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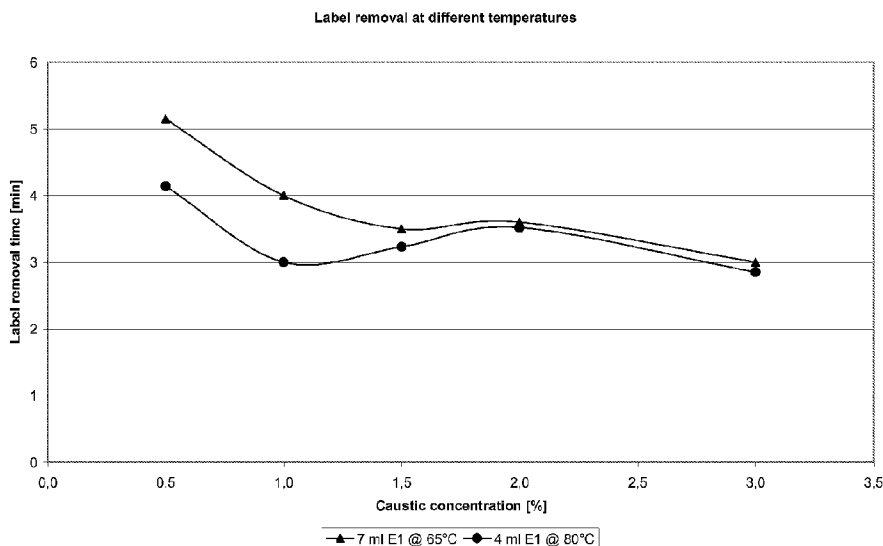
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(57) **Abrégé/Abstract:**

The present invention relates to a method for washing and/or label removal of glass, ceramic or plastic ware with a liquid cleaning composition at a process temperature below 80° C, wherein the liquid cleaning composition comprises active components in an amount of about ≥ 0.001 wt.-% to about ≤ 10 wt.-% and an alkaline source in an amount of about ≥ 0.5 wt.-% to about ≤ 3.5 wt.-%, wherein the active components comprising: a) at least one sequestering agent selected from the group of a phosphonic acid, phosphonate based sequestering agent, and/or a polymer of monomers of monoethylenically unsaturated C_3 - C_8 -carboxylic acids or salts thereof; b) at least one C_4 to C_{18} hydroxymonocarboxylic acid or salt thereof.

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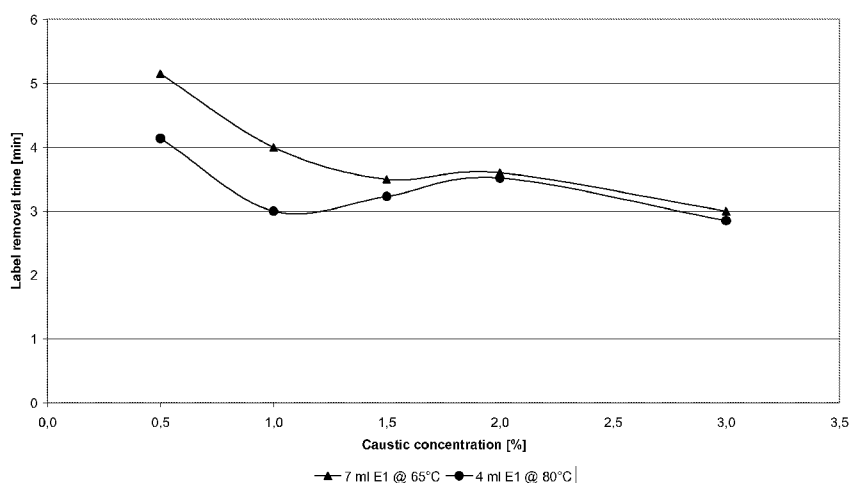
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(54) Title: PROCESS FOR CLEANING AND LABEL REMOVAL FOR BOTTLES

Fig. 1

Label removal at different temperatures



(57) **Abstract:** The present invention relates to a method for washing and/or label removal of glass, ceramic or plastic ware with a liquid cleaning composition at a process temperature below 80° C, wherein the liquid cleaning composition comprises active components in an amount of about ≥ 0.001 wt.-% to about ≤ 10 wt.-% and an alkaline source in an amount of about ≥ 0.5 wt.-% to about ≤ 3.5 wt.-%, wherein the active components comprising: a) at least one sequestering agent selected from the group of a phosphonic acid, phosphonate based sequestering agent, and/or a polymer of monomers of monoethylenically unsaturated C_3 - C_8 -carboxylic acids or salts thereof; b) at least one C_4 to C_{18} hydroxymonocarboxylic acid or salt thereof.

PROCESS FOR CLEANING AND LABEL REMOVAL FOR BOTTLES

Field of the Invention

The present invention relates to a process for cleaning bottles. In more detail, the present invention is directed to an improved method for cleaning bottles comprising the removal of bottle labels in a bottle cleaning plant.

Background of the Invention

Many beverages sold outside North America come in reusable glass bottles. By current estimates, annual worldwide production amounts to five billion reusable glass bottles.

In known processes, returnable bottles for beverage are cleaned in bottle cleaning machines using additive containing sodium hydroxide, which has been heated to at least 85° C. Hot caustic bottle cleaning of reusable glass, ceramic and plastic bottles at temperature of at least 85° C is involved with increased energy consumption.

Many of these reusable glass bottles are label that is adhered by an adhesive. These labels need to be removed at the cleaning process in a bottle cleaning plant. Further, residues such as soil, mold, dead yeast cells and there like needs to be removed during the cleaning process of a bottle cleaning plant.

Reuse of a glass bottle requires that the bottle remain aesthetically appealing for the duration of their life cycle. When the bottle themselves appear 'washed out' and bled, they are no longer aesthetically appealing, forcing the bottles to be discarded before the end of their useful lives. This lack of durability is quite understandable in light of the effect on the hot alkaline bottle washing processes. The cleaners used in hot bottle washing processes at temperatures of at least 85° C are designed to be aggressive on soils, but can also attack the bottle causing deterioration and shortening the useful life of the bottle. Bottle deterioration is undesirable because of the negative impact it has on brand image, consumer appeal and quality of the beverage package.

Therefore, there remains a need for a bottle washing process that minimizes energy consumption, attack on glass bottle appearance, while still providing adequate soil removal.

Summary of the Invention

The object addressed by the present invention is to provide a cleaning process that minimizes energy consumption for cleaning glass, ceramic, metal and/or plastic ware, such as bottles, preferably in a bottle cleaning plant, while still providing adequate soil removal and excellent label removal properties.

According to the present invention, a process for washing and/or label removal of glass, ceramic or plastic ware with a liquid cleaning composition at a temperature below 80° C, wherein the liquid cleaning composition comprises active components in an amount of about ≥ 0.001 wt.-% to about ≤ 10 wt.-% and an alkaline source in an amount of about ≥ 0.5 wt.-% to about ≤ 3.5 wt.-%, wherein the active components comprising:

- a) at least one sequestering agent selected from the group of a phosphonic acid, phosphonate based sequestering agent, and/or a polymer of monomers of monoethylenically unsaturated C₃-C₈-carboxylic acids or salts thereof;
- b) at least one C₄ to C₁₈ hydroxymonocarboxylic acid or salt thereof; wherein the weight-% of the active components are based on the total weight of the liquid cleaning composition.

A solvent, preferably water, can be added add. 100 wt.-% to the cleaning composition of the invention. The solvent content, preferably water, of the cleaning composition according to the invention is simply determined by subtracting the amounts of all the usual components from 100 wt.-%.

The weight amount (wt.-%) is calculated on the total weight amount of the liquid cleaning composition, if not otherwise stated. The total weight amount of all components of the liquid cleaning composition does not exceed 100 wt.-%.

The liquid cleaning composition may comprise the active components in an amount of about ≥ 0.003 wt.-%, preferably of about ≥ 0.006 wt.-%, further preferred of about ≥ 0.01 wt.-%, in addition preferred of about ≥ 0.05 wt.-%, also preferred of about ≥ 0.1 wt.-% or further more preferred of about ≥ 0.5 wt.-%.

It has surprisingly found, that the process of the present invention can be used for cleaning and removal of labels of glass, ceramic, metal and/or plastic ware, such as bottles, preferably in a bottle cleaning plant, while still providing adequate soil removal and excellent label removal properties, and minimizes energy consumption. For example, bottle labels can be removed at lower temperatures compared to prior art in a soaking bath, preferably in a soaking bath of a bottle cleaning plant that containing the cleaning composition used in the process of the invention.

The active components can be added to the cleaning composition in the form of an acid and/or as a salt thereof.

The cleaning composition can be obtained by adding a liquid cleaning additive that comprises the active components.

The liquid cleaning additive that comprises the active components can be an acid or alkaline solution. The liquid cleaning additive can be a concentrated solution. The concentrated liquid cleaning additive can be further diluted by admixing a solvent, preferably water.

It should be understood that the active components, the liquid cleaning additive and/or liquid cleaning composition of the invention can be free of at least one additive, preferably all additives,

selected from the group of dye, color transfer inhibitor, anti-redeposition agents, optical brighteners, builder, oil and water repellent agents, color fastness agents, starch/sizing agents, fabric softening agents, anti-microbials, fungicides, UV absorbers, thickeners, oxidizers, fragrances and/or mixtures thereof.

It has been surprisingly found that a defined weight ratio of the active components a) of at least one sequestering agent to b) of at least one C₄ to C₁₈ hydroxymonocarboxylic acid or salts thereof, used according to the method of the invention provides an adequate soil removal and excellent label removal properties at a lower process temperature.

According to an embodiment of the present invention the weight ratio of the active components a) of at least one sequestering agent to b) of at least one C₄ to C₁₈ hydroxymonocarboxylic acid or salts thereof can be in the range of about 6 : 1 to about 1 : 6, preferably 5 : 1 to 1 : 5, further preferred 4 : 1 to 1 : 4 and more preferred 3 : 1 to 1 : 3.

The ratio of components as mentioned is the weight ratio, if not otherwise indicated in the specification.

The active components as used according to the method of the invention may comprise in addition an active component c) of at least one phosphoric acid based or phosphate-based component. Exemplary, the active component c) includes preferably phosphoric acid, sodium phosphate, potassium phosphate, pyrophosphoric acid, sodium pyrophosphate, potassium pyrophosphate, and mixtures thereof.

The solvent, including water, is not considered as an active component.

The active components as used according to the method of the invention may comprise in addition an active component d) of at least one amphoteric alkoxyated C₆ to C₂₄ alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide or a salt thereof.

The process of soil removal and excellent label removal properties at a lower process temperature can be improved by adding to the liquid cleaning composition an active component of at least one non-encapped nonionic alkoxyated C₆ to C₂₄ alcohol surfactant containing about 1 to about 30 alkylene oxide units.

The addition of an active component of at least one alkyl encapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide can further improve soil removal and excellent label removal properties at a lower process temperature of the process of the invention.

According to an embodiment of the process of the invention, active components can be used that comprises in addition d) of at least one amphoteric alkoxyated C₆ to C₂₄ alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide or a salt thereof; and of at least one anti-foaming agent, preferably select from the group of silicone based defoamer, and/or of at least one alkyl encapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide.

The process according to the invention can be further optimized with respect to the label removal properties if active components are used, wherein the weight ratio of a) the sequestering agent to b) the C₄ to C₁₈ hydroxymonocarboxylic acid or salts thereof is in the range of about 5 : 1 to about 1 : 5, preferably about 4 : 1 to 1 : 4, further preferred about 3 : 1 to about 1 : 3, and more preferred about 2 : 1 to about 1 : 2.

Improved soil removal and excellent label removal properties at a lower process temperature can be achieved according to the process of the invention, if the weight ratio of the active components of c) the phosphoric acid based or phosphate -based component to a) the sequestering agent is about 10 : 1 to about 1 : 10, preferably about 5 : 1 to 1 : 5, further preferred about 3 : 1 to about 1 : 3, also preferred about 2 : 1 to about 1 : 2, and more preferred about 1.5 : 1 to about 1.2 : 1.

According to an embodiment of the process of the invention it can be preferred that the weight ratio of the active components of d) the amphoteric surfactant to b) the C₄ to C₁₈ hydroxymonocarboxylic acid, or a salt thereof is about 10 : 1 to about 1 : 10, preferably about 5 : 1 to 1 : 5, further preferred about 3 : 1 to about 1 : 3, also preferred about 2 : 1 to about 1 : 2, and more preferred about 1.7 : 1 to about 1.5 : 1.

It can be further preferred for the process of the invention that the weight ratio of the active components of f) the alkyl endcapped nonionic surfactant to e) the non-endcapped nonionic surfactant is about 10 : 1 to about 1 : 10, preferably about 5 : 1 to 1 : 5, further preferred about 4 : 1 to about 1 : 4, also preferred about 3 : 1 to about 1 : 3, and more preferred about 2.6 : 1 to about 2.3 : 1.

