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(54) **CLEANING METHOD FOR MACHINE
DISHWASHING**

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(57) **ABSTRACT**

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The present invention relates to a process for cleaning tableware using temperatures lower than 80° C. whilst maintaining high hygienic standards by using two alkaline and one acidic cleaning step.

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CLEANING METHOD FOR MACHINE DISHWASHING

TECHNICAL FIELD OF THE INVENTION

[0001] This invention relates generally to the field of machine dishwashing processes, e.g. for cleaning tableware or other surfaces soiled with food remains. More particular this invention relates to field of continuous or discontinuous machine dishwashing processes in single or multi-tank dish machines.

BACKGROUND OF THE INVENTION

[0002] In conventional dishwashing processes, may it be continuous or discontinuous, elevated temperatures are used which are commonly regarded as elementary, especially for satisfying the hygiene requirements in view of the microbiology. In Germany, the DIN 10510 (multi tank machine) and the DIN 10512 (single tank machine) advise a minimum temperature within the wash tank of 60° C. to 65° C. when using detergents without disinfection components. For the final cleaning step a minimum temperature of 80° C. to 85° C. is recommended. The overall contact time of the dishes should not be shorter than 120 seconds (multi tank) or 90 sec (single tank) respectively.

[0003] One the other hand, dishwashing processes which require lower temperatures are advantageous for ecological as well as economical reasons. Furthermore the stress for the tableware or other goods to be cleaned decreases with the temperature which these goods are exposed.

SUMMARY OF THE INVENTION

[0004] It is an object of the present invention to provide a dishwashing process in which lower temperatures can be used while satisfying hygiene requirements.

[0005] This object is solved by a process according to Claim 1. Accordingly, a process for continuous or discontinuous machine dishwashing is provided, comprising the steps of

[0006] a) Applying a first basic cleaning step whereby the cleaning solution has a pH of ≥ 10.5 and ≥ 13 at a temperature of ≥ 30 and $\leq 55^\circ\text{C}$.

[0007] b) Applying an acidic cleaning step whereby the cleaning solution has a pH of ≥ 1 and ≤ 3 at a temperature of ≥ 50 and $\leq 75^\circ\text{C}$.

[0008] c) Applying a second basic cleaning step whereby the cleaning solution has a pH of ≥ 10.5 and ≤ 13 at a temperature of ≥ 30 and $\leq 55^\circ\text{C}$.

[0009] d) Applying a rinse step, whereby the cleaning solution has a pH of ≥ 5 and ≤ 7 at a temperature of ≥ 50 and $\leq 75^\circ\text{C}$.

[0010] Surprisingly it has been found that such a process has for a wide range of applications within the present invention at least one of the following advantages:

[0011] By using this process it is possible to reach a satisfying cleaning result as well as meeting hygienic standards while avoiding high temperatures (especially temperatures over 75° C.)

[0012] By avoiding these high temperatures, a significant amount of energy can be saved

[0013] Lower temperatures lead to a lower environmental footprint of the wastewater

[0014] According to a preferred embodiment of the invention, step a) and/or step c) is performed at a temperature of ≥ 40 and $\leq 50^\circ\text{C}$., preferably around 45° C.

[0015] According to a preferred embodiment of the invention, step b) and/or step d) is performed at a temperature of ≥ 55 and $\leq 70^\circ\text{C}$., preferably between ≥ 60 and $\leq 65^\circ\text{C}$. and most preferred around 63° C.

[0016] According to a preferred embodiment of the invention in step a) and/or c) the cleaning solution has a pH of ≥ 11 and ≤ 12 .

[0017] According to a preferred embodiment of the invention in step b) the cleaning solution has a pH of ≥ 2 and ≤ 2.5 .

[0018] According to a preferred embodiment of the invention, step a) is performed for ≥ 10 s and ≤ 60 s.

[0019] According to a preferred embodiment of the invention, step b) is performed for ≥ 10 s and ≤ 20 s.

[0020] According to a preferred embodiment of the invention, step c) is performed for ≥ 20 s and ≤ 60 s.

