% to 25%, preferably from 2% to 20%, more preferably from 3% to 10%, based on the weight of the ADD. The ratio of  $\text{SiO}_2$  to the alkali metal oxide ( $\text{M}_2\text{O}$ , where M=alkali metal) is typically from 1 to 3.5, preferably from 1.6 to 3, more preferably from 2 to 2.8. Preferably, the alkali metal silicate is hydrous, having from 15% to 25% water, more preferably, from 17% to 20%.

**[0034]** The highly alkali metasilicates can in general be employed, although the less alkaline hydrous alkali metal silicates having a  $\text{SiO}_2:\text{M}_2\text{O}$  ratio of from 2.0 to 2.4 are, as noted, greatly preferred. Anhydrous forms of the alkali metal silicates with a  $\text{SiO}_2:\text{M}_2\text{O}$  ratio of 2.0 or more are also less preferred because they tend to be significantly less soluble than the hydrous alkali metal silicates having the same ratio.

**[0035]** Sodium and potassium, and especially sodium, silicates are preferred. A particularly preferred alkali metal silicate is a granular hydrous sodium silicate having a  $\text{SiO}_2:\text{Na}_2\text{O}$  ratio of from 2.0 to 2.4 available from PQ Corporation, named Britesil H20 and Britesil H24. Most preferred is a granular hydrous sodium silicate having a  $\text{SiO}_2:\text{Na}_2\text{O}$  ratio of 2.0. While typical forms, i.e. powder and granular, of hydrous silicate particles are suitable, preferred silicate particles having a mean particle size between 300 and 900 microns and less than 40% smaller than 150 microns and less than 5% larger than 1700 microns. Particularly preferred is a silicate particle with a mean particle size between 400 and 700 microns with less than 20% smaller than 150 microns and less than 1% larger than 1700 microns. Compositions of the present invention having a pH of 9 or less preferably will be substantially free of alkali metal silicate.

## Enzymes

**[0036]** Enzymes may be present in the compositions of the invention. Examples of enzymes suitable for use in the cleaning compositions of this invention include lipases, peptidases, amylases (amylolytic enzymes) and others which degrade, alter or facilitate the degradation or alteration of biochemical soils and stains encountered in cleansing situations so as to remove more easily the soil or stain from the object being washed to make the soil or stain more removable in a subsequent cleansing step. Both degradation and alteration can improve soil removal.

**[0037]** Well-known and preferred examples of these

enzymes are lipases, amylases and proteases. The enzymes most commonly used in machine dishwashing compositions are amylolytic enzymes. Preferably, the composition of the invention also contains a proteolytic enzyme. Enzymes may be present in a weight percentage amount of from 0.2 to 5% by weight. For amylolytic enzymes, the final composition will have amylolytic activity of from  $10^2$  to  $10^6$  Maltose units/kg. For proteolytic enzymes the final composition will have proteolytic enzyme activity of from  $10^6$  to  $10^9$  Glycine Units/kg.

#### Bleach Material

**[0038]** Bleach material may optionally and preferably be incorporated in composition for use in processes according to the present invention. These materials may be incorporated in solid form or in the form of encapsulates and less preferably in dissolved form.

**[0039]** The bleach material may be a chlorine- or bromine-releasing agent or a peroxygen compound. Peroxygen based bleach materials are however preferred.

**[0040]** Organic peroxy acids or the precursors therefor are typically utilized as the bleach material. The peroxyacids usable in the present invention are solid and, preferably, substantially water-insoluble compounds. By "substantially water-insoluble" is meant herein a water-solubility of less than about 1% by weight at ambient temperature. In general, peroxyacids containing at least about 7 carbon atoms are sufficiently insoluble in water for use herein.

**[0041]** Inorganic peroxygen-generating compounds are also typically used as the bleaching material of the present invention. Examples of these materials are salts of monopersulphate, perborate monohydrate, perborate tetrahydrate, and percarbonate.