It should be understood that the active components, the liquid cleaning additive and/or liquid cleaning composition of the invention can be free of the component c) of at least one phosphoric acid based or phosphate -based component.

It should be understood that the active components, the liquid cleaning additive and/or liquid cleaning composition of the invention can be free of the component d) of at least at least one amphoteric alkoxylated (, to C₂₄ alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide or a salt thereof.

It should be understood that the active components, the liquid cleaning additive and/or liquid cleaning composition of the invention can be free of at least one non-endcapped nonionic alkoxylated C₆ to C₂₄ alcohol surfactant containing about 1 to about 30 alkylene oxide units.

It should be understood that the active components, the liquid cleaning additive and/or liquid cleaning composition of the invention can be free of at least one alkyl endcapped nonionic alkoxylated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide.

It should be understood that the active components, the liquid cleaning additive and/or liquid cleaning composition of the invention can be free of the component c) of at least one phosphoric acid based or phosphate-based component and d) of at least at least one amphoteric alkoxylated C₆ to C₂₄

alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide or a salt thereof.

It should be understood that the active components, the liquid cleaning additive and/or liquid cleaning composition of the invention can be free of the component c) of at least one phosphoric acid based or phosphate-based component and d) of at least at least one amphoteric alkoxylated C_6 to C_{24} alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide or a salt thereof and e) of at least one non-endcapped nonionic alkoxylated C_6 to C_{24} alcohol surfactant containing about 1 to about 30 alkylene oxide units and/or of at least one alkyl endcapped nonionic alkoxylated C_8 to C_{18} alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide.

It should be understood that the active components, the liquid cleaning additive and/or liquid cleaning composition of the invention can be free of the component d) of at least at least one amphoteric alkoxylated C_6 to C_{24} alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide or a salt thereof and e) of at least one non-endcapped nonionic alkoxylated C_6 to C_{24} alcohol surfactant containing about 1 to about 30 alkylene oxide units and/or of at least one alkyl endcapped nonionic alkoxylated C_8 to C_{18} alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide.

It should be understood that the active components, the liquid cleaning additive and/or liquid cleaning composition of the invention can be free of the component c) of at least one phosphoric acid based or phosphate-based component and d) of at least at least one amphoteric alkoxylated C_6 to C_{24} alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide or a salt thereof, d) of at least at least one amphoteric alkoxylated C_6 to C_{24} alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide or a salt thereof and e) of at least one non-endcapped nonionic alkoxylated C_6 to C_{24} alcohol surfactant containing about 1 to about 30 alkylene oxide units and/or of at least one alkyl endcapped nonionic alkoxylated C_8 to C_{18} alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide.

The active components used in the process of the invention may be added in form of a concentrate or in a diluted form to an alkaline solution to provide the liquid cleaning composition. A concentrated liquid cleaning additive can be diluted with a solvent, preferably water, to its diluted form. The diluted liquid cleaning additive can be added to an alkaline solution to obtain the liquid cleaning composition.

It can be preferred to preprocess glass, ceramic or plastic bottle, preferably glass and/or ceramic bottles, with an alkaline solution for cleaning residues such as soil, mold, dead yeast cells and the like, and thereafter with the liquid cleaning composition for cleaning and/or label removal at a temperature below 80° C. As an alternative, right from the start a liquid cleaning composition can be used in the process of

the invention for cleaning residues such as soil, mold, dead yeast cells and there like of glass, ceramic or plastic ware and label removal at a process temperature below 80° C.

Suitable bottle cleaning plants that can be used in the process of the invention are for example a single-end-bottle washer or a double-end-bottle washer.

According to an embodiment of the invention a concentrated liquid cleaning additive may comprises

- a) about ≥ 1 wt.-% to about ≤ 30 wt.-%, preferably about ≥ 2 wt.-% to about ≤ 20 wt.-%, more preferred about ≥ 5 wt.-% to about ≤ 15 wt.-% of a gluconic acid or a salt thereof,
- b) about ≥ 1 wt.-% to about ≤ 10 wt.-%, preferably about ≥ 3 wt.-% to about ≤ 8 wt.-%, more preferred about ≥ 4 wt.-% to about ≤ 6 wt.-% of a phosphonic acid or a salt thereof, or a polymer of monomers of monoethylenically unsaturated C₃-C₈-carboxylic acids or salts thereof,
- c) about ≥ 0 wt.-% to about ≤ 20 wt.-%, preferably about ≥ 5 wt.-% to about ≤ 15 wt.-%, more preferred about ≥ 6 wt.-% to about ≤ 10 wt.-% of a phosphoric acid or a salt thereof,
- d) about ≥ 0 wt.-% to about ≤ 20 wt.-%, preferably about ≥ 3 wt.-% to about ≤ 15 wt.-%, more preferred about ≥ 5 wt.-% to about ≤ 10 wt.-% of at least one amphoteric alkoxyated C₆ to C₂₄ alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide, preferably an amphoteric alkoxyated C₁₂ to C₁₄ alcohol amine surfactant containing 10 to 14 alkylene oxide units, or a salt thereof;
- e) about ≥ 0 wt.-% to about ≤ 40 wt.-%, preferably about ≥ 1 wt.-% to about ≤ 35 wt.-%, further preferred about ≥ 10 wt.-% to about ≤ 30 wt.-%, more preferred about ≥ 15 wt.-% to about ≤ 25 wt.-% of at least one alkyl endcapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide, preferably an butyl endcapped nonionic alkoxyated C₁₂ to C₁₈ alcohol surfactant containing 8 to 10 alkylene oxide units of ethylene oxide; and/or at least one non-endcapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide, preferably at least one non-endcapped nonionic alkoxyated C₁₂ to C₁₄ alcohol surfactant containing 2 to 4 units of ethylene oxide and 3 to 5 units propylene oxide; and
- f) a solvent, preferably water, is added add. 100 wt.-%; wherein the weight-% of the components of the concentrated liquid cleaning additive are based on the total weight of the concentrated liquid cleaning additive and does not exceed 100 wt.-%.

Alternatively, the liquid cleaning additive can be presented in a diluted form. A diluted liquid cleaning additive that can be used in the process of the invention comprises about ≥ 0.01 wt.-% to about ≤ 10 wt.-%, preferably about ≥ 0.05 wt.-% to about ≤ 5 wt.-%, further preferred about ≥ 0.1 wt.-% to about ≤ 2 wt.-%, also

preferred about ≥ 0.15 wt.-% to about ≤ 1 wt.-%, in addition preferred about ≥ 0.2 wt.-% to about ≤ 0.5 wt.-%, furthermore preferred about ≥ 0.25 wt.-% to about ≤ 0.5 wt.-%, and more preferred about ≥ 0.3 wt.-% to about ≤ 0.4 wt.-% of the concentrated additive and at least one solvent, preferably water, is added add. 100 wt.-%.

Alkaline Solution

According to the process of the present invention a liquid cleaning composition comprising an alkaline source can be used having a pH in the range of about ≥ 10 pH, preferably ≥ 12 pH and more preferred ≥ 13 pH to ≤ 14 pH.

The cleaning composition can be obtained by adding the active components to an alkaline solution.

The alkaline solution or liquid cleaning composition that can be used in the process of the invention comprises about ≥ 0.5 wt.-% to about ≤ 3.5 wt.-%, preferably about ≥ 1 wt.-% to about ≤ 3 wt.-%, further preferred about ≥ 1.25 wt.-% to about ≤ 2.75 wt.-%, also preferred about ≥ 1.3 wt.-% to about ≤ 2.5 wt.-%, in addition preferred about ≥ 1.5 wt.-% to about ≤ 2.3 wt.-%, furthermore preferred about ≥ 1.7 wt.-% to about ≤ 2.25 wt.-%, and more preferred about ≥ 1.5 wt.-% to about ≤ 2.0 wt.-%, of an alkaline source, preferably sodium hydroxide, and at least one solvent, preferably water, is added add. 100 wt.-%; wherein the weight-% of the alkaline source are based on the total weight of the alkaline solution or liquid cleaning composition.

Liquid Cleaning Composition

The liquid cleaning composition can be obtained by adding the active components or a liquid cleaning additive, preferably a concentrated and more preferred a diluted liquid cleaning additive, to an alkaline solution. Thus, the liquid cleaning composition can be an alkaline solution containing the active components.

According to the process of the present invention the pH of the liquid cleaning composition used in the process of the invention is in the range of about ≥ 10 pH, preferably ≥ 12 pH and more preferred ≥ 13 pH to ≤ 14 pH. The use of an alkaline liquid cleaning composition ensures an excellent soil removable as necessary in a bottle cleaning process.

In a common bottle cleaning plant for washing of and label removal from glass, ceramic or plastic ware the process temperature of the cleaning solution of the soaking bath is of about 85°C . According to the present invention the process temperature of the cleaning solution of a soaking bath of about 85°C can be lowered to temperatures of below 80°C , that saves energy.

Further, the use of the liquid cleaning composition allows running the bottle cleaning and labeling removal process at lower temperatures. The process of the invention saves energy compared to standard cleaning conditions as used in a bottle cleaning plant for bottle cleaning and label removal at $\geq 85^{\circ}\text{C}$.

The process of the invention allows washing, such as cleaning and label removal, of glass, ceramic or plastic ware, preferably bottle cleaning and label removal in a bottle cleaning plant, at

process temperatures, preferably of the liquid cleaning solution, in the range of about $\geq 30^{\circ}\text{C}$ to $\leq 78^{\circ}\text{C}$, further preferred in the range of about $\geq 40^{\circ}\text{C}$ to $\leq 77^{\circ}\text{C}$, also preferred in the range of about $\geq 50^{\circ}\text{C}$ to $< 75^{\circ}\text{C}$, furthermore preferred in the range of about $\geq 55^{\circ}\text{C}$ to $\leq 70^{\circ}\text{C}$ and more preferred in the range of about $\geq 60^{\circ}\text{C}$ to $\leq 65^{\circ}\text{C}$.

As already mentioned before, the label removal may take place preferably in a soaking bath comprising the liquid cleaning composition at temperatures in the range of about $\geq 30^{\circ}\text{C}$ to $\leq 78^{\circ}\text{C}$, further preferred in the range of about $\geq 40^{\circ}\text{C}$ to $\leq 77^{\circ}\text{C}$, also preferred in the range of about $\geq 50^{\circ}\text{C}$ to $\leq 75^{\circ}\text{C}$, furthermore preferred in the range of about $\geq 55^{\circ}\text{C}$ to $\leq 70^{\circ}\text{C}$ and more preferred in the range of about $\geq 60^{\circ}\text{C}$ to $\leq 65^{\circ}\text{C}$.

The label removal time obtained using the liquid cleaning composition in the process of the invention can be in the range of ≥ 60 seconds to < 480 seconds, preferably of ≥ 120 seconds to ≤ 420 seconds, further preferred of ≥ 150 seconds to ≤ 390 seconds and furthermore preferred of ≥ 180 seconds to ≤ 360 seconds.

The label removal time obtained using the process of the invention fulfils the demand for label removal time required in an automated cleaning and label removal process for bottles.

The liquid cleaning composition can comprises about ≥ 0.003 wt.-% to about ≤ 0.035 wt.-%, preferably about ≥ 0.01 wt.-% to about ≤ 0.03 wt.-%, more preferred about ≥ 0.014 wt.-% to about ≤ 0.022 wt.-% of a phosphonic acid or a salt thereof, or a polymer of monomers of monoethylenically unsaturated C_3 - C_8 -carboxylic acids or salts thereof, preferably polyacrylic acid or a salt thereof.

Further, the cleaning composition can comprises about ≥ 0.003 wt.-% to about ≤ 0.105 wt.-%, preferably about ≥ 0.007 wt.-% to about ≤ 0.070 wt.-%, more preferred about ≥ 0.01 wt.-% to about ≤ 0.053 wt.-% of a gluconic acid or a salt thereof.

It can be preferred that the cleaning composition may comprises about ≥ 0 wt.-% to about ≤ 0.07 wt.-%, preferably about ≥ 0.01 wt.-% to about ≤ 0.053 wt.-%, more preferred about ≥ 0.021 wt.-% to about ≤ 0.035 wt.-% of a phosphoric acid or a salt thereof.

The liquid cleaning composition can comprises about ≥ 0 wt.-% to about ≤ 0.07 wt.-%, preferably about ≥ 0.01 wt.-% to about ≤ 0.053 wt.-%, more preferred about ≥ 0.017 wt.-% to about ≤ 0.035 wt.-% of at least one amphoteric alkoxylated C_6 to C_{24} alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide, preferably an amphoteric alkoxylated C_{12} to C_{14} alcohol amine surfactant containing 10 to 14 alkylene oxide units, or a salt thereof.

