

Cleaning program for a dishwasher having a shorter cycle with a consistent cleaning performance

The present invention relates to a method for cleaning items to be washed in a dishwasher, in particular a domestic dishwasher, with at least one predetermined sequence of a wash program, e.g. an intensive, low-temperature, automatic or standard program, with a specific mechanical and/or thermal soiling removal energy to achieve a specific cleaning and/or drying result, with which sub-program steps, e.g. pre-rinse, cleaning, intermediate rinse, final rinse and drying, are carried out, with the predetermined sequence of the wash program being configured so that the minimum quantity of water and energy is used.

The invention also relates to a dishwasher, in particular a domestic dishwasher, for implementing the method, comprising a wash compartment to hold items to be washed, a door to open and close the wash compartment, a circulating pump to apply washing water to the items to be washed, a heating unit to heat the washing water, a control facility to control at least one predetermined wash program sequence with a specific mechanical and/or thermal soiling removal energy to achieve a specific cleaning and/or drying result and means for selecting the at least one predetermined sequence of a wash program, e.g. an intensive, low-temperature, automatic or standard program.

Dishwashers today are designed to use a minimum quantity of energy and water. In the case of dishwashers with an upper basket and a lower basket, for this purpose the cleaning of the dishes in the upper basket is separated temporally from the cleaning of the dishes in the lower basket for example. To this end a water switch is used, which acts on either the upper or lower spray level in an alternating manner. The dishwasher is thus able to function with a smaller water reserve and less energy is required to heat this smaller quantity of water.

To reduce energy consumption further, the water temperature is kept at a low level. The water pressure is also reduced, so that the circulating pump, which generates the pressure, can operate more slowly and likewise uses less energy.

The cleaning performance of a dishwasher is primarily a function of the volume flow and temperature of the washing water, the nozzle pressure and the cycle. Therefore all the measures listed above have the effect that the selectable wash programs require more time in order to be able to achieve the same cleaning performance.

The drying performance of the dishwasher is a function of the volume flow of drying air, its temperature and the drying time. Here too energy-saving measures such as reducing the temperature impact on drying time.

Generally the longer operating time is not problematic for such economical dishwashers but there are situations where it is desirable to have the soiled dishes available again for use as quickly as possible. With the currently known rapid programs it is possible to reduce wash time but at the expense of the cleaning and drying result. These rapid programs can therefore only be used for dishes that are slightly soiled and not encrusted.

The object of the invention is therefore to control a modern and economical dishwasher so that it is possible to shorten the time required for the selected wash program in exceptional instances, without any deterioration in the cleaning or drying result.

The object is achieved according to the invention by a method with the features of claim 1 and a dishwasher with the features of claim 6.

In an inventive method for cleaning items to be washed in a dishwasher, in particular a domestic dishwasher, with at least one predetermined sequence of a wash program, e.g. an intensive, low-temperature, automatic or standard program, with a specific mechanical and/or thermal soiling removal energy to achieve a specific cleaning and/or drying result, with which sub-program steps, e.g. pre-rinse, cleaning, intermediate rinse, final rinse and drying, are carried out, with the predetermined sequence of the wash program being configured so that a minimum quantity of water and energy is used, with at least one additional predetermined sequence of a wash program, e.g. a rapid intensive, rapid low-temperature, rapid automatic or rapid standard program, with approximately identical mechanical and/or thermal soiling removal energy being provided to achieve the same or approximately the same specific cleaning and/or drying result, with which the wash program cycle is shortened. The mechanical soiling removal energy is the product of the volume flow (of the washing water during cleaning), nozzle pressure (of the washing water during cleaning) and cycle with respectively constant values for volume flow and nozzle pressure over the cycle. If these values are variable over the cycle, the integral should be formed. The thermal soiling removal energy is the integral of the temperature over the corresponding action time or cycle. Because of the necessary heating-up phase, the

temperature is subject to fluctuation, so that it is necessary to form an integral for precise determination of the thermal soiling removal energy.

In a further embodiment the water and/or preferably electrical energy consumption is increased.

The additional predetermined wash program sequence, wherein the water and/or energy consumption is increased, allows a user to program a dishwasher, which is economical with water and energy in normal circumstances, in an exceptional instance so that the length of the wash program is shortened and the dishes are available again for use more quickly with the same cleaning and/or drying performance. The already predetermined sequences can be fixed sequences but sequences can also be predetermined, in which the extent of soiling of the dishes is first determined and a program tailored to the determined soiling state is then automatically created (so-called automatic programs). According to the invention such programs can also be modified so that the program time is shorted whilst still maintaining the cleaning and/or drying result to be achieved.

In order to achieve such program shortening, it is possible to increase the speed of the circulating pump. This increases the water pressure and raises the nozzle pressure in the upper and lower spray levels. The mechanical soiling removal energy is increased as a result and the program time can be shortened. The mechanical soiling removal energy can be defined in terms of the product of volume flow, nozzle pressure and cycle.

