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(71) Applicant (for all designated States except US): **DI-
VERSEY, INC.** [US/US]; 8310 16th Street, M/s 509,
P.O. Box 902, Sturtevant, WI 53177-0902 (US).

(72) Inventors; and

(75) Inventors/Applicants (for US only): **NEPLENBROEK,
Antonius, Maria** [NL/NL]; Schoutenkampweg 16,
NL-3768 Soest (NL). **TANG, Alicia, Linda Lay-Tchan**
[FR/FR]; 31 Rue De La Cle, F-59650 Villeneuve D'Ascq
(FR).

(74) Agent: **BOLLIS, Gregory, S.**; Johnsondiversey, Inc.,
8310 16th Street, M/s 509, Sturtevant, WI 53177-0902
(US).

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(54) Title: METHOD TO PREVENT OR INHIBIT WARE CORROSION IN WARE WASHING

(57) Abstract: The present invention discloses a method to prevent or inhibit corrosion of ware susceptible to corrosion in a ware washing process comprising washing the ware with a detergent composition and/or rinsing the ware with a clear rinse composition, wherein said detergent and/or said clear rinse composition comprise(s) a cationic polysaccharide as a corrosion inhibitor.



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METHOD TO PREVENT OR INHIBIT WARE CORROSION IN WARE WASHING

BACKGROUND OF THE INVENTION

[0001] In general, machine ware washing detergents are mixtures of ingredients whose purpose, in combination, is to breakdown and remove food soils; to inhibit foaming caused by certain food soils; to promote the wetting of wash articles in order to minimize or eliminate visually observable spotting and filming; to remove stains such as might be caused by beverages such as coffee and tea or by vegetable soils such as carotenoid soils; to prevent a buildup of soil films on wash ware surfaces; and to reduce or eliminate tarnishing of flatware. An additional and critical characteristic that the machine ware washing detergent must possess is the ability to perform all of the above tasks without substantially etching or corroding or otherwise damaging the surface of glasses, dishes or other wares.

[0002] It is particularly critical that the fading and loss of luster from brightly colored decorations on glasses and dishes be prevented. Glassware that is repetitively washed in automatic ware washing machines has a tendency to develop a surface cloudiness that is irreversible. The glass becomes progressively more opaque with repeated washings. This cloudiness is believed to be a type of etching or corrosion of the glass. This same type of corrosion may be seen on other articles including china, porcelain, ceramics and metals.

[0003] Corrosion of glass in automatic ware washers thus is a well known phenomenon. To prevent corrosion of glass and other ware, corrosion inhibitors typically are added to the ware wash detergent and/or to the clear rinse agent. Commonly used corrosion inhibitors for instance are heavy metal ions, such as zinc and aluminium. These inhibitors have limited effect in preventing glass corrosion and have safety and environmental concerns.

SUMMARY OF THE INVENTION

[0004] The present invention now surprisingly shows that cationic polysaccharides perform extremely well as corrosion inhibitors in automatic ware washing.

DETAILED DESCRIPTION

[0005] The present invention discloses a method to prevent or inhibit corrosion of ware that is susceptible to corrosion in a ware washing process comprising washing the ware with a detergent composition and/or rinsing the ware with a clear rinse agent, wherein said

detergent composition and/or said clear rinse agent comprise(s) a cationic polysaccharide as a corrosion inhibitor.

[0006] Ware that is susceptible to corrosion in a ware washing process may encompass glass ware, metal ware and ware containing brightly coloured decorations.

[0007] The ware washing process as described herein includes domestic as well as institutional automatic ware washing. The ware washing process further includes bottle washing, such as applied in beverage plants. In this context, a beverage plant is meant to include beer breweries.

[0008] The cationic polysaccharide thus can be advantageously used to prevent or inhibit corrosion and fading of glass and decorative articles during a ware washing process in an institutional or a household ware washing machine or during bottle washing in a beverage plant.

[0009] The cationic polysaccharide preferably constitutes 0.01% to 50% (w/w) of the detergent and/or the clear rinse composition, more preferably 0.1% to 20% (w/w), even more preferably 0.2 to 10% (w/w), even more preferably 0.5% to 5% (w/w), most preferably 1 to 5% (w/w), based on total (wet or dry) weight of the composition.

[00010] Typically, the concentration of the cationic polysaccharide in the aqueous wash solution and/or the aqueous clear rinse solution obtainable by diluting or dissolving the detergent and/or the clear rinse composition in water is from 1 to 100 ppm, preferably from 2 to 50 ppm, more preferably from 5 to 50 ppm.

[00011] The cationic polysaccharide typically is added to the cleaning and/or clear rinse composition as part of the detergent and/or clear rinse agent. However, it is also possible to add the cationic polysaccharide to the cleaning and/or clear rinse composition as a separately formulated product. Such a separately formulated product may contain a relatively high level (even 100%) of polysaccharide. This separate product, which can be liquid or solid, may be dosed manually or automatically. This may for instance be done to solve stability issues between the cationic polysaccharide and the main wash detergent and/or clear rinse agent.