According to an preferred embodiment, the liquid cleaning composition comprises about ≥ 0 wt.-% to about ≤ 0.14 wt.-%, preferably about ≥ 0.003 wt.-% to about ≤ 0.123 wt.-%, further preferred about ≥ 0.035 wt.-% to about ≤ 0.0105 wt.-%, more preferred about ≥ 0.052 wt.-% to about ≤ 0.088 wt.-% of at least one alkyl endcapped nonionic alkoxylated C_8 to C_{18} alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide, preferably an butyl endcapped nonionic alkoxylated C_{12} to

C₁₈ alcohol surfactant containing 8 to 10 alkylene oxide units of ethylene oxide; and/or at least one non-encapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide, preferably at least one non-encapped nonionic alkoxyated C₁₂ to C₁₄ alcohol surfactant containing 2 to 4 units of ethylene oxide and 3 to 5 units propylene oxide.

The liquid cleaning composition may comprises about ≥ 0.5 wt.-% to about ≤ 3.5 wt.-%, preferably about > 1 wt.-% to about ≤ 3 wt.-%, further preferred about ≥ 1.25 wt.-% to about ≤ 2.75 wt.-%, also preferred about ≥ 1.3 wt.-% to about ≤ 2.5 wt.-%, in addition preferred about ≥ 1.5 wt.-% to about ≤ 2.3 wt.-%, furthermore preferred about ≥ 1.7 wt.-% to about ≤ 2.25 wt.-%, and more preferred about ≥ 1.5 wt.-% to about ≤ 2.0 wt.-%, of an alkaline source, preferably sodium hydroxide.

To the liquid composition a solvent, preferably water, can be added add. 100 wt.-%. The weight-% of the components of the liquid composition are based on the total weight of the liquid cleaning composition and does not exceed 100 wt.-%.

More preferred, the liquid cleaning composition that can be used in the process of the invention may comprise:

a) about ≥ 0.003 wt.-% to about ≤ 0.035 wt.-%, preferably about ≥ 0.01 wt.-% to about ≤ 0.03 wt.-%, more preferred about ≥ 0.014 wt.-% to about ≤ 0.022 wt.-% of a phosphonic acid or a salt thereof, or a polymer of monomers of monoethylenically unsaturated C₃-C₈- carboxylic acids or salts thereof, preferably polyacrylic acid or a salt thereof,

b) about ≥ 0.003 wt.-% to about ≤ 0.105 wt.-%, preferably about ≥ 0.007 wt.-% to about ≤ 0.070 wt.-%, more preferred about ≥ 0.01 wt.-% to about ≤ 0.053 wt.-% of a gluconic acid or a salt thereof,

c) about ≥ 0 wt.-% to about ≤ 0.07 wt.-%, preferably about ≥ 0.01 wt.-% to about ≤ 0.053 wt.-%, more preferred about ≥ 0.021 wt.-% to about ≤ 0.035 wt.-% of a phosphoric acid or a salt thereof,

d) about ≥ 0 wt.-% to about ≤ 0.07 wt.-%, preferably about ≥ 0.01 wt.-% to about ≤ 0.053 wt.-%, more preferred about ≥ 0.017 wt.-% to about ≤ 0.035 wt.-% of at least one amphoteric alkoxyated C to C₂₄ alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide, preferably an amphoteric alkoxyated C₁₂ to C₁₄ alcohol amine surfactant containing 10 to 14 alkylene oxide units, or a salt thereof;

e) about ≥ 0 wt.-% to about ≤ 0.14 wt.-%, preferably about > 0.003 wt.-% to about ≤ 0.123 wt.-%, further preferred about ≥ 0.035 wt.-% to about ≤ 0.105 wt.-%, more preferred about ≥ 0.052 wt.-% to about ≤ 0.088 wt.-% of at least one alkyl encapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide, preferably an butyl encapped nonionic alkoxyated C₁₂ to C₁₈ alcohol surfactant containing 8 to 10 alkylene oxide units of ethylene oxide; and/or at least one non-encapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide

units of ethylene oxide and/or propylene oxide, preferably at least one non- endcapped nonionic alkoxyated C₁₂ to C₁₄ alcohol surfactant containing 2 to 4 units of ethylene oxide and 3 to 5 units propylene oxide;

f) about ≥ 0.5 wt.-% to about ≤ 3.5 wt.-%, preferably about ≥ 1 wt.-% to about ≤ 3 wt.-%, further preferred about ≥ 1.25 wt.-% to about ≤ 2.75 wt.-%, also preferred about ≥ 1.3 wt.-% to about ≤ 2.5 wt.-%, in addition preferred about ≥ 1.5 wt.-% to about ≤ 2.3 wt.-%, furthermore preferred about ≥ 1.7 wt.-% to about ≤ 2.25 wt.-%, and more preferred about ≥ 1.5 wt.-% to about ≤ 2.0 wt.-%, of an alkaline source, preferably sodium hydroxide; and

g) a solvent, preferably water, is added add. 100 wt.-%; wherein the weight-% of the components are based on the total weight of the liquid cleaning composition and does not exceed 100 wt.-%.

Subsequently components of the active components, the liquid cleaning additive, the alkaline solution as well as of the liquid cleaning composition that can be used in the process of the invention are described in more detail.

Sequestrants

The active components, the liquid cleaning additive and/or liquid cleaning composition used in the process of the invention includes a) at least one sequestering agent selected from the group of a phosphonic acid, phosphonate based sequestering agent, and/or a polymer of monomers of monoethylenically unsaturated C₃-C₈-carboxylic acids or salts thereof. In general, a sequestrant is a molecule capable of coordinating (i.e., binding) the metal ions commonly found in natural water to prevent the metal ions from interfering with the action of the other deterative ingredients of a cleaning composition. Some sequestering agents can also function as a threshold agent when included in an effective amount.

A variety of phosphonic acid or phosphonate based sequestering agents can be used including, for example, organic phosphonate, condensed phosphonate, mixture thereof, or the like. Such sequestrants are commercially available. Suitable condensed phosphonates include sodium and potassium orthophosphonate, sodium and potassium pyrophosphonate, sodium and potassium tripolyphosphonate, sodium hexametaphosphonate, preferably of tripolyphosphonate.

Sodium salts of condensed phosphonates are preferred to the corresponding potassium salts. The sequestrant includes an organic phosphonate, such as an organic -phosphonic acid or alkali metal salts thereof. Some examples of suitable organic phosphonic acids including their corresponding phosphonates include:

1 -hydroxyethane- 1, 1 -diphosphonic acid:



aminotri(methylenephosphonic acid) :



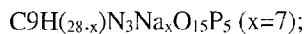
aminotri(methylenephosphonate), sodium salt;

2-hydroxyethyliminobis(methylenephosphonic acid):

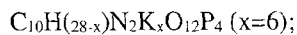


diethylenetriaminepenta(methylenephosphonic acid): $(\text{HO})_2\text{POCH}_2\text{N}[\text{CH}_2\text{CH}_2\text{N}[\text{CH}_2\text{PO}(\text{OH})_2]_2]_2;$

diethylenetriaminepenta(methylene-phosphonate), sodium salt:



hexamethylenediamine(tetramethylenephosphonate), potassium salt:



bis(hexamethylene)triamine(pentamethylenephosphonic acid):

$(\text{HO}_2)\text{POCH}_2\text{N}[\text{CH}_2]_6\text{N}[\text{CH}_2\text{PO}(\text{OH})_2]_2];$ and phosphorus acid H_3PO_3 ; and other similar organic phosphonates, and mixtures thereof.

2-hydroxyethyliminobis(methylenephosphonic acid):

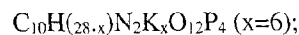


diethylenetriaminepenta(methylenephosphonic acid): $(\text{HO})_2\text{POCH}_2\text{N}[\text{CH}_2\text{CH}_2\text{N}[\text{CH}_2\text{PO}(\text{OH})_2]_2]_2;$

diethylenetriaminepenta(methylenephosphonate), sodium salt:



hexamethylenediamine(tetramethylenephosphonate), potassium salt:



bis(hexamethylene)triamine(pentamethylenephosphonic acid):

$(\text{HO}_2)\text{POCH}_2\text{N}[\text{CH}_2]_6\text{N}[\text{CH}_2\text{PO}(\text{OH})_2]_2];$ and phosphorus acid H_3PO_3 ; and other similar organic phosphonates, and mixtures thereof.

Other sequestant agents can be used selected from the group of salts of acid substituted polymers of monomers of monoethylenically unsaturated C_3 - C_8 -carboxylic acid, preferably from salts of C_3 - C_4 -monocarboxylic acid, acrylate, methacrylate, salts of polyitaconate, salts of polymaleate, and mixtures thereof, most preferred is a polyacrylate; and/or the sequestant can be selected from the group of acid substituted polymers of monomers of monoethylenically unsaturated C_3 - C_8 -carboxylic acid, preferably from a C_3 - C_4 -monocarboxylic acid, acrylic acid, methacrylic acid, polyitaconic acid, polymaleic acid, and mixtures thereof, most preferred is a polyacrylic acid or a salt thereof. Suitable polyacrylic acid polymers are Sokalan™, for example Sokalan CP 5 and/or Sokalan CP 10, obtainable from BASF.

The polymers tend to be water-soluble or at least colloidally dispersible in water. The molecular weight of these polymers may vary over a broad range although it is preferred to use polymers having an average molecular weights (Mw) ranging from $\geq 1,000$ up to $\leq 1,000,000$, preferably $\geq 2,000$ up to $\leq 800,000$, further preferred $\geq 2,500$ up to $\leq 500,000$, also preferred $\geq 3,000$ up to $\leq 250,000$, more preferred $\geq 3,500$ up to $\leq 100,000$, especially preferred $\geq 4,000$ up to $\leq 50,000$ and in particular preferred $\geq 4,500$ up to $\leq 10,000$.

The polymers or copolymers, either the acid-substituted polymers or other added polymers may be prepared by either addition or hydrolytic techniques. Thus, maleic anhydride copolymers are prepared by the addition polymerization of maleic anhydride and another comonomer such as styrene. Preferably salts of acid substituted polymers of monomers of acrylate, methacrylate, salts of polyitaconic acid, salts of polymaleic acid, and mixtures thereof. In particular preferred are salts of polyacrylic acid.

The low molecular weight acrylic acid polymer may be prepared by addition polymerization of acrylic acid or its salts either with itself or other vinyl comonomers.

Alternatively, such polymers may be prepared by the alkaline hydrolysis of low molecular weight acrylonitrile homopolymers or copolymers.

More preferred can be the use of a sequestrant in the process of the invention such as a homo polyacrylic acid and/or a homo polyacrylate. Most preferred is the use of a homo polyacrylic acid and/or a homo polyacrylate having a Mw ranging from $\geq 1,000$ up to $\leq 1,000,000$, preferably $\geq 2,000$ up to $\leq 800,000$, further preferred $\geq 2,500$ up to $\leq 500,000$, also preferred $\geq 3,000$ up to $\leq 250,000$, more preferred $\geq 3,500$ up to $\leq 100,000$, especially preferred $\geq 4,000$ up to $\leq 50,000$ and in particular preferred $\geq 4,500$ up to $\leq 10,000$.

It should be understood that other sequestrants, with the exception of at least one sequestering agent selected from the group of a phosphonic acid, phosphonate based sequestering agent, and/or a polymer of monomers of monoethylenically unsaturated C₃-C₈-carboxylic acids or salts thereof, are optional.

Phosphates

The active components, the liquid cleaning additive and/or liquid cleaning composition used in the process of the invention may comprise at least one phosphate or phosphoric acid. Phosphates or phosphoric acid can provide soil dispersion, detergency, water hardness control, and the like to the present additive or cleaning composition. Such phosphates include a monomer of phosphoric acid, a polymer of phosphoric acid, a salt of phosphoric acid, or a combination thereof; an ortho phosphate, a meta phosphate, a tripolyphosphate, or a combination thereof; phosphoric acid; alkali metal, ammonium and alkanolammonium salts of polyphosphates, for example sodium tripolyphosphate and other higher linear and cyclic polyphosphate species, pyrophosphates, and glassy polymeric meta-phosphates; amino phosphates; nitrilotrismethylene phosphates; and the like; or a combination thereof. Preferred phosphates include phosphoric acid, and monomers, polymers, and salts thereof, and the like, or a combination thereof.