**[0042]** Monoperoxy acids useful herein include alkyl peroxy acids and aryl peroxyacids such as peroxybenzoic acid and ring-substituted peroxybenzoic acids (e.g. peroxy- $\alpha$ -naphthoic acid); aliphatic and substituted aliphatic monoperoxy acids (e.g. peroxy lauric acid and peroxy stearic acid); and phthaloyl amido peroxy caproic acid (PAP).

**[0043]** Typical diperoxy acids useful herein include alkyl diperoxy acids and aryldiperoxy acids, such as 1,12-di-peroxy-dodecanedioic acid (DPDA); 1,9-diperoxyazelaic acid, diperoxybrassylic acid, diperoxysebacic acid and diperoxy-isophthalic acid; and 2-decyldiperoxybutane-1,4-dioic acid.

**[0044]** Peroxyacid bleach precursors are well known in the art. As non-limiting examples can be named N,N,N',N'-tetraacetyl ethylene diamine (TAED), sodium nonanoyloxybenzene sulphonate (SNOBS), sodium benzoyloxybenzene sulphonate (SBOBS) and the cationic peroxyacid precursor (SPCC) as described in US-A-4,751,015.

**[0045]** If desirably a bleach catalyst, such as the manganese complex, e.g. Mn-Me TACN, as described

in EP-A-0458397, or the sulphonimines of US-A-5,041,232 and US-A-5,047,163, is to be incorporated, this may be presented in the form of a second encapsulate separately from the bleach capsule or granule. Cobalt catalysts can also be used.

**[0046]** Among suitable reactive chlorine- or bromine-oxidizing materials are heterocyclic N-bromo and N-chloro imides such as trichloroisocyanuric, tribromoisocyanuric, dibromoisocyanuric and dichloroisocyanuric acids, and salts thereof with water-solubilizing cations such as potassium and sodium. Hydantoin compounds such as 1,3-dichloro-5,5-dimethyl-hydantoin are also quite suitable.

**[0047]** Particulate, water-soluble anhydrous inorganic salts are likewise suitable for use herein such as lithium, sodium or calcium hypochlorite and hypobromite. Chlorinated trisodium phosphate and chloroisocyanurates are also suitable bleaching materials.

**[0048]** Encapsulation techniques are known for both peroxygen and chlorine bleaches, e.g. as described in US-A-4,126,573, US-A-4,327,151, US-A-3,983,254, US-A-4,279,764, US-A-3,036,013 and EP-A-0,436,971 and EP-A-0,510,761. However, encapsulation techniques are particularly useful when using halogen based bleaching systems.

**[0049]** Chlorine bleaches, the compositions of the invention may comprise from about 0.5% to about 3% avCl (available Chlorine). For peroxygen bleaching agents a suitable range are also from 0.5% to 3% avO (available Oxygen). Preferably, the amount of bleach material in the wash liquor is at least  $12.5 \times 10^{-4}\%$  and at most 0.03% avO by weight of the liquor.

#### Surfactant material

**[0050]** A surfactant system comprising a surfactant selected from nonionic, anionic, cationic, ampholytic and zwitterionic surfactants and mixtures thereof is preferably present in the composition.

**[0051]** Typically the surfactant is a low to non foaming nonionic surfactant, which includes any alkoxyated nonionic surface-active agent wherein the alkoxy moiety is selected from the group consisting of ethylene oxide, propylene oxide and mixtures thereof, is preferably used to improve the detergency without excessive foaming. However, an excessive proportion of nonionic surfactant should be avoided. Normally, an amount of 15% by weight or lower, preferably 10% by weight or lower, more preferably 7% by weight or lower, most preferably 5% by weight or lower and preferably 0.1% by weight or higher, more preferably 0.5% by weight or higher is quite sufficient, although higher level may be used.

**[0052]** Examples of suitable nonionic surfactants for use in the invention are the low- to non-foaming ethoxyated straight-chain alcohols of the Plurafac® PA series, supplied by the Eurane Company; of the Lutensol® LF series, supplied by the BasF Company and of the Triton® DF series, supplied by the Rohm & Haas Com-

pany.