According to the invention the water switch, which switches the volume flow with temporal allocation between the upper and lower baskets, so that the upper and lower baskets are supplied simultaneously, is provided as a further measure. The quantity of washing water required here for each sub-program step is higher. It is also possible to increase the speed of the circulating pump even further, as the circulating pump supplies the upper and lower baskets simultaneously.

The temperature is advantageously increased during at least one sub-program step, e.g. pre-rinse, cleaning, intermediate rinse, final rinse or drying. For the rinsing and cleaning steps the washing water pumped through must be heated to a higher temperature for this purpose. For the drying step the drying air is heated more or in the final rinse the temperature is increased, depending on which drying method is used. This measure is applied particularly advantageously to all cleaning and drying steps. This allows the time

required for completion of a program to be shortened considerably with the same cleaning and/or drying result still being achieved.

An inventive dishwasher, in particular a domestic dishwasher, for implementing a method comprises a wash compartment for holding items to be washed, a door to open and close the wash compartment, a circulating pump to apply washing water to the items to be washed, a heating unit to heat the washing water, a control facility to control at least one predetermined wash program sequence to achieve a specific cleaning and/or drying result and means for selecting the at least one predetermined wash program sequence with a specific mechanical and/or thermal soiling removal energy, e.g. an intensive, low-temperature, automatic or standard program, it being possible to execute at least one additional predetermined wash program sequence, e.g. a rapid intensive, rapid low-temperature, rapid automatic or rapid standard program, with approximately identical mechanical and/or thermal soiling removal energy to achieve the same or approximately the same specific cleaning and/or drying result with a shortened wash program cycle, preferably by increasing water and/or preferably electrical energy consumption.

An operating element, e.g. a button or knob, can preferably be used to execute and/or select as an additionally predetermined wash program sequence at least one predetermined wash program sequence, which can be selected by the means for selecting the at least one predetermined wash program sequence.

An operating element, e.g. a button, can preferably be used to select and/or execute an additional predetermined wash program sequence.

With most domestic dishwashers different wash programs are provided, which can be selected as a function of the degree of soiling or type of dish to be cleaned. In one exemplary embodiment of the invention the selection of the additional predetermined wash program impacts on all the other predetermined wash programs. This means that when the additionally predetermined wash program is selected, the length of the program is shortened for all the other wash programs. It is then possible to select the correct program for the type and degree of soiling of the dishes, with the length of the program however being shortened for the selected program.

Dishwashers generally have a row of knobs or a rotary knob as their operating element. In one exemplary embodiment of an inventive dishwasher the additional predetermined wash

program sequence is selected using the same operating element. This means that the shortened time is only assigned to one specific program and this time-saving program can be selected with a rotary knob for example in the same way as the other programs. In the case of the rotary knob an additional selectable program point is assigned to a specific position of the rotary knob for this purpose, while an additional knob is provided in the case of a row of knobs.

It is however particularly advantageous for a dishwasher if every one of the selectable programs can be completed in a shorter time. To this end a separate knob is provided, the actuation of which impacts on all possible settings both in the case of a dishwasher with a rotary knob and also in the case of an appliance with a row of knobs.

The dishwasher can preferably have a display element, e.g. a LED, which indicates the operation or input of the additional predetermined wash program sequence to achieve the same or approximately the same specific cleaning result.

Further details and advantages of the invention will emerge from the subclaims in conjunction with the description of an exemplary embodiment, which is described in detail with reference to the drawings, in which:

- Figure 1 shows the operating panel of an inventive dishwasher with a rotary knob and
Figure 2 shows the operating panel of an inventive dishwasher with a row of knobs.

The operating panel 1 shown in Figure 1 has a rotary knob 4. The individual wash programs are shown symbolically by the markings 2. To select the required program, the rotary knob 4 is set to the marking 2 for the corresponding program with the arrow shown.

The operating panel 1 also has a knob 3, which can be marked in a particularly striking manner. Activation of this knob 3 must be easy to identify visually. For example an LED (not shown) could start to glow or flash. It would also be possible for the knob 3 itself to glow or flash in the depressed position.

Pressing the knob 3 could impact in the same manner on all programs that can be selected with the rotary knob 4. Thus for example pressing the knob 3 in the rinse and cleaning steps could bring about a 10° C temperature increase. Also the speed of the circulating pump could be increased in all programs, so that it is possible to operate with higher nozzle

pressures in the individual spray levels. This would result in a shortening of the wash time in all programs, without the cleaning result deteriorating.

However pressing the knob 3 can impact differently on each program. Thus for example a low-temperature program, used for dishes with delicate decoration, can be modified so that only the water level in the machine is increased slightly and the water switch is switched so that the upper and lower baskets are no longer supplied with washing water in an alternating manner but simultaneously. This allows the program to be shortened, in return for only a small increase in water consumption. The delicate dishes are however not subjected to greater stress as a result.