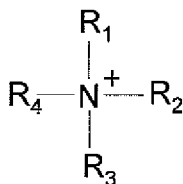
[00012] In the rinse step, the washed ware is contacted with an aqueous rinse and/or a clear rinse solution. The aqueous rinse may be substantially free from an intentionally added rinse aid. The clear rinse solution contains the usual components.

[00013] Cationic polysaccharides

[00014] As defined herein, a cationic polysaccharide is a polysaccharide containing a cationic group. The cationic charge on the cationic polysaccharide may be derived from ammonium groups, quaternary ammonium groups, guanidium groups, sulfonium groups,

phosphonium groups, bound transition metals, and other positively charged functional groups.

[00015] A preferred cationic group is a quaternary ammonium group according to the formula



wherein R_1 , R_2 , R_3 and R_4 each independently are a lower alkyl or a lower hydroxyalkyl group. More preferably R_1 , R_2 , R_3 and R_4 each independently are a C1-C6 alkyl or a C1-C6 hydroxyalkyl group. Even more preferably, R_1 , R_2 and R_3 are identical C1-C4 alkyl groups and R_4 is a C3-C6 hydroxyalkyl group. Even more preferably, R_1 , R_2 and R_3 are methyl groups and R_4 is a C3-C6 hydroxyalkyl group. Most preferred the cationic group is a quaternary 2-hydroxy-3-(trimethylammonium)propyl group.

[00016] A cationic group may be connected to the polysaccharide via an ether or an ester linkage.

[00017] The polysaccharide component of the cationic polysaccharide is a polymer comprising monosaccharide units linked by glycosidic linkages. The monosaccharide unit may be an aldose or a ketose of 5 or 6 carbon atoms. The polysaccharide may be a homopolysaccharide or a heteropolysaccharide, it may be linear or branched, it may be partially hydrolysed, it may contain substituents, and/or it may be hydrophobically modified.

[00018] Suitable polysaccharide polymers may be cellulose-based, pectin-based, starch-based, natural gum-based.

[00019] Examples of cellulose-based polysaccharides are hydroxyethylcellulose, hydrophobically modified hydroxyethylcellulose, ethyl hydroxyethyl cellulose, hydrophobically modified ethyl hydroxyethyl cellulose, hydroxypropylcellulose or sodium carboxymethylcellulose.

[00020] Examples of starch-based polysaccharides are starches from rice, tapioca, wheat, corn or potato.

[00021] Examples of natural gum-based polysaccharides are polygalactomannans like guar gums or locust bean gums, polygalactans like carrageenans, polyglucans like xanthan gums, polymannuronates like alginate. Preferred natural gums are based on guar gum.

[00022] Preferred cationic polysaccharides are cationic guar gums such as Guar gum 2-hydroxy-3-(trimethylammonium)propyl ether chloride and Guar gum 2-hydroxypropyl,

2-hydroxy-3-(trimethylammonio) propyl ether chloride. Suitable cationic guar gums are sold under the trade name Jaguar by Rhodia. Also preferred are cationic starches such as (3-Chloro-2-Hydroxypropyl)Trimethylammonium Chloride modified starch. Suitable cationic starches are sold under the trade name HI-CAT by Roquette.

[00023] Particularly preferred are the following polysaccharides:

[00024] - Cationically modified guar gums, such as Jaguar C 17, Jaguar C 162 and Jaguar C 1000 (Rhodia).

[00025] - Cationically modified starches, such as HI-CAT CWS 42 (Roquette).

[00026] These cationic polysaccharides can be used alone or in combination with other polysaccharides or with polymeric or nonionic surfactants as described in WO2006/119162 in the cleaning composition.

[00027] Cationic polysaccharides, such as the Jaguar and HI-CAT polysaccharides, may be combined with certain anions, such as silicate and/or phosphonate and/or phosphate and/or hydroxide and/or citrate and/or gluconate and/or lactate and/or acetate anions. Both for liquid and solid compositions, properties like drying performance and product stability can be influenced by the type of anion and the order of addition of the components when making these compositions.

[00028] Composition comprising the cationic polysaccharide

[00029] In addition to the cationic polysaccharides described herein above, the compositions may comprise conventional ingredients. For detergent composition, these conventional ingredients are preferably selected from alkalinity sources, builders (i.e. detergency builders including the class of chelating agents/sequestering agents), bleaching systems, anti-scalants, additional corrosion inhibitors, surfactants, antifoams and/or enzymes. Suitable caustic agents include alkali metal hydroxides, e.g. sodium or potassium hydroxides, and alkali metal silicates, e.g. sodium metasilicate. Especially effective is sodium silicate having a mole ratio of $\text{SiO}_2:\text{Na}_2\text{O}$ of from about 1.0 to about 3.3, preferably from about 1.8 to about 2.2, normally referred to as sodium disilicate. The pH of the detergent composition typically is in the alkaline region, preferably ≥ 9 , more preferably ≥ 10 . For rinse aid compositions, these conventional ingredients are preferably selected from surfactants, hydrotropes, builders (i.e. detergency builders including the class of chelating agents/sequestering agents), bleaching systems, acids, anti-scalants, additional corrosion inhibitors, and/or antifoams.

