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(54) **Title:** DISHWASHING PROCESS COMPRISING A BASIC AND ACIDIC CLEANING STEP

(57) **Abstract:** The present invention relates to a process for cleaning tableware using a basic cleaning step followed by an acidic cleaning step, both steps having a defined small pH-interval.



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Dishwashing process comprising a basic and acidic
5 cleaning step

Technical field of the invention

10 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
15 multi-tank dish machines.

Background of the invention

Dish washing machines, especially industrial dish washing
20 machines are known in the field. In this context dish
washing methods are known in which basic cleaning steps
are altered with acidic cleaning steps, e.g. from the EP
1 477 552 A1 which is hereby incorporated by reference.
These washing methods have been described to be effective
25 against starch deposits.

However, there is a constant need for improved dish
washing processes to further increase the efficiency of
cleaning tableware, especially tableware having starch
30 deposited on it.

SUMMARY OF THE INVENTION

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It is an object of the present invention to provide a dishwashing process which allows an efficient cleaning of tableware, especially of tableware having starch
5 deposits.

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
10

a) Applying a first basic cleaning step whereby the cleaning solution has a pH of $\geq 10,6$ and $\leq 10,9$

b) Applying an acidic cleaning step whereby the cleaning
15 solution has a pH of ≥ 1 and ≤ 2

c) Applying a second basic cleaning step whereby the cleaning solution has a pH of $\geq 10,5$ and ≤ 13

20 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:

- By using this process it is possible to reach a satisfying cleaning result, especially concerning
25 the removal of starch
- By using this process it is possible to operate without periodical stripping processes of the ware to remove long term starch build up.
- By using this process the cleaning result and
30 finish of glass and stainless steel ware is improved.

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- By using this process it is possible to operate without periodical de-liming of the process equipment.
- By using this process the pH value of the process
5 water to be disposed will be reduced to a more favourable value.

According to a preferred embodiment of the invention in step c) the cleaning solution has a pH of $\geq 10,6$ and $10,9$.

10

Alternatively, according to a preferred embodiment of the invention in step c) the cleaning solution has a pH of ≥ 11 and $12,5$.

- 15 According to a preferred embodiment of the invention, step a) is performed at a temperature of $\geq 30^{\circ}\text{C}$ and $\leq 70^{\circ}\text{C}$

According to a preferred embodiment of the invention, step b) is performed at a temperature of $\geq 55^{\circ}\text{C}$ and $\leq 85^{\circ}\text{C}$

20

According to a preferred embodiment of the invention, step c) is performed at a temperature of $\geq 30^{\circ}\text{C}$ and $\leq 70^{\circ}\text{C}$

- 25 According to a preferred embodiment of the invention, step a) is performed for $\geq 8\text{s}$ and $\leq 60\text{s}$.

According to a preferred embodiment of the invention, step b) is performed for $\geq 10\text{s}$ and $\leq 20\text{s}$.

- 30 According to a preferred embodiment of the invention, step c) is performed for $\geq 20\text{s}$ and $\leq 60\text{s}$.

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In the following the three steps of the invention are described in more detail:

Step a): First alkaline cleaning step

5

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 $\geq 10,6$ and $\leq 10,9$. This pH can be achieved e.g. by using hydroxide solution and/or
10 hydroxide/buffer solution, especially hydroxide/phosphate buffer solution

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

- 15
- Complexing agents, Chelants, Builders
 - Surfactants
 - Corrosion inhibitors
 - Processing additives

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

According to a preferred embodiment of the present invention, Step a) is performed at a temperature of ≥ 30
25 and $\leq 70^{\circ}\text{C}$, 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 $\leq 65^{\circ}\text{C}$, yet more preferred ≥ 50 and $\leq 60^{\circ}\text{C}$

30 Step a) preferably is performed for $\geq 8\text{s}$ and $\leq 60\text{s}$, more preferred for $\geq 20\text{s}$ and $\leq 30\text{s}$. However, it should be noted

- 5 -

that the duration of step a) is not limiting for the invention, only for some preferred applications within the same.

5 Step b): Acidic cleaning step

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 ≤ 2 . This pH can be achieved e.g. by
10 using an inorganic or organic acid.

Suitable acidic compounds in the context of this invention which are insofar preferred are sulfuric acid, nitric acid, phosphoric acid, formic acid, acetic acid,
15 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
20 formic acid, glycolic acid, gluconic acid, amidosulfonic acid or the alkanesulfonic acids, more particularly methanesulfonic acid or mixtures thereof. Especially preferred is methanesulfonic acid.

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

- Surfactants
- Hydrotropes
- Stabilizer
- 30 - Processing additives

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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).

5

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

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

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

15

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).

20 According to a preferred embodiment of the present invention, Step b) is performed at a temperature of ≥ 55 and $\leq 85^{\circ}\text{C}$, 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
25 and $\leq 80^{\circ}\text{C}$ and

Step b) preferably is performed for $\geq 10\text{s}$ and $\leq 20\text{s}$. However, it should be noted that the duration of step b) is not limiting for the invention, only for some
30 preferred applications within the same.