Chelant Component

The active components, the liquid cleaning additive and/or liquid cleaning composition used in the process of the invention includes a) at least one C₄ to C₁₈ hydroxymonocarboxylic acid or salts thereof. A chelant component exhibits soil removal properties when used for example at alkaline conditions. The chelant component is provided for tying up metals in the soil to assist in cleaning and detergency. The chelant component can be provided as part of the composition. A concentrated liquid cleaning additive can comprise

the chelant component in an amount of ≥ 1 wt.- to about ≤ 30 wt.-%, preferably about ≥ 2 wt.-% to about ≤ 20 wt.-%, more preferred about ≥ 5 wt.-% to about ≤ 15 wt.-%. It should be understood that the chelant component can include mixtures of different chelants.

Suitable C_4 to C_{18} hydroxymonocarboxylic acid or corresponding salt compounds include, but are not limited to, citric acid; propionic acid; gluconic acid; glycolic acid; glucoheptanoic acid; succinic acid; lactic acid; methylactic acid; 2-hydroxybutanoic acid; mandelic acid; atrolactic acid; phenyllactic acid; glyeric acid; 2,3, 4-trihydroxybutanoic acid; alpha hydroxylauric acid; benzillic acid; isocitric acid; citramalic acid; agaricic acid; quinic acid; uronic acids, including glucuronic acid, glucuronolactonic acid, galaturonic acid, and galacturonolactonic acid; hydroxypyruvic acid; ascorbic acid; and tropic acid. Preferred hydroxymonocarboxylic acid compounds include citric acid; propionic acid; gluconic acid; glycolic acid; glucoheptanoic acid; and succinic acid. Suitable hydroxydicarboxylic acid compounds include, but are not limited to, tartronic acid; malic acid; tartaric acid; arabiraric acid; ribaric acid; xylaric acid; lyxaric acid; glucaric acid; galactaric acid; mannaric acid; gularic acid; allaric acid; altraric acid; idaric acid; and talaric acid. Preferred hydroxydicarboxylic acid compounds include tartaric acid as well as ethylene diamine tetraacetic acid. However, most preferred is gluconic acid or a salt thereof, such as sodium gluconate.

Additional chelants can be used in the process of the present invention. Exemplary chelants that can be used in addition according to the invention include pentasodium salt of diethylenetriamine pentaacetic acid (available under the name Versenex 80), sodium glucoheptonate, ethylene diamine tetraacetic acid (EDTA), salts of ethylene diamine tetraacetic acid, hydroxyethyl ethylene diamine triacetic acid (HEDTA), salts of hydroxyethyl ethylene diamine triacetic acid, nitrilotriacetic acid (NTA), salts of nitrilotriacetic acid, diethanolglycine sodium salt (DEG), ethanoldiglycine disodium salt (EDG), tetrasodium N,N-bis(carboxylatomethyl)-L-glutamate (GLDA), and mixtures thereof. Exemplary salts of ethylene diamine tetraacetic acid include disodium salts, tetrasodium salts, diammonium salts, and trisodium salts. An exemplary salt of hydroxyethyl ethylene diamine triacetic acid is the trisodium salt.

Suitable chelant that can be used in addition in the process of the invention are iminodisuccinate, preferably the sodium salt of iminodisuccinate, hydroxyethylidene diposphonic acid and/or tetrasodium N,N-bis(carboxylatomethyl)-L-glutamate (GLDA).

It should be understood that the chelant component can include mixtures of different chelants. However, other chelants, with the exception of C_4 to C_{18} hydroxymonocarboxylic acid or salts thereof, are optional.

Acids

The active components, the liquid cleaning additive and/or liquid cleaning composition used in the process of the invention may comprises an acid or a salt thereof. Exemplary inorganic acids that

can be used include mineral acids such as sulfuric acid, nitric acid, hydrochloric acid, and phosphoric acid.

Exemplary organic acids that can be used include carboxylic acids including monocarboxylic acids and polycarboxylic acids such as dicarboxylic acids. Exemplary carboxylic acids include aliphatic and aromatic carboxylic acids. Exemplary aliphatic carboxylic acids include acetic acid, formic acid, halogen-containing carboxylic acids such as chloroacetic carboxylic acid, and modified carboxylic acids containing side groups such - OH, - R, - OR, -(EO)_x, - (PO)_x, - NH₂, and - NO₂ wherein R is a C₁ to C₁₀ alkyl group. Exemplary aromatic carboxylic acids include benzoic carboxylic acid, salicylic carboxylic acid, and aromatic carboxylic acid modified to include as a side group at least one of halogen, - OH, - R, - OR, -(EO)_x, - (PO)_x, - NH₂, and - NO₂ wherein R is a C₁ to C₁₀ alkyl group. Additional exemplary organic acids include oxalic acid, phthalic acid, sebacic acid, adipic acid, citric acid, maleic acid, and modified forms thereof containing side groups including halogen, -OH, - R, - OR, -(EO)_x, - (PO)_x, - NH₂, and - NO₂ wherein R is a C₁ to C₁₀ alkyl group. It should be understood that the subscript 'x' refers to repeating units.

The active components, the liquid cleaning additive and/or liquid cleaning composition can comprise at least one acid or a corresponding salt thereof. It should be understood that the addition of acid or a corresponding salt thereof to the active components, the liquid cleaning additive and/or liquid cleaning composition can be omitted.

Surfactant

The active components, the liquid cleaning additive and/or liquid cleaning composition used in the process of the invention may comprises at least one surfactant. The surfactant can be selected from the group of nonionic surfactant, cationic surfactant, anionic surfactant, amphoteric surfactant and mixtures thereof. More preferred are surfactant, which are biodegradable.

The additional surfactant component can be used for enhancing the cleaning properties of the liquid cleaning composition. The surfactant component can be used in the process of the invention to reduce surface tension and wet the soil particulate to allow penetration of the use solution and separation of the soil as well as removal of a bottle label.

It should be understood that the addition of a surfactant to the active components, the liquid cleaning additive and/or liquid cleaning composition is optional.

Nonionic Surfactants

Exemplary nonionic surfactants that can be used in the active components, the liquid cleaning additive and/or liquid cleaning composition for the process of the invention are alkoxylated, preferably ethoxylated or ethoxylated and propoxylated, fatty acid alkyl esters preferably containing 1 to 4 carbon atoms in the alkyl chain, more particularly the fatty acid methyl esters.

The nonionic low alkoxyated alcohol surfactants can be used to reduce surface tension, wet the soil particulate to allow penetration of the use solution, separation of the soil and enhance the bottle label removal.

The alkoxyated alcohol surfactants mentioned above includes end capped alkoxyated alcohol surfactants.

Exemplary nonionic low alkoxyated alcohol surfactants that can be used are alkoxyated alcohols containing 1 to 4 ethylene oxide groups (1-4EO), 1 to 4 butylene oxide groups (1-4BO), 1 to 4 propylene oxide groups (1-4PO), end capped alkoxyated alcohol surfactants thereof or mixtures thereof.

Most preferred are nonionic surfactants d) of at least one amphoteric alkoxyated C₆ to C₂₄ alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide or a salt thereof.

Advantageously low alkoxyated alcohols that can be useful used in addition in the process according to the invention are particularly primary and/or branched alcohols, preferably containing 8 to 18 carbon atoms, and containing 1 to 4 ethylene oxide groups (1-4EO), 1 to 4 butylene oxide groups (1-4BO), 1 to 4 propylene oxide groups (1-4PO), end capped alkoxyated alcohol surfactants thereof or may contain a mixture. The alcohol radical may be linear, branched, or may contain a mixture.

Exemplary nonionic higher alkoxyated alcohol surfactants that can be useful in the active components, the liquid cleaning additive and/or liquid cleaning composition according to the invention are alkoxyated alcohols containing 5 to 40 ethylene oxide groups (5-40EO), butylene oxide groups (5-40BO), propylene oxide groups (5-40PO), preferably 6 to 30 ethylene oxide groups (6-30EO), butylene oxide groups (6-30BO), propylene oxide groups (6-30PO), further preferred 7 to 20 ethylene oxide groups (7-20EO), butylene oxide groups (7-20BO), propylene oxide groups (7-20PO), more preferred 8 to 10 ethylene oxide groups (8-10EO), butylene oxide groups (8-10BO), propylene oxide groups (8-10PO), and most preferred 8 ethylene oxide groups (8EO), butylene oxide groups (8BO), propylene oxide groups (8PO) groups, end capped alkoxyated alcohol surfactants thereof, or mixtures thereof.

Advantageously higher alkoxyated alcohols useful in the composition of the invention are particularly linear and/or branched alcohols, preferably containing 8 to 18 carbon atoms, and 5 to 40 ethylene oxide groups (5-40EO), butylene oxide groups (5-40BO), propylene oxide groups (5-40PO), preferably 6 to 30 ethylene oxide groups (6-30EO), butylene oxide groups (6-30BO), propylene oxide groups (6-30PO), further preferred 7 to 20 ethylene oxide groups (7-20EO), butylene oxide groups (7-20BO), propylene oxide groups (7-20PO), more preferred 8 to 10 ethylene oxide groups (8-10EO), butylene oxide groups (8-10BO), propylene oxide groups (8-10PO), and most preferred 8 ethylene oxide groups (8EO), butylene oxide groups (8BO), propylene oxide groups (8PO), end capped alkoxyated alcohol surfactants thereof, or may contain a mixture. The alcohol radical may be linear, branched, or may contain a mixture.

Particularly preferred are higher alkoxyated alcohols, preferably alcohol ethoxylates with linear or branched radicals of alcohols with 12 to 18 carbon atoms, e.g. from coco-, palm-, tallow- or oleyl alcohol, containing 8 to 18 carbon atoms, and 5 to 40 ethylene oxide groups (5-40EO), butylene oxide groups (5-40BO), propylene oxide groups (5-40PO), preferably 6 to 30 ethylene oxide groups (6-30EO), butylene oxide groups (6-30BO), propylene oxide groups (6-30PO), further preferred 7 to 20 ethylene oxide groups (7-20EO), butylene oxide groups (7-20BO), propylene oxide groups (7-20PO), more preferred 8 to 10 ethylene oxide groups (8-10EO), butylene oxide groups (8-10BO), propylene oxide groups (8-10PO), and most preferred 8 ethylene oxide groups (8EO), butylene oxide groups (8BO), propylene oxide groups (8PO), end capped alkoxyated alcohol surfactants thereof, or may contain a mixture. However, most preferred is isotridecyl alcohol in the composition of the invention with 6EO to 14EO, 6PO to 14PO, 6BO to 14BO, preferably 7EO to 10EO, 7PO to 10PO, 7BO to 10BO, and most preferred 8EO, 8PO, 8BO, or may contain a mixture.

According to the present invention higher alkoxyated alcohols can be used with 5EO, 6EO, 7EO, 8EO, 9EO, 10EO, 11EO, 12EO, 13EO, 14EO, 15EO, 16EO, 17EO, 18EO, 19EO, 20EO, 21EO, 22EO, 23EO, 24EO or 25EO, 5PO, 6PO, 7PO, 8PO, 9PO, 10PO, 11PO, 12PO, 13PO, 14PO, 15PO, 16PO, 17PO, 18PO, 19PO, 20PO, 21PO, 22PO, 23PO, 24PO or 25PO, 5BO, 6BO, 7BO, 8BO, 9BO, 10BO, 11BO, 12BO, 13BO, 14BO, 15BO, 16BO, 17BO, 18BO, 19BO, 20BO, 21BO, 22BO, 23BO, 24BO or 25BO, end capped alkoxyated alcohol surfactants thereof, or may contain a mixture.

Exemplary higher alkoxyated alcohols with 5EO to 40EO, preferably 6EO or 30EO, further preferred 7EO to 20EO, more preferred 8EO to 10EO and most preferred 8EO; 5PO to 40PO, preferably 6PO or 30PO, further preferred 7PO to 20PO, more preferred 8PO to 10PO and most preferred 8PO; 5BO to 40BO, preferably 6BO or 30BO, further preferred 7BO to 20BO, more preferred 8BO to 10BO and most preferred 8BO include C₁₂-C₁₄-alcohols; C₉-C₁₁-alcohols, C₁₃-C₁₅-alcohols, C₁₂-C₁₈-alcohols, end capped alkoxyated alcohol surfactants thereof, and mixtures thereof, as well as mixtures of C₁₂-C₁₄-alcohols and C₁₂-C₁₈ -alcohols, end capped alkoxyated alcohol surfactants thereof, and most preferred is a C₁₃-alcohol.

In addition to these nonionic surfactants, fatty alcohols containing more than 12 EO, 12 PO, 12 BO may also be used. Examples of such fatty alcohols are tallow fatty alcohol containing 14 EO, 25 EO, 30 EO or 40 EO, 14 PO, 25 PO, 30 PO or 40 PO, 14 BO, 25 BO, 30 BO or 40 BO and end capped alkoxyated alcohol surfactants thereof.