[00030] Builder Materials

[00031] Suitable builder materials (phosphates and non-phosphate builder materials) are well known in the art and many types of organic and inorganic compounds have been

described in the literature. They are normally used in all sorts of cleaning compositions to provide alkalinity and buffering capacity, prevent flocculation, maintain ionic strength, extract metals from soils and/or remove alkaline earth metal ions from washing solutions.

[00032] The builder material usable herein can be any one or mixtures of the various known phosphate and non-phosphate builder materials. Examples of suitable non-phosphate builder materials are the alkali metal citrates, carbonates and bicarbonates; and the salts of nitrilotriacetic acid (NTA); methylglycine diacetic acid (MGDA); glutaric diacetic acid (GLDA), polycarboxylates such as polymaleates, polyacetates, polyhydroxyacrylates, polyacrylate/polymaleate and polyacrylate/polymethacrylate copolymers, as well as zeolites; layered silicas and mixtures thereof. They may be present (in % by wt.), in the range of from 1 to 70, and preferably from 5 to 60, more preferably from 10 to 60.

[00033] Particularly preferred builders, also for use in rinse aid compositions, are phosphates, NTA, EDTA, MGDA, GLDA, citrates, carbonates, bicarbonates, polyacrylate/polymaleate, maleic anhydride/(meth)acrylic acid copolymers, e.g. Sokalan CP5 available from BASF.

[00034] Antiscalants

[00035] Scale formation on ware and machine parts can be a significant problem. It can arise from a number of sources but, primarily it results from precipitation of either alkaline earth metal carbonates, phosphates or silicates. Calcium carbonate and phosphates are the most significant problem. To reduce this problem, ingredients to minimize scale formation can be incorporated into the composition. These include polyacrylates of molecular weight from 1,000 to 400,000 examples of which are supplied by Rohm & Haas, BASF and Alco Corp. and polymers based on acrylic acid combined with other moieties. These include acrylic acid combined with maleic acid, such as Sokalan CP5 and CP7 supplied by BASF or Acusol 479N supplied by Rohm & Haas; with methacrylic acid such as Colloid 226/35 supplied by Rhone-Poulenc; with phosphonate such as Casi 773 supplied by Buckman Laboratories; with maleic acid and vinyl acetate such as polymers supplied by Huls; with acrylamide; with sulfophenol methallyl ether such as Aquatreat AR 540 supplied by Alco; with 2-acrylamido-2-methylpropane sulfonic acid such as Acumer 3100 supplied by Rohm & Haas or such as K-775 supplied by Goodrich; with 2-acrylamido-2-methylpropane sulfonic acid and sodium styrene sulfonate such as K-798 supplied by Goodrich; with methyl methacrylate, sodium methallyl sulfonate and sulfophenol methallyl ether such as Alcosperse 240 supplied by Alco; polymaleates such as Belclene 200 supplied by FMC; polymethacrylates such as Tamol 850 from Rohm & Haas; polyaspartates; ethylenediamine disuccinate;

organo polyphosphonic acids and their salts such as the sodium salts of aminotri (methylenephosphonic acid) and ethane 1-hydroxy-1,1-diphosphonic acid. The anti-scalant, if present, is included in the composition from about 0.05% to about 10% by weight, preferably from 0.1% to about 5% by weight, most preferably from about 0.2% to about 5% by weight.

[00036] Surfactants

[00037] Surfactants and especially nonionics may be present to enhance cleaning and/or to provide drying of the substrates in combination with the polysaccharide and/or to act as defoamer. Typically used nonionics are obtained by the condensation of alkylene oxide groups with an organic hydrophobic material which may be aliphatic or alkyl aromatic in nature, e.g. selected from the group consisting of a C2-C18 alcohol alkoxylate having EO, PO, BO and PEO moieties or a polyalkylene oxide block copolymer.

[00038] The surfactant may be present in a concentration of about 0.1% to about 10% by weight, preferably from 0.5% to about 5% by weight, most preferably from about 0.2% to about 2% by weight. Due to the additional rinse-aid effect of the cationic polysaccharide, the surfactant level in detergent formulations may be lowered to at the most 2% by weight.

[00039] Bleaches

[00040] Suitable bleaches for use in the system according the present invention may be halogen-based bleaches or oxygen-based bleaches. More than one kind of bleach may be used.

[00041] As halogen bleach, alkali metal hypochlorite may be used. Other suitable halogen bleaches are alkali metal salts of di- and tri-chloro and di- and tri-bromo cyanuric acids.

[00042] Suitable oxygen-based bleaches are the peroxygen bleaches, such as sodium perborate (tetra- or monohydrate), sodium percarbonate or hydrogen peroxide.

[00043] The amounts of hypochlorite, di-chloro cyanuric acid and sodium perborate or percarbonate preferably do not exceed 15%, and 25% by weight, respectively, e.g. from 1-10% and from 4-25% and by weight, respectively.