**[0053]** Other surfactants such as anionic surfactant may be used but may require the additional presence of an antifoam to suppress foaming. If an anionic surfactant is used it is advantageously present at levels of 2 wt% or below.

#### Water Soluble Polymeric Polycarboxylic Compounds

**[0054]** A water-soluble polymeric polycarboxylic compound is advantageously present in the dish wash composition. Preferably these compounds are homo- or co-polymers of polycarboxylic compounds, especially co-polymeric compounds in which the acid monomer comprises two or more carboxyl groups separated by not more than two carbon atoms. Salts of these materials can also be used.

**[0055]** Particularly preferred polymeric polycarboxylates are copolymers derived from monomers of acrylic acid and maleic acid. the average molecular weight of these polymers in the acid form preferably ranges from 4,000 to 70,000.

**[0056]** Another type of polymeric polycarboxylic compounds suitable for use in the composition of the invention are homopolymeric polycarboxylic acid compounds with acrylic acid as the monomeric unit. The average weight of such homopolymers in the acid form preferably ranges from 1,000 to 100,000 particularly from 3,000 to 10,000.

**[0057]** Acrylic sulphonated polymers as described in EP 851 022 (Unilever) are also suitable.

**[0058]** Preferably, this polymeric material is present at a level of at least 0.1%, more preferably at levels from 1 wt% to 7 wt% of the total composition.

#### Chelating Agent

**[0059]** A chelating agent may be present in the composition. If present it is preferable if the level of chelating agent is from 0.5 to 3 wt% of the total composition.

**[0060]** Preferred chelating agents include organic phosphonates, amino carboxylates, polyfunctionally-substituted compounds, and mixtures thereof.

**[0061]** Particularly preferred chelating agents are organic phosphonates such as  $\alpha$ -hydroxy-2 phenyl ethyl diphosphonate, ethylene diphosphonate, hydroxy 1,1-hexylidene, vinylidene 1,1 diphosphonate, 1,2 dihydroxyethane 1,1 diphosphonate and hydroxy-ethylene 1,1 diphosphonate. Most preferred is hydroxy-ethylene 1,1 diphosphonate.

#### Anti-tarnishing Agents

**[0062]** Anti-tarnishing agents such as benzotriazole and those described in EP 723 577 (Unilever) may also be included.

#### Optional Ingredients

**[0063]** Optional ingredients are, for example, buffering agents, reducing agents, e.g., borates, alkali metal hydroxide and the well-known enzyme stabilisers such as the polyalcohols, e.g. glycerol and borax; anti-scaling agents; crystal-growth inhibitors, threshold agents; thickening agents; perfumes and dyestuffs and the like.

**[0064]** Reducing agents may e.g. be used to prevent the appearance of an enzyme-deactivating concentration of oxidant bleach compound. Suitable agents include reducing sulphur-oxy acids and salts thereof. Most preferred for reasons of availability, low cost, and high performance are the alkali metal and ammonium salts of sulphuroxy acids including ammonium sulphite  $((\text{NH}_4)_2\text{SO}_3)$ , sodium sulphite  $(\text{Na}_2\text{SO}_3)$ , sodium bisulphite  $(\text{NaHSO}_3)$ , sodium metabisulphite  $(\text{Na}_2\text{S}_2\text{O}_3)$ , potassium metabisulphite  $(\text{K}_2\text{S}_2\text{O}_5)$ , lithium hydrosulphite  $(\text{Li}_2\text{S}_2\text{O}_4)$ , etc., sodium sulphite being particularly preferred. Another useful reducing agent, though not particularly preferred for reasons of cost, is ascorbic acid. The amount of reducing agents to be used may vary from case to case depending on the type of bleach and the form it is in, but normally a range of about 0.01% to about 1.0% by weight, preferably from about 0.02% to about 0.5% by weight, will be sufficient.

