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(12) # EUROPEAN PATENT APPLICATION

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(71) Applicant: **UNILEVER N.V.**
P.O. Box 760
NL-3000 DK Rotterdam(NL)

(72) Inventor: **Oldenburg, Willem, c/o UNILEVER Research Lab.**
Olivier van Noortlaan 120
NL-3133 AT Vlaardingen(NL)

(74) Representative: **Tan, Bian An, Ir. et al**
Unilever N.V.
Patent Division
P.O. Box 137
NL-3130 AC Vlaardingen (NL)

(54) **Machine wash programme.**

(57) An improved wash programme for washing machines, especially automatic dishwashing machines, is provided, the improvement being that the main-wash cycle is operated with a hold-time of from 1-15 minutes, preferably about 5-10 minutes, at a temperature of from about 40 °-55 °C.

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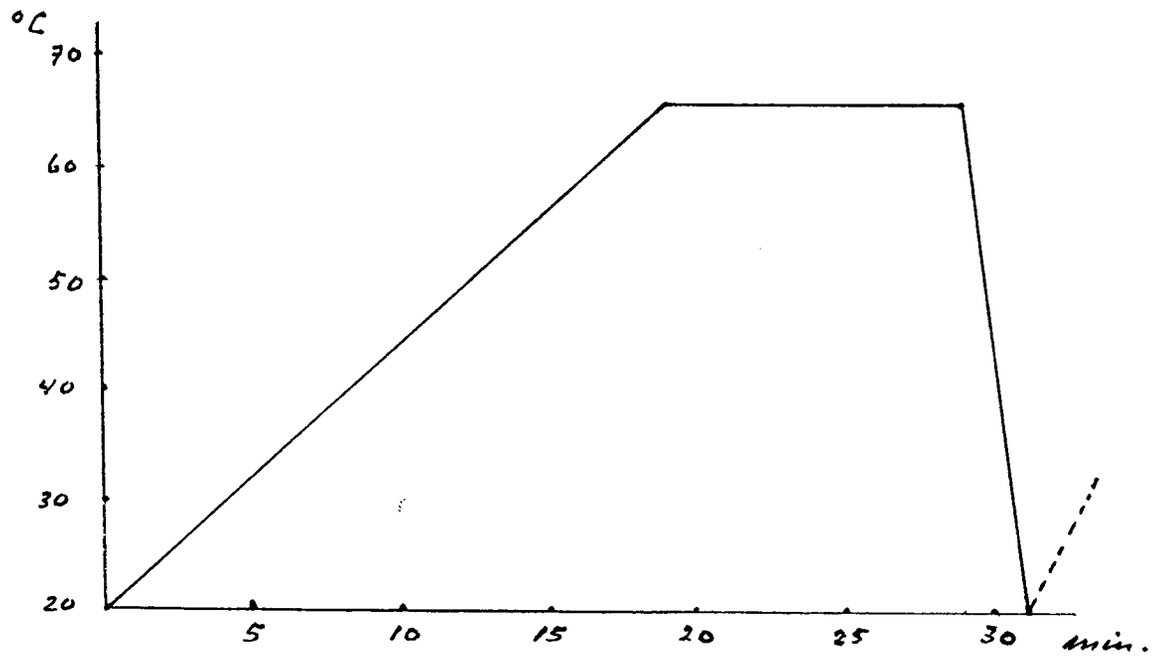
This invention relates to an improved wash programme for washing machines, particularly automatic dishwashers of the domestic-type.

Automatic dishwashing machines of the domestic type normally operate according to a fixed programme consisting of an optional pre-wash cycle, a main-wash cycle, a rinse cycle and a drying cycle, wherein the machine dishwashing product is dosed at the beginning of the main-wash cycle.

During the main-wash the wash liquor is gradually heated from ambient tap-water temperature of about 20 °C to a maximum of about 65 °C in about 19 minutes and washing is continued for a further 10 minutes at the maximum temperature as shown in the diagram below.