[00044] Enzymes

[00045] Amylolytic and/or proteolytic enzymes would normally be used as an enzymatic component of the detergent. The enzymes usable herein can be those derived from bacteria or fungi.

[00046] Acids

[00047] Acids may be incorporated in the rinse aid composition. Any suitable organic and/or inorganic acid in any suitable amount may be used. Suitable acids include: acetic acid, aspartic acid, benzoic acid, boric acid, bromic acid, citric acid, formic acid, gluconic acid,

glutamic acid, hydrochloric acid, lactic acid, malic acid, nitric acid, sulfamic acid, sulfuric acid, tartaric acid, phosphoric acid, oxalic acid, malonic acid, succinic acid, glutaric acid, adipic acid, and mixtures thereof. Acids are typically present in a rinse aid composition in the range from about 0.01 % to about 30%.

[00048] Minor amounts of various other components may be present in the detergent composition. These include solvents and hydrotropes such as ethanol, isopropanol, xylene sulfonates and cumene sulfonates; anti-redeposition agents; corrosion inhibitors; and other functional additives. The detergents may further comprise flow control agents and/or enzyme stabilizing agents.

[00049] Components of the detergent composition may independently be formulated in the form of solids (optionally to be dissolved before use), aqueous liquids or non-aqueous liquid (optionally to be diluted before use).

[00050] The ware washing detergent may be in solid or liquid form. The solid may be a powder and/or a granulate, a tablet or a solid block. The liquid may be a conventional liquid, structured liquid or gel form. When in powder form, a flow aid may be present to provide good flow properties and to prevent lump formation of the powder. The detergent may be a combination of powder and/or a granulate and tablet in a sachet, to provide a unit dose for several washes.

[00051] The cationic polysaccharide can be incorporated rather easily in main wash detergents like tablets, blocks, powders or granules without sacrificing physical properties like flow and stability. The polysaccharide, incorporated in the wash detergent, can be in a liquid form, but also in solid form.

[00052] The chemical cleaning method may be utilized in any of the conventional automatic institutional or domestic ware washing processes, and in bottle washing processes such as applied in beverage plants.

[00053] Typical institutional ware washing processes are either continuous or non-continuous and are conducted in either a single tank or a multi-tank/conveyor type machine. In the conveyor system pre-wash, wash, post-rinse and drying zones are generally established using partitions. Wash water is introduced into the rinsing zone and is passed cascade fashion back towards the pre-wash zone while the dirty dishware is transported in a counter-current direction.

[00054] Typically, an institutional warewash machine is operated at a temperature of between 45-65°C in the washing step and about 80-90°C in the rinse step. The washing step

typically does not exceed 10 minutes, or even does not exceed 5 minutes. In addition, the aqueous rinse step typically does not exceed 2 minutes.

[00055] It is envisaged to dose the detergent and/or the rinse aid composition in the ware washing process in a concentrated version, e.g. using about 10% of the common amount of aqueous diluent, and to add the remaining 90% of the aqueous diluent in a later stage of the washing process, e.g. after 10 to 30 seconds contact time of the ware with the concentrated detergent, such as performed in the Divojet® concept of JohnsonDiversey.

[00056] It is also envisaged to use the ware washing detergent for periodically treating the ware. A treatment using a detergent comprising a cationic polysaccharide as described herein may be alternated with one or more washings using a detergent without polysaccharide. Such a periodic treatment may be done with a relatively high concentration of cationic polysaccharide in the detergent, providing e.g. 50 to 1000 ppm polysaccharide in the wash solution.

[00057] The detergent comprising a cationic polysaccharide as described herein also performs very well when soft water, or even reverse osmosis water, is used in the rinse step, and optionally also in the wash step. Reverse osmosis water is often used for warewashing when high visual appearance of substrates, especially glasses, is important, because this type of water leaves no water residues.

[00058] The cationic polysaccharide which provides anti-corrosion properties in ware washing processes can have some cleaning, defoaming, builder, binder, rheology modifying, thickening, structuring or scale preventing properties as well and so improve the overall wash process. In particular, a reduced scale build up was observed as compared to a similar system without cationic polysaccharide and rinsing with water only. Also, a positive soil release effect on fatty type of soils was observed.

[00059] Bottle washing, differs from other institutional (and household) ware washing in that washing is done with a highly caustic wash solution at an elevated temperature and in that the final rinse step usually does not contain any added chemical, since this step should ensure that the bottle is in a suitable condition for refill with beverage. In a further embodiment, it now is shown that the cationic polysaccharide as described herein also advantageously provides, in addition to an anti-corrosive effect, a rinse aid effect in a bottle washing process when incorporated in the main wash detergent composition.

[00060] The primary function of the bottle washing is to remove residual beverage and foreign matter (e.g. rust from crowns, mould, paper labels if applicable, etc), and provide a sterile bottle ready for filling. The bottle washing process should especially be suitable to

remove mould contamination of the bottle. In general, bottle washing is done using a wash solution comprising 1000 to 50,000 ppm of a caustic agent as described herein, preferably 5000 to 40,000 ppm of the caustic agent, more preferably 10,000 to 30,000 ppm of the caustic agent, at an elevated temperature of 70-80°C. Caustic soda (sodium hydroxide, 2-3% w/w) is typically used in the wash sections as a cost effective compound to break down organic soils (hydrolysis) and to sterilise the bottle (as a function of time, temperature and concentration).