[0021] According to a preferred embodiment of the invention, step d) is performed for ≥ 5 s and ≤ 15 s.

[0022] In the following the four steps of the invention are described in more detail:

[0023] Step a): First Alkaline Cleaning Step

[0024] Step a) is the first alkaline cleaning step in the context of the invention and is performed using a cleaning solution having a pH of ≥ 10.5 and ≤ 13 , preferably ≥ 11 and ≤ 12 . This pH can be achieved e.g. by using hydroxide solution and/or hydroxide/buffer solution, especially hydroxide/phosphate buffer solution

[0025] Furthermore the cleaning solution used in step a) may include one or more of the following ingredients:

[0026] Complexing agents, Chelants, Builders

[0027] Surfactants

[0028] Corrosion inhibitors

[0029] Processing additives

[0030] The cleaning solution is sprayed onto the tableware trough a rotating washing arm as a heavy water curtain.

[0031] Step a) is performed at a temperature of ≥ 30 and $\leq 55^\circ\text{C}$., which means that the cleaning solution which is applied to the tableware has this temperature. More preferred, step a) is performed at a temperature of ≥ 40 and $\leq 50^\circ\text{C}$., preferably around 45° C.

[0032] Step a) preferably is performed for ≥ 10 s and ≤ 60 s, more preferred for ≥ 20 s and ≤ 30 s. However, it should be noted that the duration of step a) is not limiting for the invention, only for some preferred applications within the same.

[0033] Step b): Acidic Cleaning Step

[0034] Step b) is the acidic cleaning step in the context of the invention and is performed using a cleaning solution having a pH of ≥ 1 and ≤ 3 , preferably ≥ 2 and ≤ 2.5 This pH can be achieved e.g. by using an inorganic or organic acid.

[0035] Suitable acidic compounds in the context of this invention which are insofar preferred are sulfuric acid, nitric acid, phosphoric acid, formic acid, acetic acid, propanoic acid, glycolic acid, citric acid, maleic acid, lactic acid, gluconic acid, alkanesulfonic acid, amidosulfonic acid, succinic acid, glutaric acid, adipic acid, phosphonic acids, polyacrylic acids or mixtures thereof and, in a most particularly embodiment, from formic acid, glycolic acid, gluconic acid, amidosulfonic acid or the alkanesulfonic acids, more particularly methanesulfonic acid or mixtures thereof. Especially preferred is methanesulfonic acid.

[0036] Furthermore the cleaning solution used in step b) may include one or more of the following ingredients:

[0037] Surfactants

[0038] Hydrotropes

[0039] Stabilizer

[0040] Processing additives

[0041] In a preferred embodiment of the process according to the invention, the cleaning solution is allowed to act on the tableware and the soil for a certain contact time (during which spraying stops).

[0042] In another preferred embodiment, the tableware is not intentionally sprayed during the contact time.

[0043] Alternatively or additionally, the cleaning solution is sprayed onto the tableware as a fine, gentle mist-like liquid spray.

[0044] Alternatively or additionally, the cleaning solution is applied to the tableware as foam.

[0045] Alternatively or additionally, the cleaning solution is applied to the tableware in droplet form or by the Ecolab process known commercially as thin film cleaning (TFC).

[0046] Step b) is performed at a temperature of ≥ 50 and $\leq 75^\circ \text{C}$., which means that the cleaning solution which is applied to the tableware has this temperature. More preferred, step b) is performed at a temperature of ≥ 60 and $\leq 65^\circ \text{C}$. and most preferred around 63°C .

[0047] Step b) preferably is performed for ≥ 10 s and ≤ 20 s. However, it should be noted that the duration of step b) is not limiting for the invention, only for some preferred applications within the same.