The degrees of 5EO to 40EO, 5PO to 40PO, 5BO to 40BO preferably 6EO or 30EO, 6PO or 30PO, 6BO or 30BO, further preferred 7EO to 20EO, 7PO to 20PO, 7BO to 20BO, more preferred 8EO to 10 EO, 8PO to 10 PO, 8BO to 10 BO and most preferred 8EO, 8PO, 8BO alkoxylation mentioned are statistical mean values, which for a special product, may be either a whole number or a fractional number. However, more preferred, the degrees of 5EO to 40EO, 5PO to 40PO, 5BO to 40BO preferably 6EO or 30EO, 6PO or 30PO, 6BO or 30BO further preferred 7EO to 20EO, 7PO to 20PO, 7BO to 20BO, more preferred 8EO to 10 EO,

8PO to 10 PO, 8BO to 10 BO and most preferred 8EO, 8PO, 8BO alkoxylation mentioned may be either a whole number or a fractional number. Most preferred, the degrees of 5EO to 40EO, 5PO to 40PO, 5BO to 40BO, preferably 6EO or 30EO, 6PO or 30PO, 6BO or 30BO, further preferred 7EO to 20EO, 7PO to 20PO, 7BO to 20BO, more preferred 8EO to 10 EO, 8PO to 10PO, 8BO to 10BO and most preferred 8EO, 8PO, 8BO. The alkoxylation grade mentioned may be a whole number.

Preferred higher alkoxyated alcohols have a narrow homolog distribution (narrow range ethoxylates, NRE).

Further surfactants include alkoxyated long chain fatty acid amides where the fatty acid has 8-20 carbon atoms and the amide group is alkoxyated with 1-20 ethylene oxide, propylene oxide and/or butylenes oxide units.

A further class of nonionic surfactants, which can be used as ingredients in a active components, the liquid cleaning additive and/or liquid cleaning composition according to the invention, is that of the alkyl polyglycosides (APG). Suitable alkyl polyglycosides satisfy the general Formula $RO(G)_z$ where R is a linear or branched, particularly 2-methyl -branched, saturated or unsaturated aliphatic radical containing 8 to 22 and preferably 12 to 18 carbon atoms and G stands for a glucose unit containing 5 or 6 carbon atoms, preferably glucose. The degree of oligomerization z is a number between 1.0 and 4.0 and preferably between 1.1 and 1.4.

Silicone containing nonionic surfactants, such as the ABIL B8852 or Silwet 7602, can also be used. An exemplary silicone -containing surfactant is silicone polybutane.

Examples of amine oxide surfactants include: dimethyldodecylamine oxide, dimethyltetradecylamine oxide; ethylmethyltetradecylamine oxide, cetyldimethylamine oxide, dimethylstearylamine oxide, cetyl ethylpropylamine oxide, diethyldodecylamine oxide, diethyltetradecylamine oxide, dipropyldodecylamine oxide, lauryl dimethyl amine oxide, bis- (2-hydroxyethyl) dodecylamine oxide, bis- (2-hydroxyethyl)-3-dodecoxy-1- hydroxypropyl amine oxide, (2-hydroxypropyl) methyltetradecylamine oxide, dimethyloleyamine oxide, dimethyl- (2-hydroxydodecyl) amine oxide, and the corresponding decyl, hexadecyl and octadecyl homologs of the above compounds.

Additional nitrogen-containing surfactants include ethoxylated primary alkyl amines where the alkyl group has 10-20 carbon atoms and the amine is ethoxylated with 2-20 ethylene oxide units.

Additionally, non-ionic surfactants derived from the condensation of ethylene oxide with the product resulting from the reaction of propylene oxide and ethylene diamine are also useful. For example, there are compounds containing from 40% to 80% of polyoxyethylene by weight and having a molecular weight from 5,000 to 11,000 resulting from the reaction of ethylene oxide groups with a hydrophobic base constituted of the reaction product from ethylene diamine and excess propylene oxide wherein the base has a molecular weight on order of 2,500-3,000.

Suitable nonionic surfactants include the polyoxyethylene -polyoxypropylene condensates, which are sold by BASF under the trade name 'Pluronic', polyoxyethylene condensates of aliphatic alcohols/ethylene oxide condensates having from 1 to 30 moles of ethylene oxide per mole of coconut alcohol; ethoxylated long chain alcohols sold by Shell Chemical Co. under the trade name 'Neodol', polyoxyethylene condensates of sorbitan fatty acids, alkanolamides, such as the monoalkoanolamides, dialkanolamides and the ethoxylated alkanolamides, for example coconut monoethanolamide, lauric isopropanolamide and lauric diethanolamide; and amine oxides for example dodecyl dimethylamine oxide.

Further exemplary non-ionic surfactants include alkylphenol alkoxylates, and amine oxides such as alkyl dimethylamine oxide or bis (2- hydroxyethyl) alkylamine oxide.

The additional nonionic surfactants can be provided in the active components and/or the liquid cleaning additive as used in the process of the invention in an amount of ≥ 0 wt.-% to about ≤ 40 wt.-%, preferably about ≥ 1 wt.-% to about ≤ 35 wt.-%, further preferred about ≥ 10 wt.-% to about ≤ 30 wt.-%, more preferred about ≥ 15 wt.-% to about ≤ 25 wt.-%, based on the total weight amount of the liquid cleaning additive or liquid cleaning composition.

Most preferred is the use of at least one alkyl endcapped nonionic alkoxylated C_8 to C_{18} alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide, preferably an butyl endcapped nonionic alkoxylated C_{12} to C_{18} alcohol surfactant containing 8 to 10 alkylene oxide units of ethylene oxide; and/or at least one non-endcapped nonionic alkoxylated C_8 to C_{18} alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide, preferably at least one non-endcapped nonionic alkoxylated C_{12} to C_{14} alcohol surfactant containing 2 to 4 units of ethylene oxide and 3 to 5 units propylene oxide.

It should be understood that the addition of a nonionic surfactant to the active components, the liquid cleaning additive and/or liquid cleaning composition of the invention is optional.

Anionic Surfactants

The active components, the liquid cleaning additive and/or liquid cleaning composition that can be used in a process according to the invention is preferably free of an anionic surfactant.

Exemplary anionic surfactants that can be used include organic carboxylates, organic sulfonates, organic sulfates, organic phosphates and the like, particularly linear alkylaryl sulfonates, such as alkylarylcarboxylates, alkylarylsulfonates, alkylarylphosphates, and the like. These classes of anionic surfactants are known within the surfactant art as linear alkyl benzyl sulfonates (LABS), alpha olefin sulfonates (AOS), alkyl sulfates, and secondary alkane sulfonates.

The anionic surfactants can be provided in the active components and/or the liquid cleaning additive as used in the process of the invention in an amount of ≥ 0 wt.-% to ≤ 40 wt.-%, preferably ≥ 0.1 wt.-% to ≤ 35

wt.-%, further preferred ≥ 0.5 wt.-% to ≤ 32 wt.-%, and more preferred 1.0 wt.-% to 30 wt.-%, based on the weight of all components of the total composition.

It should be understood that the addition of an anionic surfactant to the active components, the liquid cleaning additive and/or liquid cleaning composition of the invention is optional.

Cationic Surfactants

The presence of the nonionic surfactants enables the use of low levels of higher foaming cationic surfactants, while keeping the foaming at an acceptable level. In a preferred embodiment of the invention, the active components, the liquid cleaning additive and/or liquid cleaning composition also comprises a cationic surfactant.

Suitable cationic surfactants include quaternary ammonium compounds having the formula of $RR'R''R'''N^+X^-$, where R, R', R'' and R''' are each a C_1 - C_{24} alkyl, aryl or arylalkyl group that can optionally contain one or more P, O, S or N heteroatoms, and X is F, Cl, Br, I or an alkyl sulfate. Additional preferred cationic surfactants include ethoxylated and/or propoxylated alkyl amines, diamines, or triamines.

Each of R, R', R'' and R''' can independently include, individually or in combination, substituents including 6 to 24 carbon atoms, preferably 14 to 24 carbon atoms, and more preferably, 16 to 24 carbon atoms.

Each of R, R', R'' and R''' can independently be linear, cyclic, branched, saturated, or unsaturated, and can include heteroatoms such as oxygen, phosphorous, sulfur, or nitrogen. Any two of R, R', R'' and R''' can form a cyclic group. Any one of three of R, R', R'' and R''' can independently be hydrogen. X is preferably a counter ion and preferably a non-fluoride counter ion. Exemplary counter ions include chloride, bromide, methosulfate, ethosulfate, sulfate, and phosphate.

In an embodiment, the quaternary ammonium compound includes alkyl ethoxylated and/or propoxylated quaternary ammonium salts (or amines).

Preferably, the alkyl group contains between about 6 and about 22 carbon atoms and can be saturated and/or unsaturated. The degree of alkoxylation is preferably between about 2 and about 20, and/or the degree of propoxylation is preferably between about 0 and about 30.

In an embodiment, the quaternary ammonium compound includes an alkyl group with about 6 to about 22 carbon atoms and a degree of alkoxylation between about 2 and about 20.

The cationic surfactants can be provided in the active components and/or the liquid cleaning additive as used in the process of the invention in an amount of ≥ 0 wt.-% to ≤ 40 wt.-%, preferably ≥ 0.1 wt.-% to ≤ 35 wt.-%, further preferred ≥ 0.5 wt.-% to ≤ 32 wt.-%, and more preferred 1.0 wt.-% to 30 wt.-%, based on the weight of all components of the total composition.

It should be understood that the addition of a cationic surfactant to the active components, the liquid cleaning additive and/or liquid cleaning composition of the invention is optional.

Amphoteric Surfactants

The active components, the liquid cleaning additive and/or liquid cleaning composition according to the invention can be free of amphoteric surfactants. Examples of suitable amphoteric surfactants include capryloamphopropionate, disodium lauryl B-iminodipropionate, and cocoamphocarboxypropionate, and disodium octylimino dipropionate.

Most preferred is the use of an amphoteric surfactant d) of at least one amphoteric alkoxyated C₆ to C₂₄ alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide or a salt thereof, in the process of the invention.

The amphoteric surfactants can be provided in the liquid cleaning additive and/or the liquid cleaning composition in an amount of ≥ 0 wt.-% to about ≤ 20 wt.-%, preferably about ≥ 3 wt.-% to about ≤ 15 wt.-%, more preferred about ≥ 5 wt.-% to about ≤ 10 wt.-%, based on the weight of the liquid cleaning additive and/or liquid cleaning composition.

It should be understood that the addition of an amphoteric surfactant to the active components, the liquid cleaning additive and/or liquid cleaning composition of the invention is optional.

Foam Inhibitor

The active components, the liquid cleaning additive and/or liquid cleaning composition as used in the process of the invention may contain at least one foam inhibitor. Suitable foam inhibitors are, for example, organopolysiloxanes and mixtures thereof with microfine, optionally silanised silica and also paraffins, waxes, microcrystalline waxes and mixtures thereof with silanised silica or bis-fatty acid alkylenediamides such as bis-stearyl ethylenediamide. The amount of foam inhibitors of the active components and/or the liquid cleaning additive as used in the process of the invention can be of ≥ 0 wt.-% to about ≤ 20 wt.-%, preferably about ≥ 3 wt.-% to about ≤ 15 wt.-%, more preferred about ≥ 5 wt.-% to about ≤ 10 wt.-%, based on the total weight of the cleaning additive or liquid cleaning composition.

Mixtures of various foam inhibitors, for example mixtures of silicones, paraffins or waxes, are also used with advantage. It should be understood that the addition of a foam inhibitor to the liquid cleaning additive and/or cleaning composition as used in the process of the invention is optional.

Alkaline Source

The source of alkalinity can be any source of alkalinity that is compatible with the other components of the cleaning composition and that will provide the desired pH.

Exemplary sources of alkalinity include alkali metal hydroxides, alkali metal salts, phosphates, amines, and mixtures thereof.

Exemplary alkali metal hydroxides include sodium hydroxide, potassium hydroxide, and lithium hydroxide. Exemplary alkali metal salts include sodium carbonate, trisodium phosphate, potassium carbonate, and mixtures thereof. Most preferred is the use of sodium hydroxide as alkaline source.

The source of alkalinity, preferably an alkali metal hydroxide, may be added to the composition in a variety of forms, dissolved in an aqueous solution or a combination thereof. Alkali metal hydroxides are commercially available as pellets or beads or as an aqueous solution.

The alkaline solution or the liquid cleaning composition can comprise the source of alkalinity, preferably sodium hydroxide, in an amount of about ≥ 0.5 wt.-% to about ≤ 3.5 wt.-%, preferably about ≥ 1 wt.-% to about ≤ 3 wt.-%, further preferred about ≥ 1.25 wt.-% to about ≤ 2.75 wt.-%, also preferred about ≥ 1.3 wt.-% to about ≤ 2.5 wt.-%, in addition preferred about ≥ 1.5 wt.-% to about ≤ 2.3 wt.-%, furthermore preferred about ≥ 1.7 wt.-% to about ≤ 2.25 wt.-%, and more preferred about ≥ 1.5 wt.-% to about ≤ 2.0 wt.-%; wherein the weight-% of the alkaline source are based on the total weight of the alkaline solution or liquid cleaning composition.