[00061] The bottle washing process consists of several pre-wash, detergent and rinse sections where the bottles are soaked and sprayed (internal & external). An additional function of the pre-wash and rinse section is to provide a safe temperature profile between ambient and elevated temperature in the detergent sections. In the final rinse step, the bottle typically is not treated with any chemicals.

[00062] This invention will be better understood from the Examples which follow. However, one skilled in the art will readily appreciate that the specific methods and results discussed are merely illustrative of the invention and no limitation of the invention is implied.

[00063] Example 1

[00064] In this example the effect on glass corrosion is tested for a cationic polysaccharide present in an institutional ware washing process.

[00065] Working method

[00066] An institutional multi tank machine was used for these trials: Hobart FTN-ESB.

The following drinking glasses (ex Libbey) were used in these trials:

Table 1: type of glasses used for corrosion tests

Nr.	Type of glass
1	Wine glass Fortius
2	Wine glass-Libbey 3057
3	Gin glass-Intermezzo
4	Wineglass-Bouquet
5	Long drink glass-endēssa

[00067] The weights of these glasses are between 70 and 300 gram. For each test, 4 glasses from each type, so in total 20 glasses, were divided over 2 racks. These racks were placed in the Hobart FTN multi tank machine.

[00068] The conveyor belt of the multi tank machine is switched off, which implies that the substrates are not moved and are continuously in contact with the sprayed wash water.

During these tests the wash solution (at 60 degrees C), with products to be tested are pumped around continuously via the wash nozzles over the glasses during 17 hours. This relates to contact with wash water during about 1.000 washes (assuming an average wash time of 1 minute for an institutional multi-tank wash process).

[00069] Before and after the wash process the glasses were weighted. The weight loss is a measure for the glass corrosion during the wash process.

[00070] Furthermore, the visual appearance of the glasses was assessed after the test. Each of the glasses was evaluated by giving a score from 0 (no visual changes) to 5 (significant level of stripes clearly visible on the glass).

[00071] In this example the glass corrosion properties are tested for a liquid detergent containing a cationic polysaccharide in an institutional ware washing process. These glass corrosion properties are compared with a reference process with similar liquid detergent, but without the presence of the cationic polysaccharide. The following reference detergent was made:

Table 2: Composition reference detergent

order	Raw material	%
1	Soft water	27%
2	Dequest 2000 (50% Amino tri (methylene phosphonic acid), ex Thermphos)	2%
3	Caustic soda (50% NaOH solution)	20%
4	Trilon A liquid (40% NTA-Na3 ex BASF)	51%

[00072] For the test with cationic polysaccharide present in the detergent a cationically modified guar gum was used:

[00073] Jaguar C 1000; ex Rhodia; Guar gum, 2 hydroxy-3-(trimethylammonium)propyl ether chloride (CAS Nr: 65497-29-2).

[00074] The following product was made by adding the raw materials in given order:

Table 3: Composition detergent + cationic polysaccharide

order	Raw material	%
1	Soft water	26.5%
2	Jaguar C1000 (ex Rhodia)	0.5%
3	Dequest 2000 (ex Thermphos)	2%
4	Caustic soda (50% NaOH solution)	20%
5	Trilon A liquid (40% NTA-Na3 ex BASF)	51%

[00075] Furthermore, the glass corrosion properties of these 2 products are compared with Suma Protect L44. This commercially available product (supplied by JohnsonDiversey) is in use for glass washing applications in the institutional market. This product contains glass corrosion inhibitors based zinc gluconate.

[00076] Soft water was used for these tests and each of the liquid based products were dosed in the wash solution, via automatic dosing pumps, at a constant concentration of 2 g/L.

[00077] Results

[00078] In table 4, the total weight loss for all 20 glasses and the average score on the visual evaluation of the glasses is given for all 3 detergents.

Table 4: Corrosion results

Product	Weight loss; total 20 glasses: mgram	Visual appearance; average score
Reference detergent	2595	3.6
Detergent with cationic polysaccharide	185	0.0
Suma Protect L44	1155	0.3

[00079] The test with reference detergent shows that glasses will be corroded significantly when washing continuously for 17 hours in an institutional ware washing process, containing a standard alkaline detergent. This corrosion is quantified by the weight loss of the glasses.

Furthermore, this substrate damage is also clearly visible by the stripes.

[00080] The corrosion by a similar detergent containing a low level of cationic polysaccharide is much less. The weight loss is reduced significantly when the cationic polysaccharide is present in the wash solution. This is also illustrated by the fact that the visual appearance of the glasses is the same as before the test was started (score of 0 meaning that no visible changes of the glasses were observed).

[00081] Suma Protect L44 provides significantly less glass corrosion than the reference detergent. This leads to reduced weight loss but also improved visual appearance. This system, based on the presence of zinc ions in the wash solution, is the standard technique in the market to prevent glass corrosion. However, the presence of cationic polysaccharides in the wash solution leads to even further reduction of glass corrosion.