#### pH of wash liquor

**[0065]** The invention relates to washing processes in mechanical dish washing machines wherein the wash liquor has a low pH. By "low pH" is meant here that the pH of the wash liquor is preferably higher than about 6.5, more preferably 7.5 or higher, most preferably 8.5 or higher. Preferably the pH is lower than about 10.5, more preferably lower than about 10, more preferably lower than about 9.5. The most advantageous pH range is from 8.5 to 10.

#### Temperature of washing process

**[0066]** The present invention preferably relates to processes of mechanically washing soiled articles with a wash liquor at a temperature of at least 40°C, more preferably at least 50°C, most preferably at least 55°C.

#### Rinse Aid

**[0067]** The rinse aid for use in the invention comprises a water soluble acid builder or salt, preferably organic acids including, for example, carboxylic acids, such as citric and succinic acids, polycarboxylic acids, such as polyacrylic acid, and also acetic acid, boric acid, malonic acid, adipic acid, fumaric acid, lactic acid, glycolic acid, tartaric acid, tartronic acid, malonic acid, their derivatives and any mixtures of the foregoing.

**[0068]** Suitable water-soluble monomeric or oligomeric carboxylate builders can be selected from a wide

range of compounds but such compounds preferably have a first carboxyl logarithmic acidity/constant ( $pK_1$ ) of less than 9, preferably of between 2 and 8.51 more preferably of between 2.5 and 7.5.

**[0069]** The carboxylate or polycarboxylate builder can be monomeric or oligomeric in type although monomeric polycarboxylates are generally preferred for reasons of cost and performance. Monomeric and oligomeric builders can be selected from acyclic, alicyclic, heterocyclic and aromatic carboxylates.

**[0070]** Suitable carboxylates containing one carboxy group include the water-soluble salts of lactic acid, glycolic acid and ether derivatives thereof. Polycarboxylates containing two carboxy groups include the water-soluble salts of succinic acid, malonic acid, (ethylenedioxy) diacetic acid, maleic acid, diglycolic acid, tartaric acid, tartronic acid and fumaric acid, as well as the ether carboxylates and the sulfinyl carboxylates. Polycarboxylates containing three carboxy groups include, in particular, water-soluble citrates, aconitrates and citraconates as well as succinate derivatives such as the carboxymethoxysuccinates, lactoxysuccinates, and aminosuccinates, and the oxypolycarboxylate materials such as 2-oxa-1,1,3-propane tricarboxylates. The carboxylate or polycarboxylate builder compounds described above can also have a dual function as pH controlling agents.

**[0071]** Polycarboxylates containing four carboxy groups include oxydisuccinates, 1,1,2,2-ethane tetracarboxylates, 1,1,3,3-propane tetracarboxylates and 1,1,2,3-propane tetracarboxylates. Polycarboxylates containing sulfo substituents include the sulfosuccinate derivatives, and the sulfonated pyrolysed citrates.

**[0072]** Alicyclic and heterocyclic polycarboxylates include cyclopentane-cis,cis,cis-tetracarboxylates, cyclopentadienide pentacarboxylates, 2,3,4,5-tetrahydrofuran - cis, cis, cis-tetracarboxylates, 2,5-tetrahydrofuran - cis - dicarboxylates, 2,2,5,5-tetrahydrofuran - tetracarboxylates, 1,2,3,4,5,6-hexane - hexacarboxylates and carboxymethyl derivatives of polyhydric alcohols such as sorbitol, mannitol and xylitol. Aromatic polycarboxylates include mellitic acid, pyromellitic acid and the phthalic acid derivatives disclosed in British Patent No. 1,425,343.

**[0073]** Of the above, the preferred polycarboxylates are hydroxycarboxylates containing up to three carboxy groups per molecules, more particularly citrates or citric acid.

**[0074]** As an alternative to the above phosphonates may be used.

**[0075]** The parent acids of the monomeric or oligomeric polycarboxylate chelating agents or mixtures thereof with their salts, e.g. citric acid or citrate/citric acid mixtures are also contemplated as components of builder systems of rinse compositions in accordance with the present invention.