Use of Cleaning Composition

The cleaning composition as used in the process of the invention can be used for cleaning hard and/or soft surfaces, preferably glass, ceramic, metal and/or plastic ware. Preferably, the cleaning composition as used in the process of the invention can be used for cleaning bottles. More preferred, the cleaning composition as used in the process of the invention can be used for cleaning glass, ceramic, metal and/or plastic ware, preferably bottles, in a bottle cleaning plant.

Bottle labels are removed in soaking bath containing the cleaning composition of the invention. Suitable cleaning plants are a single-end-bottle washer or double-end bottle washer.

Most preferred is the use of the cleaning solution of the invention, to clean and to remove labels of glass, ceramic, metal and/or plastic ware, especially glass, ceramic and/or plastic bottles, in an automated processing.

Figures

Fig.1 shows the label removal time of glass bottles achieved in a bottle cleaning plant using a liquid cleaning solution at different temperatures,

Fig.2 shows the label removal time of glass plates using a liquid cleaning solution at different temperatures.

Examples

The following examples E1 to E5 of the liquid cleaning additive are used to illustrate the improved cleaning and label removal effect at lower temperatures.

Example E1 - additive

Liquid cleaning additive	Wt.-% %	
phosphoric acid 75%	10.0	
gluconic acid 50%	10.0	
phosphonic acid 50%	11.0	sequestering agent
fatty alcohol C12-18 9 EO-butyl capped	17.0	endcapped nonionic surfactant
fatty alcohol C12-14 2 EO – 4PO	7.0	non endcapped nonionic surfactant
PEG Coco amine 12EO	8.0	amphoteric surfactant
distilled water	Add. 100 wt.-%	

Example E2 - surfactant free liquid cleaning additive

Liquid cleaning additive	Wt.-% %	
phosphoric acid 75%	10.0	
gluconic acid 50%	10.0	
phosphonic acid 50%	11.0	
distilled water	add. 100 wt.-%	

Example E3 - defoamer free liquid cleaning additive

Liquid cleaning additive	Wt.-% %	
phosphoric Acid 75%	10.0	
gluconic Acid 50%	10.0	
fatty alcohol C12-14 2 EO – 4PO	7.0	non endcapped nonionic surfactant
PEG Coco amine 12EO	8.0	amphoteric surfactant
distilled water	add. 100 wt.-%	

Example E4 - sequestrant free liquid cleaning additive

Liquid cleaning additive	Wt.-% %	
phosphoric acid 75%	10.0	
gluconic acid 50%	10.0	
fatty alcohol C12-18 9 EO-butyl capped	17.0	endcapped nonionic surfactant
fatty alcohol C12-14 2EO – 4 PO	7.0	non endcapped nonionic surfactant
PEG Coco amine 12EO	8.0	amphoteric surfactant
distilled water	add. 100 wt.-%	

Example E5 – only sequestrant

Liquid cleaning additive	Wt.-% %	
gluconic acid 50%	10.0	
posphonic acid 50%	11.0	sequestering agent
distilled water	Add. 100 wt.-%	

Label removal testBackground:

This test method has been developed to evaluate the label removal performance of different caustic additives for bottle washing. The label removal test is a measurement for the cleaning efficacy of an additive. It can be applied for polyethylene terephthalate (PET) and for glass bottles.

Equipment:

- 700 ml mineral water glass bottles with a plane outer surface to which a Mifare™ Standard Paper Label with a Casein ST 50 KF adhesive is attached
- uncoated glass plates of 19 cm x 10 cm or uncoated glass 330 ml glass bottles
- Analytical balance capable of weighing to the 0.0001 place
- Casein ST 50 KF adhesive obtainable from the company Tuermerleim GmbH in Ludwigshafen/Rhein, Germany (glass plates)
- Mifare Standard Paper Label with Label size: 85.60 +/- 0.12mm x 53.98 +/- 0.05mm, total thickness: 0.30 +/- 0.03mm and weight: 0.20 g +/- 0.05 g

- Roll coater / Hand coater
- double-walled vessel of 5000 ml inner volume

Procedure:Label removing device for glass plates:

The label removing device is composed of an oscillating motor (wind screen wiper motor obtained from a car "Opel Record") where a glass plate can be fixed in a clamping tool in a vertically position for testing. The speed of the oscillating motor has been set so that it moves forward and backward every second. The testing solution is heated in a double-walled vessel. The vessel is connected to a thermostat, which regulates the required temperature.

Label removing device for mineral water glass bottles:

The 700 ml mineral water glass bottles with a plane outer surface to which a Mifare Standard Paper Label with a Casein ST 50 KF adhesive was attached are processed in a Fontana RME SEN cleaning plant with a capacity of 45.000 bottles per hour. The soaking bath for label removal was filled up with a cleaning composition as used in the process of the invention and described below.

Glass plates labeling:

The glass plates are degreased with acetone and dried at room temperature. A label is applied to the glass plates with a hand coater using the Casein ST 50 KF adhesive. The adhesive film should be very thin (100 μ m). The labels are dried for 3 days at room temperature.

Bottle labeling:

The mineral bottles are degreased with acetone and dried at room temperature. A label is applied to the glass plates with a hand coater using the Casein ST 50 KF adhesive. The adhesive film should be very thin (100 μ m). The labels are dried for 3 days at room temperature.

Liquid cleaning solution:

The various cleaning solution are obtained by mixing 2000 ml of a 2 wt.-% NaOH alkaline solution with 4 ml of the liquid cleaning additive of examples E1 or 7 ml of the liquid cleaning additive of examples E1 to E5.

After that, the cleaning solutions as used for label removal of glass bottles according to Fig. 1 are heated in a soaking bath of the Fontana RME SEN to the required temperature of 65° C and 80° C (see Fig. 1) and the cleaning process is started. The time is measured for each glass bottle with respect to the used cleaning solution until the label is completely removed (= label removal time [sec]). For each cleaning solution and temperature, the test is repeated 3 times.

For the glass plates label test the liquid cleaning composition in the double-walled vessel is brought to the temperature of 60° C (see Fig. 2). Subsequently, a labeled glass plate is fixed with a clamping tool and the glass plate is introduced into the cleaning solution so that the label is completely dipped into the cleaning solution and the oscillating motor is started. The time is measured for each glass plate with respect to the used cleaning solution until the label is completely removed (= label removal time [sec]). For each cleaning solution and temperature, the test is repeated 3 times.

Results:

Figure 1 clearly shows that the label removal performance for 700 ml mineral water glass bottles with a plane outer surface to which a Mifare Standard Paper Label with a Casein ST 50 KF adhesive is attached using 7 ml of an additive of example E1 added to a 2000 ml caustic solution of 2.0 wt.-% NaOH processed at a process temperature of 65° C provides the same label removal time as compared to 4 ml of the same additive of example E1 added to 2000 ml of a 2.0 wt.-% NaOH caustic solution at a cleaning temperature of 80° C. Thus, Fig. 1 demonstrates that the process of the present invention provides good cleaning and label removal characteristics at lower temperatures.

Figure 2 shows that the label removal for glass plates using 7 ml of an additive of example E2, E3, E4 and E5 to a 2000 ml caustic solution of 2.0 wt.-% NaOH at a process temperature of 60° C provides improved label removal time of between 120 sec to 140 sec. Thus, Fig. 2 shows that the process of the present invention provides good cleaning and label removal characteristics at lower process temperatures.

As used herein, the term "about" refers to variation in the numerical quantity that can occur, for example, through typical measuring and liquid handling procedures used for making concentrates or use solutions in the real world; through inadvertent error in these procedures; through differences in the manufacture, source, or purity of the ingredients used to make the compositions or carry out the methods; and the like. The term "about" also encompasses amounts that differ due to different equilibrium conditions for a composition resulting from a particular initial mixture. Whether or not modified by the term "about", the claims include equivalents to the quantities.

It should be noted that, as used in this specification and the appended claims, the singular forms "a", "an" and "the" include plural referents unless the content clearly dictates otherwise. Thus, for example, reference to a composition containing "a compound" includes a mixture of two or more compounds. It should also be noted that the term "or" is generally employed in its sense including "and/or" unless the content clearly dictates otherwise. All publications and patent applications in this specification are indicative of the level of ordinary skill in the art to which this invention pertains. The invention has been described to various specific and preferred embodiments and techniques. However, it should be understood that many variations and modifications may be made while remaining within the spirit and scope of the invention.

What is claimed is:

1. A method for washing and/or label removal of glass, ceramic or plastic ware with a liquid cleaning composition at a process temperature below 80° C, wherein the liquid cleaning composition comprises active components in an amount of about 0.1 wt.-% to about 10 wt.-% and an alkaline source in an amount of about 0.5 wt.-% to about 3.5 wt.-% based on the total weight of the liquid cleaning composition, wherein the active components comprise:
 - a) at least one sequestering agent selected from the group consisting of a phosphonic acid, phosphonate based sequestering agent, and a polymer of monomers of monoethylenically unsaturated C₃-C₈-carboxylic acids or salts thereof;
 - b) at least one C₄ to C₁₈ hydroxymonocarboxylic acid or salt thereof;
 - c) at least one amphoteric alkoxyated C₆ to C₂₄ alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide or a salt thereof; and
 - d) at least one non-endcapped nonionic alkoxyated C₆ to C₂₄ alcohol surfactant containing about 1 to about 30 alkylene oxide units;wherein the weight-% of the active components is based on the total weight of the liquid cleaning composition.
2. The method of claim 1, wherein the weight ratio of the active components a) of the at least one sequestering agent to b) of the at least one C₄ to C₁₈ hydroxymonocarboxylic acid or salts thereof is in the range of about 6:1 to about 1:6.
3. The method of claim 2, wherein the weight ratio of the active components a) of the at least one sequestering agent to b) of the at least one C₄ to C₁₈ hydroxymonocarboxylic acid or salts thereof is in the range of about 5:1 to about 1:5.
4. The method of claim 2, wherein the weight ratio of the active components a) of the at least one sequestering agent to b) of the at least one C₄ to C₁₈ hydroxymonocarboxylic acid or salts thereof is in the range of about 4:1 to about 1:4.
5. The method of claim 2, wherein the weight ratio of the active components a) of the at least one sequestering agent to b) of the at least one C₄ to C₁₈ hydroxymonocarboxylic acid or salts thereof is in the range of about 3:1 to 1:3.

6. The method of any one of claims 1-5, wherein the active components further comprise an active component e) of at least one phosphoric acid based or phosphate - based component.
7. The method of any one of claims 1-6, wherein the active components further comprise at least one alkyl endcapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide.
8. The method of claim 1 or 7, wherein the active components further comprise at least one anti-foaming agent.
9. The method of claim 1, wherein the weight ratio of the active components of a) the at least one sequestering agent to b) the at least one C₄ to C₁₈ hydroxymonocarboxylic acid or salts thereof is in the range of about 2:1 to about 1:2.
10. The method of claim 1, wherein the weight ratio of the active components of a) the at least one sequestering agent to b) the at least one C₄ to C₁₈ hydroxymonocarboxylic acid or salts thereof is in the range of about 1.5:1 to about 1.2:1.
11. The method of claim 6, wherein the weight ratio of the active components of e) the at least one phosphoric acid based or phosphate-based component to a) the at least one sequestering agent is about 10:1 to about 1:10.
12. The method of claim 6, wherein the weight ratio of the active components of e) the at least one phosphoric acid based or phosphate-based component to a) the at least one sequestering agent is in the range of about 5:1 to about 1:5.
13. The method of claim 6, wherein the weight ratio of the active components of e) the at least one phosphoric acid based or phosphate-based component to a) the at least one sequestering agent is in the range of about 3:1 to about 1:3.