[00082] It can be concluded from these tests that the cationic polysaccharide present in this wash process leads to protection of the glass surface and so prevents glass corrosion.

[00083] Example 2

[00084] In this example the effect on glass corrosion is tested for different types and concentrations of cationic polysaccharides present in an institutional ware washing process.

[00085] Working method

[00086] An institutional single tank ware washing machine was used for these trials: Hobart AUXX 1300. The following glass substrates were used in these trials:

Table 5: type of glass substrates used for corrosion tests

Nr.	Type of glass
1	Wine glass-Libbey 3057; ex Libbey
2	Gin glass-Intermezzo; ex Libbey
3	Glass coupons (148*79*4mm)

[00087] The weights of these glasses are between 70 and 230 gram. For each test, 2 glass substrates from each type, so in total 6 glass substrates, were placed in 1 rack. This rack was placed in the single tank machine.

[00088] The warewasher used for these tests is a Hobart-single tank hood machine, which is automated for laboratory testing, such that the hood is opened and closed automatically and the rack with ware is transported automatically into and out off the dishwashing machine.

[00089] Specifications single tank hood machine

[00090] Type: Hobart AUXX 1300

[00091] Volume washbath: 50L

[00092] Volume rinse: 4L

[00093] Wash time: 4 minutes

[00094] Rinse time: 12 seconds

[00095] Wash temperature: 60°C

[00096] Rinse temperature: 80°C

[00097] Water: soft water (water hardness: < 1 DH).

[00098] Liquid detergent is dosed in the wash solution, via automatic dosing pumps, at a constant concentration of 4 g/L. The washwater is circulated in the machine by the internal wash pump and the wash arms over the dishware. When the wash time of 4 minutes is over, the wash pump stops and the wash water stays in the reservoir below the substrates. Then 4L

of the wash bath is drained automatically by a pump into the drain. Then the rinse program starts; fresh warm water from the boiler (connected to the soft water reservoir) is rinsed by the rinse arms over the dishware. When the rinse time is over, the machine is opened and the rack is transported out of the machine. After 10 seconds, the rack is transported again into the machine where next wash process starts.

[00099] One total cycle, including washing, rinsing and transport out off and into the machine, takes 5 minutes. The glass corrosion properties for each detergents is determined by executing in total 216 automatic cycles. During one test, the glass substrates are in contact with the wash solution for more than 800 minutes which relates to about 1.000 washes (assuming an average wash time of 50 seconds for an institutional single tank wash process).

[000100] Before and after the test the glasses were weighted. The weight loss is a measure for the glass corrosion during the wash process.

[000101] In this example the glass corrosion properties are tested for 5 liquid detergents; 4 of these detergents contained a cationic polysaccharide. These glass corrosion properties are compared with a reference process with similar liquid detergent, but without the presence of a cationic polysaccharide.

[000102] The materials used as cationic polysaccharides in these tests are:

[000103] - Jaguar C 1000; ex Rhodia; Guar gum, 2 hydroxy-3-(trimethylammonium)propyl ether chloride (CAS Nr: 65497-29-2).

[000104] - Jaguar C162; ex Rhodia; Guar gum, 2-hydroxypropyl; 2-hydroxy-3-(trimethylammonio) propyl ether chloride (CAS Nr: 71329-50-5).

[000105] - HI-CAT CWS 42 ex Roquette Freres; cold water soluble cationic potato starch (CAS Nr : 56780-58-6).

[000106] The compositions of the 5 liquid detergents are given in table 6.

Table 6: Compositions detergents

Raw material	1	2	3	4	5
Soft water	27.0%	26.5%	26.0%	26.5%	26.0%
Jaguar C1000 (ex Rhodia)	-	0.5%	1.0%	-	-
Jaguar C162 (ex Rhodia)	-	-	-	0.5%	-
HI-CAT CWS 42 (ex Roquette Freres)	-	-	-	-	1.0%
Dequest 2000 (ex Thermphos)	2.0%	2.0%	2.0%	2.0%	2.0%
Caustic soda (50% NaOH solution)	20.0%	20.0%	20.0%	20.0%	20.0%
Trilon A liquid (40% NTA-Na3 ex BASF)	51.0%	51.0%	51.0%	51.0%	51.0%

[000107] Product 1 is the reference product without cationic polysaccharide. Products 1 till 4 are produced by adding and mixing the raw materials in given order at room temperature. Product 5, containing 1% Hi Cat CWS 42, is produced by adding and mixing the raw materials at 50 degrees C.

[000108] Each of these liquid detergents were dosed at 4g/L in the wash solution and soft water was used for these tests.

[000109] Results

[000110] In table 7, total weight loss for all 6 glass substrates is given for each detergent.