**[0076]** A surfactant system comprising a surfactant selected from nonionic, anionic, cationic, ampholytic

and zwitterionic surfactants and mixtures thereof is preferably present in the composition.

**[0077]** The surfactant system most preferably comprises low foaming nonionic surfactant, selected for its wetting ability, preferably selected from ethoxylated and/or propoxylated nonionic surfactants, more preferably selected from nonionic ethoxylated/propoxylated fatty alcohol surfactants.

**[0078]** The surfactant system is typically present at a level of from 1% to 40% by weight, more preferably 1.5% to 30% by weight, most preferably from 5% to 20% by weight of the compositions. If an anionic surfactant is used it is advantageously present at levels of 1 wt% or below.

**[0079]** The compositions of the invention may contain organic solvents, particularly when formulated as liquids or gels. The compositions in accord with the invention preferably contain a solvent system present at levels of from 1% to 30% by weight, preferably from 3% to 25% by weight, more preferably from 5% to 20% by weight of the composition. The solvent system may be a mono or mixed solvent system. Preferably, at least the major component of the solvent system is of low volatility.

**[0080]** Suitable organic solvent for use herein has the general formula  $RO(CH_2C(Me)HO)_nH$ , wherein R is an alkyl, alkenyl, or alkyl aryl group having from 1 to 8 carbon atoms, and n is an integer from 1 to 4. Preferably, R is an alkyl group containing 1 to 4 carbon atoms, and n is 1 or 2. Especially preferred R groups are n-butyl or isobutyl. Preferred solvents of this type are 1-n-butoxypropane-2-ol (n = 1); and 1(2-n-butoxy-1-methylethoxy)propane-2-ol (n = 2), and mixtures thereof.

**[0081]** Other solvents useful herein include the water-soluble CARBITOL<sup>7</sup> solvents or water-soluble CELLOSOLVE<sup>7</sup> solvents. Water-soluble CARBITOL<sup>7</sup> solvents are compounds of the 2-(2-alkoxyethoxy)ethanol class wherein the alkoxy group is derived from ethyl, propyl or butyl; a preferred water-soluble carbitol is 2(2-butoxyethoxy) ethanol also known as butyl carbitol. Water-soluble CELLOSOLVE<sup>7</sup> solvents are compounds of the 2-alkoxyethoxy ethanol class, with 2-butoxyethoxyethanol being preferred.

**[0082]** Other suitable solvents are benzyl alcohol, and diols such as 2-ethyl-1,3-hexanediol and 2,2,4-trimethyl-1,3-pentanediol.

**[0083]** Hydrotropes may be present and are typically present at levels of from 0.5% to 20%, preferably from 1% to 10%, by weight.

**[0084]** Useful hydrotropes include sodium, potassium, and ammonium xylene sulfonates, sodium, potassium, and ammonium toluene sulfonate, sodium potassium and ammonium cumene sulfonate, and mixtures thereof.

**[0085]** In a highly preferred aspect of the invention, the compositions have a pH as a 1% solution in distilled water at 20°C of less than 7, preferably from 0.5 to 6.5, most preferably from 0.5 to 1.0.

## Product Form

**[0086]** The dish washing composition for use in the invention may be in any product form, however it is preferred if it granular. Granular in the context of the present invention includes both powdered material and tablets.

**[0087]** The rinse aid is preferably a liquid.

**[0088]** Dishwash compositions according to the present invention may be dosed in the wash liquor at levels of from 10 g/l to 2.5 g/l.

**[0089]** Rinse aid composition according to the present invention may be dosed in the final rinse liquor at levels 1 g/l or less.

**[0090]** The invention will now be illustrated by the following non-limiting Examples. Examples of the invention are illustrated by a number, comparative Examples are illustrated by a letter.