This time-temperature profile has been working well for the conventional chlorine bleach containing highly alkaline machine dishwashing products.

Recently however there has been a strong tendency towards milder and more environmentally friendly products, and indeed most of the present day machine dishwashing products are mildly alkaline products containing enzymes such as amylase, protease and lipase, and a peroxygen bleach system based on a percompound and a bleach activator, such as sodium perborate and N, N, N^1, N^1-tetraacetylethylene diamine (TAED).

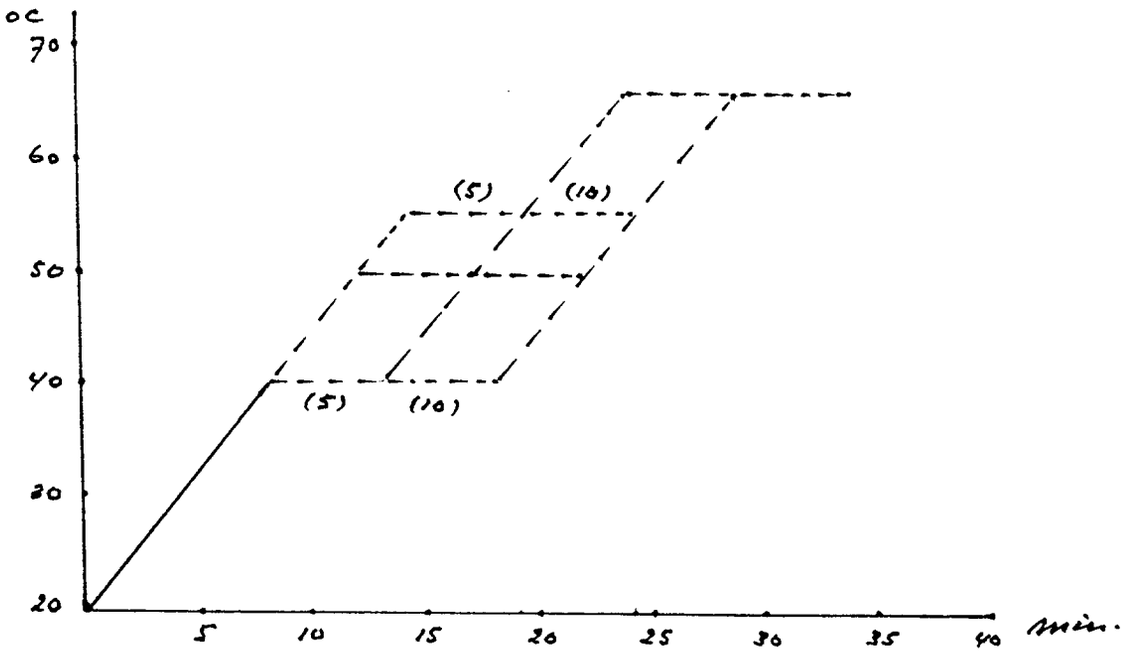
Thorough examination and experiments have brought into light that with the current dishwashing machines the benefits of the active enzyme and bleach ingredients cannot be fully attained.

It is an object of the present invention to provide an improved wash programme for automatic dishwashing machines that will give larger benefits for modern mild machine dishwashing products comprising an enzyme and a peroxygen bleach.

It is another object of the invention to provide a wash programme for automatic dishwashing machines that will still deliver the same good washing results as previously with conventional highly alkaline chlorine bleach containing machine dishwashing products.

It is a further object of the invention to provide an automatic dishwashing machine having improved wash programme that can be suitably used for washing dishes, cups, pots and pans, crockeries, kitchen utensils etc. with conventional chlorine bleach containing machine dishwashing compositions as well as with modern mild enzymatic/bleach compositions.