Table 7: Glass corrosion results

Nr	Product	Weight loss; total 6 glass substrates: mgram
1	Reference detergent	343
2	Detergent with 0.5% Jaguar C1000	152
3	Detergent with 1.0% Jaguar C1000	104
4	Detergent with 0.5% Jaguar C162	192
5	Detergent with 1.0% HI-CAT CWS 42	196

[000111] It can be concluded from these trials that various types of cationic polysaccharides, present in this wash process lead to protection of the glass surface and so inhibit glass corrosion. Different types of cationically modified guar gums and cationically modified starch present in the wash solution, lead to a significant reduction in glass corrosion.

[000112] Example 3

[000113] In this example the effect on metal corrosion is tested for different types of cationic polysaccharides present in a cleaning solution.

[000114] Working method

[000115] Corrosion tests were carried out with metal discs in a Rotating Disc Corrosion Apparatus under full immersion and dynamic conditions. Two types of metal substrates were used in these trials:

[000116] 1 Copper

[000117] 2 Brass.

[000118] These standardized metal discs have a diameter of 50 mm and a weight of about 25 gram. These discs turned around at 80 rpm in a cleaning solution for 24 hours at 50 degrees C. For each test, 1 metal disc from each type was used.

[000119] Before and after the test the metal coupons were weighted accurately. The weight loss is a measure for the metal corrosion during this process.

[000120] In this example metal corrosion properties were tested for 3 liquid detergents; 2 of these detergents contained a cationic polysaccharide. These metal corrosion properties were compared with a reference process with similar liquid detergent, but without the presence of a cationic polysaccharide.

[000121] The materials used as cationic polysaccharides in these tests were:

[000122] - Jaguar C 1000; ex Rhodia; Guar gum, 2 hydroxy-3-(trimethylammonium)propyl ether chloride (CAS Nr: 65497-29-2).

[000123] - HI-CAT CWS 42 ex Roquette Freres; cold water soluble cationic potato starch (CAS Nr : 56780-58-6).

[000124] The compositions of the 3 liquid detergents are given in table 8.

Table 8: Compositions detergents

Raw material	1	2	3
Soft water	27.0%	26.0%	26.0%
Jaguar C1000 (ex Rhodia)	-	1.0%	-
HI-CAT CWS 42 (ex Roquette Freres)	-	-	1.0%
Dequest 2000 (ex Thermphos)	2.0%	2.0%	2.0%
Caustic soda (50% NaOH solution)	20.0%	20.0%	20.0%
Trilon A liquid (40% NTA-Na ₃ ex BASF)	51.0%	51.0%	51.0%

[000125] These detergents were prepared as described in example 2. Metal corrosion properties were tested for each of these liquid detergents at 2g/L in soft water.

[000126] Results

[000127] In table 9, weight loss for the metal substrates is given for each detergent.

Table 9: Metal corrosion results

Nr	Product	Weight loss; mgram	
		Copper	Brass
1	Reference detergent	21.4	27.7
2	Detergent with 1.0% Jaguar C1000	13.4	23.2
3	Detergent with 1.0% HI-CAT CWS 42	13.0	18.5

[000128] It can be concluded from these trials that various types of cationic polysaccharides, present in a cleaning solution lead to protection of the metal surface and so inhibit metal corrosion. The presence of cationically modified guar gum and cationically modified starch in the wash solution, leads to a reduced corrosion of copper and brass substrates.

[000129] Example 4

[000130] In this example the effect on glass corrosion is tested of a cationic polysaccharide present in an alkaline cleaning solution under bottle washing conditions in a beverage plant. Bottle washing processes take place at high temperatures and with very high alkalinity in the wash bath. Therefore, corrosion was tested by immersing glass substrates during 18 hours in a wash solution containing 2% of pure caustic at 70 degrees C.

[000131] For these trials, glass coupons were used. The weight of these glass substrates is about 4.8 gram. For each test, 2 glass coupons were placed in an alkaline solution of 300 gram. In this example the glass corrosion properties were tested for a wash solution containing a cationically modified guar gum:

[000132] Jaguar C1000; ex Rhodia; Guar gum, 2 hydroxy-3-(trimethylammonium)propyl ether chloride.

[000133] The wash solution contained 0.01% of Jaguar C1000, 2% NaOH and 97.99% water. These glass corrosion properties were compared with a reference process with similar alkalinity but without cationic polysaccharide. The reference wash solution therefore contained 2% NaOH and 98% water.

[000134] The solutions containing 2 glass coupons were placed in an oven at 70 degrees C during 18 hours. Before and after this process the glasses were weighted. The weight loss is a measure for glass corrosion taking place during many repeated wash cycles in a bottle washing process.

[000135] In table 10, the weight loss of each glass substrate and the average weight losses are given.

Table 10: Corrosion results bottle washing conditions

Nr.	NaOH	Jaguar C1000	Weight loss: mgram	Average weight loss %
1 Reference	20 g/L	0.0 g/L	8.8	0.18 %
	20 g/L	0.0 g/L	8.8	
2	20 g/L	0.1 g/L	6.0	0.12 %
	20 g/L	0.1 g/L	5.7	

[000136] The reference test shows that severe glass corrosion is obtained in a bottle washing solution with high alkalinity in combination with high temperature.

[000137] This glass corrosion is reduced significantly when a cationic polysaccharide is present in the wash solution; even at the very low concentration of 0.01%.