[0048] Step c): Second Alkaline Cleaning Step

[0049] Step c) is the second alkaline cleaning step in the context of the invention and is performed using a cleaning solution having a pH of ≥ 10.5 and ≤ 13 , preferably ≥ 11 and ≤ 12 . This pH can be achieved e.g. by using hydroxide solution and/or hydroxide/buffer solution, especially hydroxide/phosphate buffer solution

[0050] Furthermore the cleaning solution used in step a) may include one or more of the following ingredients:

[0051] Complexing agents, Chelants, Builders

[0052] Surfactants

[0053] Corrosion inhibitors

[0054] Processing additives

[0055] The cleaning solution is sprayed onto the tableware through a rotating washing arm as a heavy water curtain.

[0056] Step c) is performed at a temperature of ≥ 30 and $\leq 55^\circ \text{C}$., which means that the cleaning solution which is applied to the tableware has this temperature. More preferred, step c) is performed at a temperature of ≥ 40 and $\leq 50^\circ \text{C}$., preferably around 45°C .

[0057] Step c) preferably is performed for ≥ 20 s and ≤ 60 s, more preferred ≥ 45 s and ≤ 55 s. However, it should be noted that the duration of step c) is not limiting for the invention, only for some preferred applications within the same.

[0058] Step d): Rinsing Step

[0059] Step d) is the neutral rinsing step in the context of the invention and is performed using a rinse aid solution having a pH of ≥ 5 and ≤ 7 .

[0060] The rinse aid solution used in step d) may include one or more of the following ingredients:

[0061] Surfactants

[0062] Organic and/or inorganic acids

[0063] Auxiliaries

[0064] Hydrotropes

[0065] Processing additives

[0066] In a preferred embodiment of the process according to the invention, the cleaning solution is allowed to act on the tableware and the soil for a certain contact time (during which spraying stops), as it step d) usually is the last step in the dishwashing cycle.

[0067] In another preferred embodiment, the tableware is not intentionally sprayed during the contact time.

[0068] Step d) is performed at a temperature of ≥ 50 and $\leq 75^\circ \text{C}$., which means that the cleaning solution which is applied to the tableware has this temperature. More preferred, step b) is performed at a temperature of ≥ 60 and $\leq 65^\circ \text{C}$. and most preferred around 63°C .

[0069] Step d) preferably is performed for ≥ 5 s and ≤ 15 s, preferably ≥ 9 s and ≤ 12 s. However, it should be noted that the duration of step d) is not limiting for the invention, only for some preferred applications within the same.

[0070] The afore mentioned components, as well as the claimed components and the components to be used in accordance with the invention in the described embodiments, are not subject to any special exceptions with respect to their size, shape, material selection and technical concept such that the selection criteria known in the pursuant field can be applied without a limitation.

BRIEF DESCRIPTION OF THE EXAMPLES

[0071] Additional details, features, characteristics and advantages of the object of the invention are disclosed in the following description of the examples, which—in exemplary fashion—show several embodiments and examples of a process according to the invention. The examples are to be understood merely to further illustrate the invention and are not binding.

Example I

[0072] Cleaning of table cups and table plates in a MEIKO DV80.2 dishwashing machine sold by Meiko company, Offenburg, Germany.

[0073] For each test, 3 dry, clean table cups were soiled by being dipped in a coffee and milk brew at 70°C . for 25 times (1 min in the solution followed by 1 min drying each dipping cycle) and afterwards dried for 2 hours at 90°C . according to a standardized test protocol.

[0074] Furthermore for each test 3 dry, clean table cups were dipped in a black tea and milk brew at 70°C . for 25 times (1 min in the solution followed by 1 min drying each dipping cycle) and afterwards dried for 2 hours at 90°C . according to a standardized test protocol.

[0075] Finally for each test three plates soiled with starch at room temperature by a standardized test method.

[0076] To this end, a ca. 6% aqueous composition containing corn starch was cooled to 75°C . after boiling and was applied to each cup with a brush in a quantity of ca. 4 ml. The cups thus treated were left to stand for at least 3 hours and then dried at ca. 100°C . for 16 hours.

[0077] The cleaning tests were carried out in a Meiko DV80.2 hood-type dishwashing machine according to the following scheme:

[0078] a) Cleaning for 25 seconds at a temperature of 45°C . with a 0.2% by weight aqueous solution of an alkaline detergent, the solution having a pH of 12.