It has now been found that these and other objects which will be apparent from the further description of the invention can be achieved if the time-temperature profile of the main-wash cycle is changed such that a hold-time of from 1-15 minutes, preferably from about 5-10 minutes is introduced when the wash liquor temperature has reached a value of from about 40 °C to 55 °C, whereafter heating and washing can be continued unchanged. A diagram of the proposed time-temperature profile is given below.



Accordingly the invention provides a wash programme design for automatic dishwashing machines consisting essentially of an optional pre-wash cycle, a main-wash cycle, a rinse cycle and a drying step wherein the main-wash cycle operates with an intermediate holding of the wash liquor temperature at a value lying between about 40 °C and 55 °C for a period of 1-15 minutes, preferably about 5-10 minutes.

Introduction of hold-time may result in the washing-cycle being prolonged for about 1-15 minutes, if the washing time at the maximum operating temperature is kept at 10 minutes. However it is found that with the introduction of a hold-time according to the invention a washing time at the maximum temperature of 10 minutes or 5 minutes makes no difference with respect to enzyme activity contribution. A preferred wash programme is therefore wherein the washing time at the maximum temperature of the wash cycle is less than 10 minutes, preferably about 5 minutes.

A further preferred wash programme according to the invention is wherein the hold-time in the wash cycle is about 5 minutes.

Without wishing to be bound by any theory it is believed that time and temperature form a combination determining to a large extent the relative activities of enzymes and bleach. Temperature rise is inevitable for cleaning. Whereas generally enzymes are active up to 55 °C and above that temperature, oxidation by bleach becomes dominant, the bleach obtains its full potential at temperatures above 55 °C. It is thus of utmost importance to find a correct balance between these two factors.

Temperature holds below 55 °C are therefore very effective because of significant delay of enzyme decomposition but also contributions to peracid integrated activity, resulting in a significant increase of both bleach and enzyme effectivity.

Reducing the wash time at the maximum temperature may reduce the machine factor, but apparently does not affect integrated peroxyacid and enzyme activity.

Optimal results are obtained with a hold-time of about 5 minutes at about 50 °C and a wash-time of about 5 minutes at a maximum temperature of about 65 °C.

It should be appreciated that introduction of hold-time in the wash cycle as hereinbefore described can also be beneficially applied to automatic fabric washing machines.

The invention therefore encompasses a wash programme usable in fabric washing machines.

In the following Table 1 the stability profiles for peracid, protease (Savinase®) and amylase (Termamyl®) in conventional 65 °C machine dishwash programme are given.

In Table 2 the relative integrated activity as effect of hold-time of peracid, protease and amylase is tabulated.

Table 1

Time min	Peracid	Protease	Xy1ase	Temp c	F(T,t) *
	activity %				
0	0	0	0	21.0	
1	8	20	20	23.4	1.2
2	16	40	40	25.7	1.4
3	24	60	60	28.1	1.6
4	30	80	75	30.4	1.9
5	38	100	90	32.8	2.2
6	46	96	85	35.1	2.6
7	54	93	80	37.5	3.1
8	62	90	75	39.8	3.6
9	70	85	69	42.2	4.3
10	75	80	63	44.5	5.0
11	80	75	57	46.9	5.9
12	78	70	50	49.2	7.0
13	76	65	35	51.6	8.2
14	73	60	20	53.9	9.7
15	70	50	5	56.3	11.4
16	66	40	0	58.6	13.4
17	62	30	0	61.0	15.8
18	58	25	0	63.3	18.6
19	54	20	0	65.7	21.9
20	50	10	0	65.7	23.8
21	45	0	0	65.7	23.8
22	40	0	0	65.7	23.8
23	35	0	0	65.7	23.8
24	30	0	0	65.7	23.8
25	25	0	0	65.7	23.8
26	20	0	0	65.7	23.8
27	15	0	0	65.7	23.8
28	10	0	0	65.7	23.8
29	5	0	0	65.7	23.8

* Machine factor integrating temperature and time

Table 2

Hold effect without time compensation (i.e. longer washing time)