**[0091]** All percentages are on a weight basis.

## EXAMPLE I

**[0092]**

Table 1

	WT/%	
	DW 1	DW2
Gasil 200 TP <sup>3</sup>	0	3.0
Na-citrate 2aq	39.4	40.0
Na-bicarbonate	0	25.7
Na-carbonate	5.5	
Na-perborate	18.0	16.0
Enzyme	4.0	3.5
Sokalan PC 525 <sup>1</sup>	6.0	6.0
EHDP	1.0	1.5
Bleach catalyst	2.8	2.8
Perfume	0.2	0.2
Nonionic surfactant <sup>2</sup>	1.5	1.4
Na disilicate	21.7	0

1) maleic and acrylic acid copolymer  
MWT 50,000, acrylic acid polymer mwt  
4,000.

2) Nonionic surfactant, ex BASF (LF  
403)

3) Silica material with an average particle  
size d50 (by Malvern Laser) of 7-11  
mm, ex Crosfield

**[0093]** The compositions were tested in a robotised Miele G5953C (total water hardness 28°FH, including

temporary hardness of 18°FH).

**[0094]** The compositions were dosed at a level of 20 g/wash; the main wash time was 20 minutes; the drying time with open door was 10-20 minutes; the washing temperature was up to 65°C;

**[0095]** 30 washes were carried out by loading the machine with on-glaze decorated porcelain, glass, plates plus cutlery, stainless steel articles and plastics,

**[0096]** Rinse aid was added to the rinse via the rinse and dispenser. The rinse aid had the following formulations.

TABLE 2

	wt%	
	RA 3	RA 4
Nonionic LF400S	14.5	14.5
Sodium Xylene Sulphonate	5.0	5.0
Citric Acid	9.5	40
Water	to 100%	
ex BASF		

## Overall appearance

**[0097]** Overall appearance was measured by placing the tested articles on a black cloth under a reflected artificial daylight source (Kelvin temperature 2300°K); placed 2 metres above the articles. A subjective scoring system on a 1-9 scale was used

1 as new → 9 extremely poor.

**[0098]** The overall appearance was a combination of white filming due to calcium salt deposits, spots, streaks and glass corrosion.

**[0099]** The results are given in table 3.

TABLE 3

	Score		
	Glass	Plastic	Metal
DW1 and RA4	9.0	6.6	8.5
DW2 and RA3	5.5	5.4	7.3
DW2 and RA4	4.0	4.9	4.2

## Composition of Kit

**[0100]** An example of a kit according to the invention comprises twenty five 18g tablets of detergent composition formulated according to table 1, each tablet being flow wrapped in a plastic wrapper. 75 mls of rinse

aid is provided in a bottle with a directing spout to enable the liquid be poured into a rinse aid reservoir accurately. An outer packaging for the tablets and bottle comprises a cardboard box having an internal partition dividing the box into two compartments, a first for the wrapped tablets, and a second for the bottle.

**[0101]** The packaging includes instructions on how to use the kit. Specifically the fact that no separate ion-regenerating salt is needed is clearly pointed out. The pack will also include directions to empty the rinse aid component into the rinse aid reservoir. Dosage instructions for the detergent component will be given. Further the instructions will point out that when the detergent component has been completely used up, that the rinse aid reservoir will need to be replenished, ideally by using a further kit according to the invention.

**[0102]** The invention is not limited to the embodiments hereinbefore described, which may be varied in construction and detail.

### Claims

#### 1. A machine dishwashing kit comprising:

- an amount of packaged rinse aid composition sufficient to provide X number of rinse cycles:
- an amount of packaged detergent composition sufficient to provide X/Y number of washes, wherein X is greater than or equal to Y, X and Y are whole numbers, X/Y is equal to a whole number, and Y is between 1 and 3.

#### 2. A kit as claimed in claim 1 in which Y is 1.

#### 3. A kit as claimed in claims 1 or 2 wherein one or both of the rinse aid and detergent composition are formulated to create conditions within the machine during a washing/rinse cycle that obviate the need for a separate ion exchange regenerating salt.

#### 4. A kit as claimed in any preceding claim in which the detergent composition comprises a plurality of unit doses such as tablets.