Step c): Second alkaline cleaning step

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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 $\geq 10,5$ and ≤ 13 ,
5 preferably $\geq 10,6$ and $\leq 10,9$. This pH can be achieved e.g. by using hydroxide solution and/or hydroxide/buffer solution, especially hydroxide/ phosphate buffer solution

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

- Complexing agents, Chelants, Builders
- Surfactants
- Corrosion inhibitors
- Processing additives

15

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

According to a preferred embodiment of the present
20 invention, Step c) is performed at a temperature of ≥ 30 and $\leq 70^{\circ}\text{C}$, 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 $\leq 65^{\circ}\text{C}$, yet more preferred ≥ 50 and $\leq 60^{\circ}\text{C}$

25

Step c) preferably is performed for $\geq 20\text{s}$ and $\leq 60\text{s}$, more preferred $\geq 45\text{s}$ and $\leq 55\text{s}$. However, it should be noted that the duration of step c) is not limiting for the invention, only for some preferred applications within
30 the same.

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According to a further preferred embodiment of the present invention, the process furthermore comprises a step d) being a neutral rinsing step. This embodiment will be described in more detail later on.

5

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 .

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

- Surfactants
- Organic and/or inorganic acids
- Auxiliaries
- 15 - Hydrotropes
- Processing additives

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.

20

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

25

According to a preferred embodiment of the present invention, Step d) is performed at a temperature of ≥ 55 and $\leq 85^{\circ}\text{C}$, which means that the cleaning solution which is applied to the tableware has this temperature. More

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preferred, step b) is performed at a temperature of ≥ 60 and $\leq 80^{\circ}\text{C}$.

Step d) preferably is performed for $\geq 5\text{s}$ and $\leq 15\text{s}$,
5 preferably $\geq 9\text{s}$ and $\leq 12\text{s}$. 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.

10 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
15 such that the selection criteria known in the pursuant field can be applied without a limitation.

The particular combinations of elements and features in the above detailed embodiments are exemplary only; the
20 interchanging and substitution of these teachings with other teachings in this and the patents/applications incorporate by reference are also expressly contemplated. As those skilled in the art will recognize, variations, modifications, and other implementations of what is
25 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
30 "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

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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.

- 5 Furthermore, reference signs used in the description and claims do not limit the scope of the invention as claimed.

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Claims

1.

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

a) Applying a first basic cleaning step whereby the
cleaning solution has a pH of $\geq 10,6$ and $\leq 10,9$.

10 b) Applying an acidic cleaning step whereby the cleaning
solution has a pH of ≥ 1 and ≤ 2

c) Applying a second basic cleaning step whereby the
cleaning solution has a pH of $\geq 10,5$ and ≤ 13

15

2.

The process according to claim 1, whereby in step c) the
cleaning solution has a pH of $\geq 10,6$ and $\leq 10,9$

20 3.

The process according to claim 1, whereby in step c) the
cleaning solution has a pH of ≥ 11 and $\leq 12,5$

4.

25 The process according to any of the claims 1 to 3,
wherein step a) is performed at a temperature of $\geq 30^{\circ}\text{C}$
and $\leq 70^{\circ}\text{C}$

5.

30 The process according to any of the claims 1 to 4,
wherein step b) is performed at a temperature of $\geq 55^{\circ}\text{C}$
and $\leq 85^{\circ}\text{C}$

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6.

The process according to any of the claims 1 to 5,
wherein step c) is performed at a temperature of $\geq 30^{\circ}\text{C}$
5 and $\leq 70^{\circ}\text{C}$

7.

The process according to any of the claims 1 to 6,
wherein step a) is performed for $\geq 8\text{s}$ and $\leq 60\text{s}$
10

8.

The process according to any of the claims 1 to 7,
wherein step b) is performed for $\geq 10\text{s}$ and $\leq 20\text{s}$.

15 9.

The process according to any of the claims 1 to 8,
wherein step c) is performed for $\geq 20\text{s}$ and $\leq 60\text{s}$.

INTERNATIONAL SEARCH REPORT

International application No
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A. CLASSIFICATION OF SUBJECT MATTER
INV. A47L15/00 C11D11/00
ADD.

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

B. FIELDS SEARCHED

Minimum documentation searched (classification system followed by classification symbols)
A47L C11D

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

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

EPO-Internal, WPI Data

C. DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
X	WO 2005/068598 A1 (ECOLAB INC [US]; STROTHOFF WERNER [DE]; TROLL WINFRIED [DE]; MAIER HEL) 28 July 2005 (2005-07-28) page 5, lines 7-9 page 6, line 5 - page 7, line 4 page 10, line 11 - page 11, line 3 page 54, line 19 - page 56, line 15 page 64, lines 4-8; claims -----	1-9
X	WO 02/100993 A1 (ECOLAB GMBH & CO OHG [DE]; STROTHOFF WERNER [DE]; MAIER HELMUT [DE]) 19 December 2002 (2002-12-19) the whole document -----	1-9
A	EP 0 761 156 A1 (SHARP KK [JP]) 12 March 1997 (1997-03-12) the whole document ----- -/-	1-9



Further documents are listed in the continuation of Box C.



See patent family annex.

* Special categories of cited documents :

"A" document defining the general state of the art which is not considered to be of particular relevance

"E" earlier document but published on or after the international filing date

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"P" document published prior to the international filing date but later than the priority date claimed

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"X" document of particular relevance; the claimed invention cannot be considered novel or cannot be considered to involve an inventive step when the document is taken alone

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

"&" document member of the same patent family

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C(Continuation). DOCUMENTS CONSIDERED TO BE RELEVANT

Category*	Citation of document, with indication, where appropriate, of the relevant passages	Relevant to claim No.
A	WO 92/18047 A1 (HENKEL KGAA [DE]) 29 October 1992 (1992-10-29) the whole document -----	1-9

INTERNATIONAL SEARCH REPORT

Information on patent family members

International application No

PCT/EP2011/058194

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