	Relative increase of activities			
1 minute hold	F(T,t)	Peracid	Protease	Amylase
40°C	1.01	1.00	1.02	1.05
50°C	1.02	1.02	1.03	1.07
55°C	1.03	1.02	1.04	1.04
5 minutes hold				
40°C	1.06	1.02	1.12	1.27
50°C	1.10	1.09	1.16	1.37
55°C	1.14	1.10	1.19	1.21
10 minutes hold				
40°C	1.11	1.15	1.40	1.67
50°C	1.20	1.16	1.26	1.59
55°C	1.27	1.06	1.13	1.24

Table 3 shows integrated activity vs. reference for various components in a 65 °C machine dishwash programme with 1, 5 or 10 minutes holds at 40 °, 50 ° and 55 °C and respectively 9, 5 or 0 minutes wash at 65 °C. The integrated activities of the reference of components in a standard 65 °C machine dishwash programmeis set at 1.0.

Table 3

Hold effect with time compensation

	Relative increase of activities			
1 minute hold	F(T,t)	Peracid	Protease	Amylase
40°C	0.94	0.98	1.02	1.05
50°C	0.95	0.99	1.03	1.07
55°C	0.96	0.99	1.04	1.04
5 minutes hold				
40°C	0.72	0.88	1.12	1.27
50°C	0.76	0.94	1.16	1.37
55°C	0.80	0.97	1.19	1.21
10 minutes hold				
40°C	0.44	0.63	1.27	1.67
50°C	0.53	0.75	1.21	1.59
55°C	0.61	0.71	1.11	1.24

Claims

1. A wash programme for automatic-dishwashing machines consisting essentially of an optional pre-wash cycle, a main-wash cycle, a rinse cycle and a drying cycle, characterized in that the main-wash cycle operates with a hold-time of from 1-15 minutes at a temperature of from about 40-55 °C.

2. A wash programme according to claim 1, characterized in that the hold-time is from about 5 to 10 minutes.

3. A wash programme according to claim 2, characterized in that the hold-time is about 5 minutes.

4. A wash programme according to claim 1, 2 or 3, characterized in that the hold-time is operated at a temperature of about 50 °C.

5. A wash programme according to any of the preceding claims 1-4, characterized in that the main wash cycle comprises washing at the maximum operating temperature of about 5 minutes.

6. A wash programme according to any one of the preceding claims 1-5, characterized in that said maximum operating temperature is about 65 °C.

7. A wash programme according to claim 6, characterized in that it comprises a hold-time of about 5 minutes at a temperature of about 50 °C and a wash time of about 5 minutes at a maximum operating temperature of 65 °C.

8. Automatic dishwashing machine provided with a wash programme as claimed in any of the aforementioned claims 1-7.

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EUROPEAN SEARCH REPORT

Application Number
EP 92 20 2897

DOCUMENTS CONSIDERED TO BE RELEVANT

Category	Citation of document with indication, where appropriate, of relevant passages	Relevant to claim	CLASSIFICATION OF THE APPLICATION (Int. Cl.5)
X	DE-A-2 134 850 (ROBERT BOSCH HAUSGERÄTE GMBH)	1,4,8	A47L15/00 D06F35/00
A	* the whole document *	2,3,5,7	
X	GB-A-2 179 683 (UNILEVER PLC)	1,4,8	
A	* the whole document *	2,3,5-7	
A	EP-A-0 346 212 (CIAPEM) * column 3, line 26 - line 35 *	1,8	
A	EP-A-0 501 240 (LICENTIA PATENT - VERWALTUNGS - GMBH) * column 1, line 49 - column 2, line 6 *	1	

TECHNICAL FIELDS SEARCHED (Int. Cl.5)
A47L D06F

The present search report has been drawn up for all claims

Place of search	Date of completion of the search	Examiner
THE HAGUE	24 MAY 1993	KELLNER M.

CATEGORY OF CITED DOCUMENTS

X : particularly relevant if taken alone
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E : earlier patent document, but published on, or after the filing date
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