14. The method of claim 6, wherein the weight ratio of the active components of e) the phosphoric acid based or phosphate-based component to a) the sequestering agent is in the range of about 2:1 to about 1:2.
15. The method of claim 6, wherein the weight ratio of the active components of e) the phosphoric acid based or phosphate-based component to a) the sequestering agent is in the range of about 1.5:1 to about 1.2:1.
16. The method of claim 1, wherein the weight ratio of the active components of c) the at least one amphoteric surfactant to b) the at least one C₄ to C₁₈ hydroxymonocarboxylic acid, or a salt thereof is about 10:1 to about 1:10.
17. The method of claim 16, wherein the weight ratio of the active components of c) the at least one amphoteric surfactant to b) the at least one C₄ to C₁₈ hydroxymonocarboxylic acid, or a salt thereof is in the range of about 5:1 to about 1:5.
18. The method of claim 16, wherein the weight ratio of the active components of c) the at least one amphoteric surfactant to b) the at least one C₄ to C₁₈ hydroxymonocarboxylic acid, or a salt thereof is in the range of about 3:1 to about 1:3.
19. The method of claim 16, wherein the weight ratio of the active components of c) the at least one amphoteric surfactant to b) the at least one C₄ to C₁₈ hydroxymonocarboxylic acid, or a salt thereof is in the range of about 2:1 to about 1:2.
20. The method of claim 16, wherein the weight ratio of the active components of c) the at least one amphoteric surfactant to b) the at least one C₄ to C₁₈ hydroxymonocarboxylic acid, or a salt thereof is in the range of about 1.7:1 to about 1.5:1.
21. The method of claim 7, wherein the weight ratio of the active components of the at least one alkyl endcapped nonionic surfactant to the at least one non-endcapped nonionic surfactant is about 10:1 to about 1:10.

22. The method of claim 21, wherein the weight ratio of the active components of the at least one alkyl endcapped nonionic surfactant to the at least one non-endcapped nonionic surfactant is in the range of about 5:1 to about 1:5.
23. The method of claim 21, wherein the weight ratio of the active components of the at least one alkyl endcapped nonionic surfactant to the at least one non-endcapped nonionic surfactant is in the range of about 4:1 to about 1:4.
24. The method of claim 21, wherein the weight ratio of the active components of the at least one alkyl endcapped nonionic surfactant to the at least one non-endcapped nonionic surfactant is in the range of about 3:1 to about 1:3.
25. The method of claim 21, wherein the weight ratio of the active components of the at least one alkyl endcapped nonionic surfactant to the at least one non-endcapped nonionic surfactant is in the range of about 2.6:1 to about 2.3:1.
26. The method of any one of claims 1-25, wherein the liquid cleaning composition has a pH in the range of about 10 to about 14.
27. The method of claim 26, wherein the liquid cleaning composition has a pH in the range of about 12 to about 14.
28. The method of claim 26, wherein the liquid cleaning composition has a pH in the range of about 13 to about 14.
29. The method of any one of claims 1 to 28, wherein the process temperature is in the range of about 30° C to about 78° C.
30. The method of claim 29, wherein the process temperature is in the range of about 40° C to about 77° C.
31. The method of claim 29, wherein the process temperature is in the range of about 50° C to about 75° C.

32. The method of claim 29, wherein the process temperature is in the range of about 55° C to about 70° C.

33. The method of claim 29, wherein the process temperature is in the range of about 60° C to about 65° C.

34. The method of any one of claims 1-33, wherein the liquid cleaning composition is obtained by adding a liquid cleaning additive to an alkaline solution, wherein the liquid cleaning additive is a concentrated liquid cleaning additive which comprises:

- a) about 1 wt.-% to about 10 wt.-% of a phosphonic acid or a salt thereof, or a polymer of monomers of monoethylenically unsaturated C₃-Ca-carboxylic acids or salts thereof,
- b) about 1 wt.-% to about 30 wt.-% of a gluconic acid or a salt thereof,
- c) about 5 wt.-% to about 20 wt.-% of a phosphoric acid or a salt thereof,
- d) about 3 wt.-% to about 20 wt.-% of at least one amphoteric alkoxyated C₆ to C₂₄ alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide, or a salt thereof;
- e) about 1 wt.-% to about 40 wt.-% of at least one alkyl endcapped nonionic alkoxyated C₈ to C₁₈; alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide; and/or
at least one non-endcapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide; and
- f) a solvent is added add. 100 wt.-%; wherein the weight-% of the components of the concentrated liquid additive are based on the total weight of the concentrated liquid additive and does not exceed 100 wt.-%.

35. The method of claim 34, wherein the concentrated liquid cleaning additive comprises
a) about 3 wt.-% to about 8 wt.-% of the phosphonic acid or a salt thereof or the polymer of monomers of monoethylenically unsaturated C₃-C₈-carboxylic acids or salts thereof.

36. The method of claim 34, wherein the concentrated liquid cleaning additive comprises a) about 4 wt.-% to about 6 wt.-% of the phosphonic acid or a salt thereof, or the polymer of monomers of monoethylenically unsaturated C₃-C₈-carboxylic acids or salts thereof.
37. The method of any one of claims 34-36, wherein the polymer of monomers of monoethylenically unsaturated C₃-C₈ carboxylic acids is polyacrylic acid of a salt thereof.
38. The method of any one of claims 34-37, wherein the concentrated liquid cleaning additive comprises b) about 2 wt.-% to about 20 wt.-% of the gluconic acid of a salt thereof.
39. The method of any one of claims 34-37, wherein the concentrated liquid cleaning additive comprises b) about 5 wt.-% to about 15 wt.-% of the gluconic acid of a salt thereof.
40. The method of any one of claims 34-39, wherein the concentrated liquid cleaning additive comprises c) about 5 wt.-% to about 15 wt.-% of the phosphoric acid or a salt thereof.
41. The method of any one of claims 34-39, wherein the concentrated liquid cleaning additive comprises c) about 6 wt.-% to about 10 wt.-% of the phosphoric acid of a salt thereof.
42. The method of any one of claims 34-41, wherein the concentrated liquid cleaning additive comprises d) about 3 wt.-% to about 15 wt.-% of the at least one amphoteric alkoxylated C₆ to C₂₄ alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide, or a salt thereof.
43. The method of any one of claims 34-41, wherein the concentrated liquid cleaning additive comprises d) about 5 wt.-% to about 10 wt.-% of at least one amphoteric alkoxylated C₆ to C₂₄ alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide, or a salt thereof.
44. The method of any one of claims 34-43, wherein the at least one amphoteric alkoxylated C₆ to C₂₄ alcohol amine surfactant is an alkoxylated C₁₂ to C₁₄ alcohol amine surfactant containing 10-14 alkylene oxide units.

45. The method of any one of claims 34-44, wherein the concentrated liquid cleaning additive comprises e) about 1 wt.-% to about 35 wt.-% of the at least one alkyl endcapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide and/or the at least one non-endcapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide.
46. The method of any one of claims 34-44, wherein the concentrated liquid cleaning additive comprises c) about 10 wt.-% to about 30 wt.-% of the at least one alkyl endcapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide and/or the at least one non-endcapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide.
47. The method of any one of claims 34-44, wherein the concentrated liquid cleaning additive comprises e) about 15 wt.-% to about 25 wt.-% of the at least one alkyl endcapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide and/or the at least one non-endcapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide.
48. The method of any one of claims 34-47, wherein the at least one alkyl endcapped nonionic alkoxyated C_a to C_{1a} alcohol surfactant is a butyl endcapped nonionic alkoxyated C₁₂ to C₁₈ alcohol surfactant containing 8 to 10 alkylene oxide units of ethylene oxide.
49. The method of any one of claims 34-48, wherein the at least one non-endcapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant is a non-endcapped nonionic alkoxyated C₁₂ to C₁₄ alcohol surfactant containing 2 to 4 units of ethylene oxide and 3 to 5 units of propylene oxide.
50. The method of any one of claims 34-49, wherein the solvent is water.

51. The method of any one of claims 1-50, wherein the liquid cleaning composition is obtained by adding a diluted liquid cleaning additive to an alkaline solution, wherein the diluted liquid cleaning additive comprises about 0.01 wt.-% to about 10 wt.-% of the concentrated additive and at least one solvent, is added add. 100 wt.-%.
52. The method of claim 51, wherein the diluted liquid cleaning additive comprises about 0.05 wt.-% to about 5 wt.-% of the concentrated additive.
53. The method of claim 51, wherein the diluted liquid cleaning additive comprises about 0.1 wt.-% to about 2 wt.-% of the concentrated additive.
54. The method of claim 53, wherein the diluted liquid cleaning additive comprises about 0.15 wt.-% to about 1 wt.-% of the concentrated additive.
55. The method of claim 53, wherein the diluted liquid cleaning additive comprises about 0.2 wt.-% to about 0.5 wt.-% of the concentrated additive.
56. The method of claim 53, wherein the diluted liquid cleaning additive comprises about 0.25 wt.-% to about 0.5 wt.-% of the concentrated additive.
57. The method of claim 53, wherein the diluted liquid cleaning additive comprises about 0.3 wt.-% to about 0.4 wt.-% of the concentrated additive.
58. The method of any one of claims 51-57, wherein the solvent is water.
59. The method of any one of claims 1-58, wherein the liquid cleaning composition comprises about 1 wt.-% to about 3 wt.-% of the alkaline source.
60. The method of any one of claims 1-58, wherein the liquid cleaning composition comprises about 1.25 wt.-% to about 2.75 wt.-% of the alkaline source.
61. The method of any one of claims 1-58, wherein the liquid cleaning composition comprises about 1.3 wt.-% to about 2.5 wt.-% of the alkaline source.

62. The method of any one of claims 1-58, wherein the liquid cleaning composition comprises about 1.5 wt.-% to about 2.3 wt.-% of the alkaline source.
63. The method of any one of claims 1-58, wherein the liquid cleaning composition comprises about 1.7 wt.-% to about 2.25 wt.-% of the alkaline source.
64. The method of any one of claims 1-58, wherein the liquid cleaning composition comprises about 1.5 wt.-% to about 2.0 wt.-% of the alkaline source.
65. The method of any one of claims 1 or 59-64, wherein the alkaline source is sodium hydroxide.
66. A method for washing glass, ceramic, or plastic ware comprising applying to the ware at a temperature below 80° C a liquid cleaning composition comprising:
- a) about 0.003 wt.-% to about 0.035 wt.-% of a phosphonic acid or a salt thereof, or a polymer of monomers of monoethylenically unsaturated C₃-C₈- carboxylic acids or salts thereof,
 - b) about 0.003 wt.-% to about 0.105 wt.-% of a gluconic acid or a salt thereof,
 - c) about 0.01 wt.-% to about 0.07 wt.-% of a phosphoric acid or a salt thereof,
 - d) about 0.01 wt.-% to about 0.07 wt.-% of at least one amphoteric alkoxylated C₆ to C₂₄ alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide, or a salt thereof;
 - e) about 0.003 wt.-% to about 0.14 wt.-%, of at least one alkyl endcapped nonionic alkoxylated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide, and/or at least one non-endcapped nonionic alkoxylated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide;
 - f) about 0.5 wt.-% to about 3.5 wt.-%, of an alkaline source; and
 - g) a solvent added add. 100 wt.-%;
- wherein the weight-% of the components are based on the total weight of the liquid cleaning composition and does not exceed 100 wt.-%.

67. The method of claim 66, wherein the liquid cleaning composition comprises a) about 0.01 wt.-% to about 0.03 wt.-% of a phosphoric acid or a salt thereof, or a polymer of monomers of monoethylenically unsaturated C₃-C₈-carboxylic acids or salts thereof.

68. The method of claim 66, wherein the liquid cleaning composition comprises a) about 0.014 wt.-% to about 0.022 wt.-% of a phosphoric acid or a salt thereof, or a polymer of monomers of monoethylenically unsaturated C₃-C₈ carboxylic acids or salts thereof.

69. The method of any one of claims 66-68, wherein the polymer of monomers of monoethylenically unsaturated C₃-C₈ carboxylic acids is polyacrylic acid or a salt thereof.

70. The method of any one of claims 66-69, wherein the liquid cleaning composition comprises b) about 0.007 wt.-% to about 0.070 wt.-% of the gluconic acid or a salt thereof.

71. The method of any one of claims 66-69, wherein the liquid cleaning composition comprises b) about 0.01 wt.-% to about 0.053 wt.-% of the gluconic acid or a salt thereof.

72. The method of any one of claims 66 or 69-71, wherein the liquid cleaning composition comprises c) about 0.01 wt.-% to about 0.053 wt.-% of the phosphoric acid or a salt thereof.

73. The method of any one of claims 66 or 69-71, wherein the liquid cleaning composition comprises c) about 0.021 wt.-% to about 0.035 wt.-% of the phosphoric acid or a salt thereof.

74. The method of any one of claims 66-73, wherein the liquid cleaning composition comprises d) about 0.01 wt.-% to about 0.053 wt.-% of the at least one amphoteric alkoxylated C₆ to C₂₄ alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide, or a salt thereof.

75. The method of any one of claims 66-73, wherein the liquid cleaning composition comprises d) about 0.017 wt.-% to about 0.035 wt.-% of the at least one amphoteric alkoxylated C₆ to C₂₄ alcohol amine surfactant containing 4 to 18 alkylene oxide units of ethylene oxide and/or propylene oxide, or a salt thereof.

76. The method of any one of claims 66-73, wherein the at least one amphoteric alkoxyated C₆ to C₂₄ alcohol amine surfactant is an amphoteric alkoxyated C₁₂ to C₁₄ alcohol amine surfactant containing 10 to 14 alkylene oxide units.