CLAIMS

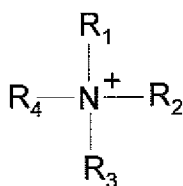
1. A method to prevent or inhibit corrosion of ware susceptible to corrosion in a ware washing process comprising washing the ware with an aqueous wash solution comprising a detergent composition and/or rinsing the ware with an aqueous clear rinse solution comprising a clear rinse composition, wherein said detergent composition and/or said clear rinse composition comprise(s) a cationic polysaccharide as a corrosion inhibitor.

2. A method for the washing of bottles in a beverage plant comprising washing the bottles with an aqueous wash solution comprising a detergent composition, said wash solution comprising 1000 to 50,000 ppm of a caustic agent, wherein said detergent composition comprises a cationic polysaccharide.

3. The method according to claim 2, wherein the cationic polysaccharide prevents or inhibits corrosion of the bottles.

4. The method according to claim 1, wherein the cationic polysaccharide contains a cationic group which is derived from an ammonium group, a quaternary ammonium group, a guanidium group, a sulfonium group and/or a phosphonium group.

5. The method according to claim 4, wherein the cationic polysaccharide contains a cationic group which is a quaternary ammonium group according to the formula



wherein R_1 , R_2 , R_3 and R_4 each independently are a lower alkyl or a lower hydroxyalkyl group, preferably wherein R_1 , R_2 , R_3 and R_4 each independently are a C1-C6 alkyl or a C1-C6 hydroxyalkyl group, more preferably wherein R_1 , R_2 and R_3 are identical C1-C4 alkyl groups and R_4 is a C3-C6 hydroxyalkyl group, even more preferably wherein R_1 , R_2 and R_3 are methyl groups and R_4 is a C3-C6 hydroxyalkyl group.

6. The method according to claim 1, wherein the cationic polysaccharide is a cationic guar or a cationic starch.

7. The method according to claim 6, wherein the cationic guar is Guar gum 2-hydroxy-3-(trimethylammonium)propyl ether chloride or Guar gum 2-hydroxypropyl, 2-hydroxy-3-(trimethylammonio) propyl ether chloride.

8. The method according to claim 6, wherein the cationic starch is (3-Chloro-2-Hydroxypropyl)Trimethylammonium Chloride modified starch.

9. The method according to claim 1, wherein the cationic polysaccharide constitutes 0.01% to 50% (w/w) of the composition, preferably 0.1% to 20% (w/w), more preferably 0.2 to 10% (w/w), even more preferably 0.5% to 5% (w/w), most preferably 1 to 5% (w/w), based on total (wet or dry) weight of the composition.

10. The method according to claim 1, wherein the concentration of the cationic polysaccharide in the aqueous wash solution and/or the aqueous clear rinse solution is from 1 to 100 ppm, preferably from 2 to 50 ppm, more preferably from 5 to 50 ppm.

11. Use of a cationic polysaccharide to prevent or inhibit corrosion and fading of decorative articles during a ware washing process in an institutional or a household ware washing machine or during bottle washing in a beverage plant.

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/066162

A. CLASSIFICATION OF SUBJECT MATTER
INV. C11D3/00 C11D3/22

According to International Patent Classification (IPC) or to both national classification and IPC

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
C11D

Documentation searched other than minimum documentation to the extent that such documents are included in the fields searched

Electronic data base consulted during the international search (name of data base and, where practical, search terms used)

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 01/85890 A1 (UNILEVER PLC [GB]; UNILEVER NV [NL]; LEVER HINDUSTAN LTD [IN]) 15 November 2001 (2001-11-15) page 1, line 12 - page 2, line 9; claim 1; example 10 -----	1-11
A	EP 0 893 491 A1 (UNILEVER PLC [GB]; UNILEVER NV [NL] UNILEVER NV [NL]) 27 January 1999 (1999-01-27) page 1, lines 1-7; claims 1-4,8-10 -----	1-11
A	US 4 101 456 A (RENAUD JEAN ET AL) 18 July 1978 (1978-07-18) column 1, line 1 - line 24; claims 1-12; examples 1-8 ----- -/--	1-11

☒ Further documents are listed in the continuation of Box C.

☒ See patent family annex.

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"Y" document of particular relevance; the claimed invention cannot be considered to involve an inventive step when the document is combined with one or more other such documents, such combination being obvious to a person skilled in the art.

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Date of the actual completion of the international search

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Date of mailing of the international search report

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Name and mailing address of the ISA/

European Patent Office, P.B. 5818 Patentlaan 2
NL - 2280 HV Rijswijk
Tel. (+31-70) 340-2040,
Fax: (+31-70) 340-3016

Authorized officer

Klier, Erich

INTERNATIONAL SEARCH REPORT

International application No
PCT/US2009/066162

C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT		
Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 99/05248 A1 (UNILEVER PLC [GB]; UNILEVER NV [NL]) 4 February 1999 (1999-02-04) page 12, line 5 - line 15; claims 1,12-14; examples 3,4 -----	1-11

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Information on patent family members

International application No

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