#### 5. A kit as claimed in claim 4 in which each tablet provides sufficient detergent for a single wash cycle.

#### 6. A kit as claimed in any of claims 1 to 3 in which the detergent composition is in a particulate form, wherein the kit further includes means for dispensing an accurate and consistent dose of the detergent composition.

#### 7. A kit as claimed in claim 6 in which the dispensing means comprises a pour-spout.

#### 8. A kit as claimed in any preceding claim in which the

rinse aid is a liquid.

#### 9. A kit as claimed in any preceding claim in which the packaged detergent and rinse aid compositions are enclosed within a secondary pack.

#### 10. A kit as claimed in any of claims 5, 7, 8 or 9 comprising a plurality of detergent tablets, each tablet packed in an individual pack such as a flow wrap, and a liquid rinse aid composition in a bottle, the kit further including a secondary pack having a first compartment for the wrapped tablets and a second compartment for the bottle of rinse aid.

#### 11. A kit as claimed in any of claims 1 to 8 in which the detergent composition is packaged within a first receptacle, and the rinse aid is packaged within a second receptacle, wherein the first and second receptacles engage in a retro fit manner.

#### 12. A kit as claimed in claim 8 in which the receptacles engage in a tamper evident manner.

#### 13. A kit as claimed in either of claims 11 or 12 in which the rinse aid receptacle engages a lid means of the detergent receptacle.

#### 14. A kit as claimed in any preceding claim in which the detergent composition comprises greater than 20wt% of a bicarbonate salt and a silica or silicate material.

#### 15. A kit as claimed in claim 14 wherein the detergent composition further comprises a polymer or copolymer of acrylic acid.

#### 16. A kit as claimed in claims 14 or 15 in which a 1% aqueous solution of the detergent composition, at a temperature of 25°C, has a pH from 8.5 to 10.

#### 17. A kit as claimed in any preceding claim in which the rinse aid comprises 20wt% or greater of a water-soluble acid builder or salt thereof.

#### 18. A kit as claimed in claim 17 in which the acid is a carboxy acid.

#### 19. A kit as claimed in either of claims 17 or 18 in which the acid is citric acid.

#### 20. A kit as claimed in any preceding claim including instructions concerning the dosage of rinse aid required per rinse cycle.

#### 21. A kit as claimed in any preceding claim including instruction on the use of the kit, which instructions comprise directions to:-

(a) empty the amount of rinse aid composition into a rinse aid reservoir of a automatic dish-washing machine;

(b) dose a specified amount of detergent composition per wash cycle; and 5

(c) once the total amount of detergent in the kit has been used, repeat step (a). 10

22. A kit as claimed in claim 21 in which step (c) of the instructions includes an additional direction to replace the kit prior to repeating step (a).

23. A kit as claimed in any preceding claim including instructions to use the kit in the absence of a separate ion regenerating dishwashing salt. 15

24. A process for automatic machine washing of dishes which employs a kit of any of claims 1 to 22 and comprises the steps of :- 20

- dispensing the amount of rinse aid composition into a rinse aid reservoir of the automatic washing machine; 25
- dosing a specified quantity of detergent composition per wash cycle; and
- replenishing the rinse aid reservoir when the amount of detergent composition has been used up. 30

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# EUROPEAN SEARCH REPORT

Application Number  
EP 00 30 0826

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The present search report has been drawn up for all claims			
Place of search		Date of completion of the search	Examiner
THE HAGUE		3 May 2000	Saunders, T
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EPO FORM 1503 03/82 (P04C01)



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<p>CATEGORY OF CITED DOCUMENTS</p> <p>X : particularly relevant if taken alone Y : particularly relevant if combined with another document of the same category A : technological background O : non-written disclosure P : intermediate document</p> <p>T : theory or principle underlying the invention E : earlier patent document, but published on, or after the filing date D : document cited in the application L : document cited for other reasons ----- &amp; : member of the same patent family, corresponding document</p>			

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