77. The method of any one of claims 66-76, wherein the liquid cleaning composition comprises e) about 0.003 wt.-% to about 0.123 wt.-% of the at least one alkyl endcapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide, and/or the at least one non-endcapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide.

78. The method of any one of claims 66-76, wherein the liquid cleaning composition comprises e) about 0.035 wt.-% to about 0.0105 wt.-% of the at least one alkyl endcapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide, and/or the at least one non-endcapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide.

79. The method of any one of claims 66-76, wherein the liquid cleaning composition comprises e) about 0.052 wt.-% to about 0.088 wt.-% of the at least one alkyl endcapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide, and/or the at least one non-endcapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant containing 4 to 16 alkylene oxide units of ethylene oxide and/or propylene oxide.

80. The method of any one of claims 66-79, wherein the at least one alkyl endcapped nonionic alkoxyated C₈ to C₁₈ alcohol surfactant is a butyl endcapped nonionic alkoxyated C₁₂ to C₁₈ alcohol surfactant containing 8 to 10 alkylene oxide units of ethylene oxide.

81. The method of any one of claims 66-80, wherein the at least one non-endcapped nonionic alkoxyated C₈ to C₁₀ alcohol surfactant is a non-endcapped nonionic alkoxyated C₁₂ to C₁₄ alcohol surfactant containing 2 to 4 units of ethylene oxide and 3 to 5 units propylene oxide.

82. The method of any one of claims 66-81, wherein the liquid cleaning composition comprises f) about 1 wt.-% to about 3 wt.-% of the alkaline source.
83. The method of any one of claims 66-81, wherein the liquid cleaning composition comprises f) about 1.25 wt.-% to about 2.75 wt.-% of the alkaline source.
84. The method of any one of claims 66-81, wherein the liquid cleaning composition comprises f) about 1.3 wt.-% to about 2.5 wt.-% of the alkaline source.
85. The method of any one of claims 66-81, wherein the liquid cleaning composition comprises f) about 1.5 wt.-% to about 2.3 wt.-% of the alkaline source.
86. The method of any one of claims 66-81, wherein the liquid cleaning composition comprises f) about 1.7 wt.-% to about 2.25 wt.-% of the alkaline source.
87. The method of any one of claims 66-81, wherein the liquid cleaning composition comprises f) about 1.5 wt.-% to about 2.0 wt.-% of the alkaline source.
88. The method of any one of claims 66-87, wherein the alkaline source is sodium hydroxide.
89. The method of any one of claims 66-88, wherein the solvent is water.
90. The method of claim 8, wherein the at least one anti-foaming agent is a silicone-based defoamer.
91. The method of any one of claims 1-90, wherein the label removal time is in the range of > 60 seconds to < 480 seconds.
92. The method of claim 91, wherein the label removal time is in the range of > 120 seconds to < 420 seconds.

93. The method of claim 91, wherein the label removal time is in the range of > 150 seconds to < 390 seconds.
94. The method of claim 91, wherein the label removal time is in the range of > 180 seconds to < 360 seconds.
95. The use of the liquid cleaning composition as defined in any one of claims 1 to 82 or 88-94, wherein the amount of the alkaline source is in the range of 0.5 to 3.0 wt.-%, for cleaning hard and/or soft surfaces.
96. The use of claim 95, wherein the hard and/or soft surfaces are glass, ceramic, metal and/or plastic ware.
97. The use of claim 95, wherein the hard and/or soft surfaces are bottles.
98. The use of claim 96, for cleaning bottles in a bottle cleaning plant.
99. A liquid cleaning composition as defined in any one of claims 1-82 or 88-94 wherein the amount of the alkaline source is in the range of 0.5 to 3.0 wt.-%.
100. A liquid cleaning additive comprising the active components as defined in any one of claims 1-94 wherein the amount of the alkaline source is in the range of 0.5 to 3.0 wt.-%.
101. The method of any one of claims 34-58, wherein the alkaline solution comprises about 0.5 wt.-% to about 3.5 wt.-% of the alkaline source.
102. The method of any one of claims 34-58, wherein the alkaline solution comprises about 1 wt.-% to about 3 wt.-% of the alkaline source.
103. The method of any one of claims 34-58, wherein the alkaline solution comprises about 1.25 wt.-% to about 2.75 wt.-% of the alkaline source.

104. The method of any one of claims 34-58, wherein the alkaline solution comprises about 1.3 wt.-% to about 2.5 wt.-% of the alkaline source.
105. The method of any one of claims 34-58, wherein the alkaline solution comprises about 1.5 wt.-% to about 2.3 wt.-% of the alkaline source.
106. The method of any one of claims 34-58, wherein the alkaline solution comprises about 1.7 wt.-% to about 2.25 wt.-% of the alkaline source.
107. The method of any one of claims 34-58, wherein the alkaline solution comprises about 1.5 wt.-% to about 2.0 wt.-% of the alkaline source.
108. The method of any one of claims 101-106, wherein the alkaline source is sodium hydroxide.

Fig. 1

Label removal at different temperatures

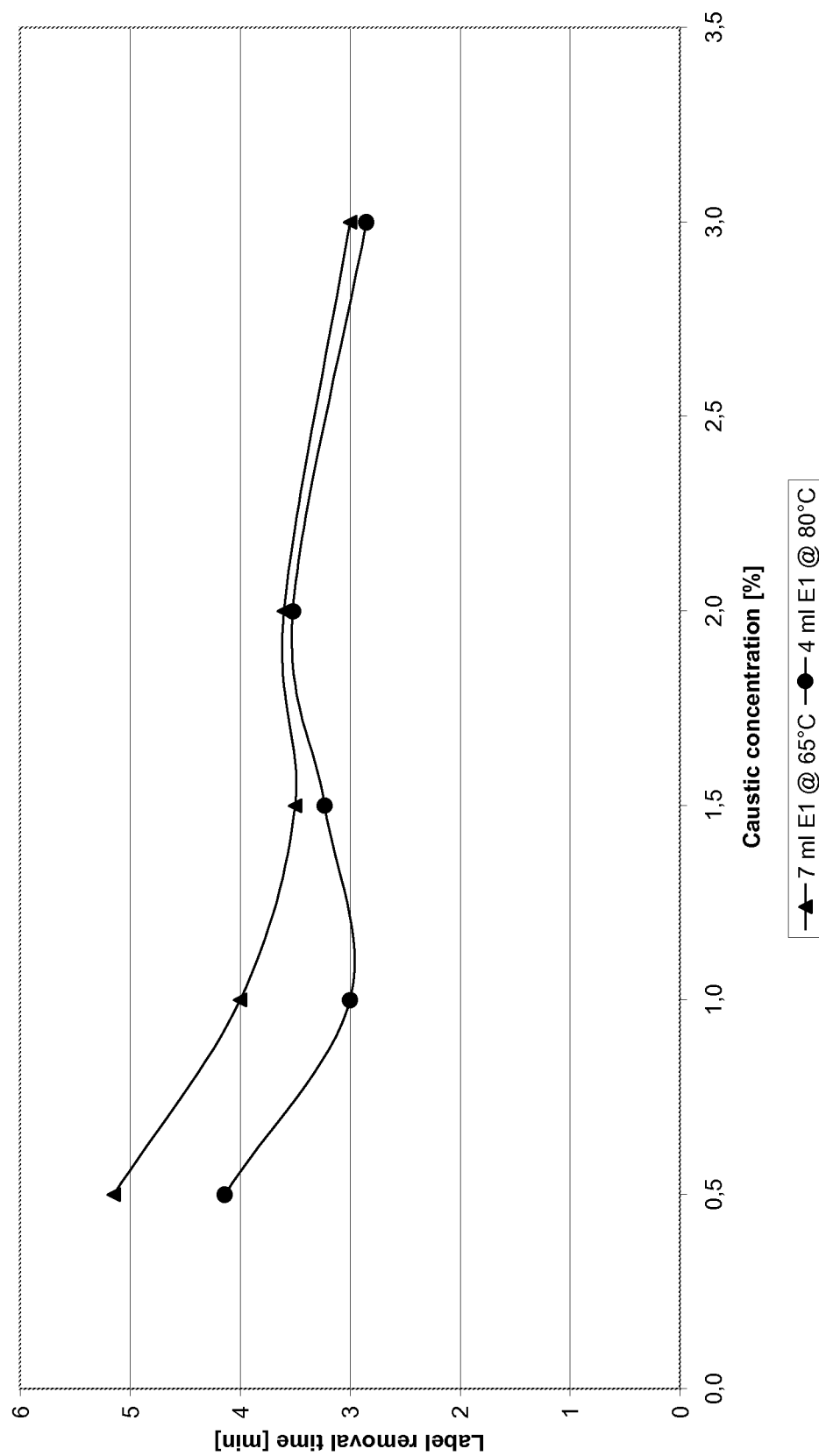
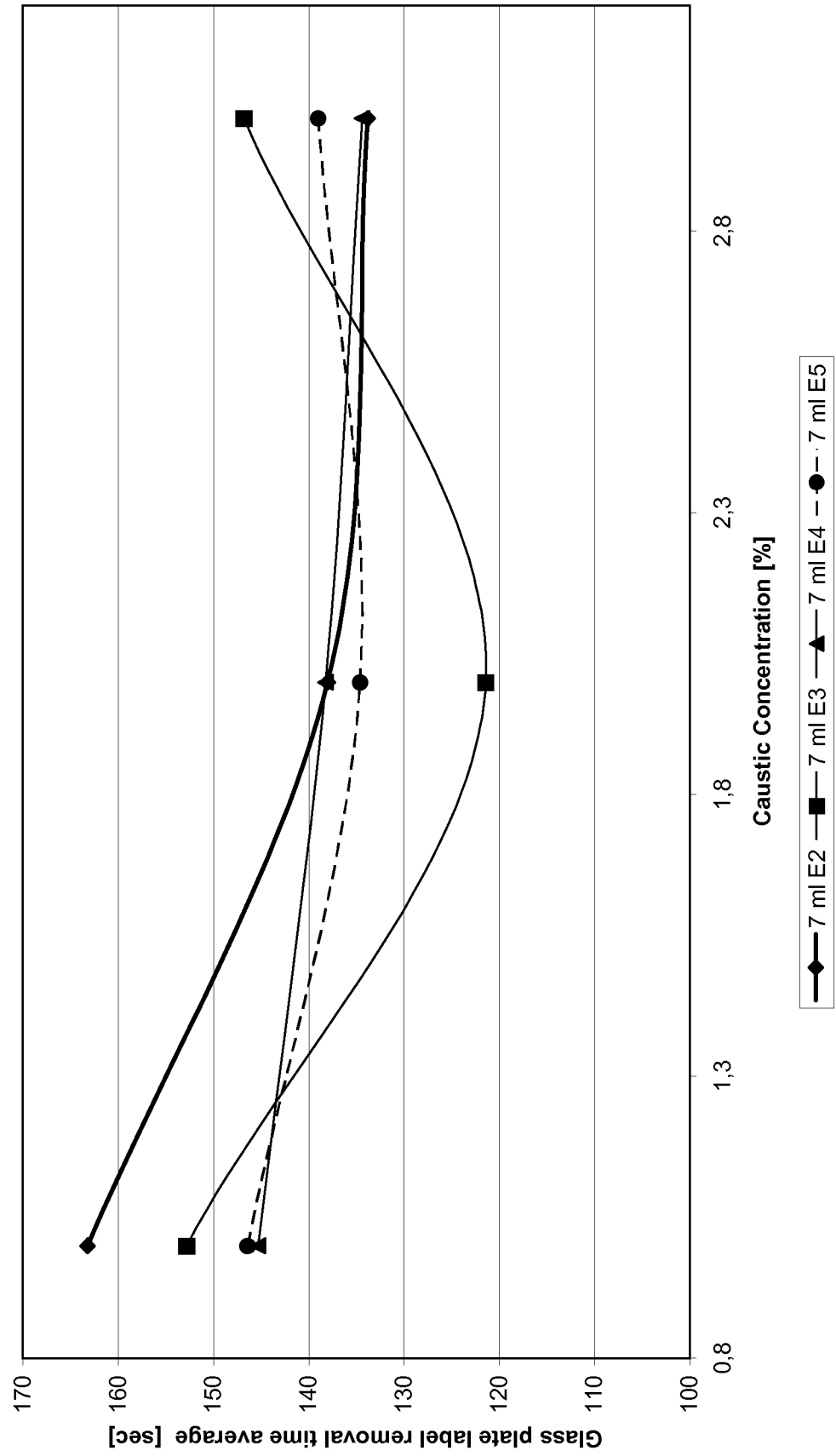


Fig. 2
Glass plate label removal



Label removal at different temperatures