[0079] b) Cleaning for 5 seconds at a temperature of 63°C . with a 0.2% by weight aqueous solution of an acidic detergent, the solution having a pH of 2.5.

[0080] c) Cleaning for 49 s seconds at a temperature of 45°C . with a 0.2% by weight aqueous solution of an alkaline detergent, the solution having a pH of 12.

[0081] d) Rinsing for 12 seconds at a temperature of 63°C . with fresh water

[0082] The cleaning was evaluated by scoring on a scale of 1 (=no visible sign of cleaning) to 10 (=complete removal of soil), resulting in a score of 8.

Example II

[0083] Example II is identical with Example I, only that an Electrolux "Clean and Green" WT65 dishwashing machine, sold by Electrolux company, Stockholm, Sweden was used.

[0084] The cleaning resulted in a score of 9.

[0085] The particular combinations of elements and features in the above detailed embodiments are exemplary only; the interchanging and substitution of these teachings with other teachings in this and the patents/applications incorporate by referency are also expressly contemplated. As those skilled in the art will recognize, variations, modifications, and other implementations of what is described herein can occur to those of ordinary skill in the art without departing from the spirit and the scope of the invention as claimed. Accordingly, the foregoing description is by the way of example only and is not intending as limiting. In the claims, the wording "comprising" does not exclude other elements or steps, and the identified article "a" or "an" does not exclude a plurality. The mere fact that certain measures are recited in mutually different dependent claims does not indicate that a combination of these measures can not be used to advantage. The inventions scope is defined in the following claims and the equivalents thereto. Furthermore, reference signs used in the description and claims do not limit the scope of the invention as claimed.

1. A process for continuous or discontinuous machine dishwashing comprising the steps of

- a) Applying a first basic cleaning step whereby the cleaning solution has a pH of ≥ 10.5 and ≤ 13 at a temperature of ≥ 30 and $\leq 55^\circ\text{C}$.
- b) Applying an acidic cleaning step whereby the cleaning solution has a pH of ≥ 1 and ≤ 3 at a temperature of ≥ 50 and $\leq 75^\circ\text{C}$.

c) Applying a second basic cleaning step whereby the cleaning solution has a pH of ≥ 10.5 and ≤ 13 at a temperature of ≥ 30 and $\leq 55^\circ\text{C}$.

d) Applying a rinse step, whereby the cleaning solution has a pH of ≥ 5 and ≤ 7 at a temperature of ≥ 50 and $\leq 75^\circ\text{C}$.

2. The process according to claim 1, whereby step a) and/or step c) is performed at a temperature of ≥ 40 and $\leq 50^\circ\text{C}$., preferably around 45°C .

3. The process according to any of the claims 1 and 2, wherein step b) and/or step d) is performed at a temperature of ≥ 55 and $\leq 70^\circ\text{C}$., preferably between ≥ 60 and $\leq 65^\circ\text{C}$. and most preferred around 63°C .

4. The process according to any of the claims 1 to 3, wherein in step a) and/or c) the cleaning solution has a pH of ≥ 11 and ≤ 12 .

5. The process according to any of the claims 1 to 4, wherein in step b) the cleaning solution has a pH of ≥ 2 and ≤ 2.5 .

6. The process according to any of the claims 1 to 5, wherein step a) is performed for ≥ 10 s and ≤ 30 s

7. The process according to any of the claims 1 to 6, wherein step b) is performed for ≥ 10 s and ≤ 20 s.

8. The process according to any of the claims 1 to 7, wherein step c) is performed for ≥ 20 s and ≤ 50 s

9. The process according to any of the claims 1 to 8, wherein step d) is performed for ≥ 5 s and ≤ 15 s

10. The process according to any of the claims 1 to 9, whereby in step a) the cleaning solution is sprayed onto the tableware trough a rotating washing arm as a heavy water curtain

11. The process according to any of the claims 1 to 10, whereby in step c) the cleaning solution is sprayed onto the tableware trough a rotating washing arm as a heavy water curtain

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