The operating panel in Figure 2 is configured as a row of knobs 5. The selectable programs here are assigned to the knobs 6, which are identified symbolically here by letters A to E. The knob 7, shown with the letter P, must be characterized in its active position in the same way as the knob 3 in Figure 1. To highlight the special function of knob 7, it is configured larger than the other knobs.

The knob 7 can be assigned to a rapid program, with which the same cleaning and drying result is achieved as with the selection of a universal program, which is selected for example using the knob C. However with this rapid program the quantity of water required is increased and energy consumption rises.

It is possible here too for the knob marked P to be linked to in any manner to another program knob A to E and for its activation to have a very different impact on the various wash programs. Some examples are set out and explained below:

Example 1

Rapid program	Cleaning temperature	Final rinse temperature	Water switch	Circulating pump	Drying temperature
No	50°C	65°C	Alternating	Mid-range	65°C
Yes	50°C	65°C	Simultaneous	High range	65°C
Yes	50°C	65°C	Simultaneous	Mid-range	65°C

In this example – as with the low-temperature program described above – activating the rapid program only changes control of the water switch (the water switch activates either both spray arms simultaneously with water or the spray arms in an alternating manner; not

shown) so that the upper and lower baskets are no longer supplied with water in an alternating manner but simultaneously. In order to be able to generate the larger volume flow of washing water without reducing the nozzle pressure in the spray levels, the speed of the circulating pump and the water level in the appliance can also be increased. This increases water consumption slightly from approximately 14 to 15 liters for example and energy consumption slightly from approximately 1.05 to 1.44 kWh for example. The time required for completion of a wash program can thus be reduced from approximately 140 to approximately 70 mins with the same cleaning and drying performance.

Example 2

Rapid program	Cleaning temperature	Final rinse temperature	Water switch	Circulating pump	Drying temperature
No	50°C	65°C	Alternating	Mid-range	65°C
Yes	72°C	72°C	Alternating	Mid-range	72°C

In the example shown here activating the rapid program increases the temperature in all cleaning and rinsing steps. The drying temperature is also increased. The higher water temperature is achieved by more frequent heating phases. The measures shown increase energy consumption from approximately 1.05 to 1.44 kWh for example, while water consumption remains the same. The required program time is reduced to half from approximately 140 to approximately 70 mins.

Example 3

Rapid program	Cleaning temperature	Final rinse temperature	Water switch	Circulating pump	Drying temperature
No	50°C	65°C	Alternating	Mid-range	65°C
Yes	50°C	65°C	Alternating	High range	65°C

In this third example only the speed of the circulating pump and therefore the nozzle pressure in the spray levels is increased. This increases energy consumption only from approximately 1.05 to 1.44 for example, while water consumption remains the same. The time required is reduced from approximately 140 to approximately 110 mins.

Naturally the described measures can be combined with one another in any manner to save even more time. However energy and water consumption then rise accordingly.

Claims

1. A method for cleaning items to be washed in a dishwasher, in particular a domestic dishwasher, with at least one predetermined sequence of a wash program, e.g. an intensive, low-temperature, automatic or standard program, with a specific mechanical and/or thermal soiling removal energy to achieve a specific cleaning and/or drying result, with which sub-program steps, e.g. pre-rinse, cleaning, intermediate rinse, final rinse and drying, are carried out, with the predetermined sequence of the wash program being configured so that the minimum quantity of water and energy is used, characterized in that at least one additional predetermined sequence of a wash program, e.g. a rapid intensive, rapid low-temperature, rapid automatic or rapid standard program, with approximately identical mechanical and/or thermal soiling removal energy is provided to achieve the same or approximately the same specific cleaning and/or drying result, with which the wash program cycle is shortened.
2. The method as claimed in claim 1, characterized in that water and/or preferably electrical energy consumption is increased.
3. The method as claimed in claim 1 or 2, characterized in that with the additional predetermined wash program sequence the speed of a circulating pump for circulating the washing water is increased to increase the mechanical soiling removal energy acting on the items to be washed.
4. The method as claimed in one of the preceding claims, characterized in that with the additional predetermined wash program sequence an upper and lower basket of the dishwasher are subjected to washing water simultaneously, to increase the mechanical soiling removal energy acting on the items to be washed.
5. The method as claimed in one of the preceding claims, characterized in that with the additional predetermined wash program sequence the temperature is increased during at least one sub-program step, to increase the thermal soiling removal energy acting on the items to be washed and/or the drying performance.
6. The method as claimed in one of the preceding claims, characterized in that a number of different wash programs are predetermined and selecting the additionally predetermined wash program increases water and/or energy consumption for all

predetermined wash programs, simultaneously shortening the cycle.

7. A dishwasher, in particular a domestic dishwasher, for implementing a method as claimed in one or more of claims 1 to 5, having
 - a wash compartment to hold the items to be washed,
 - a door to open and close the wash compartment,
 - a circulating pump to apply washing water to the items to be washed,
 - a heating unit to heat the washing water,
 - a control facility to control at least one predetermined wash program sequence to achieve a specific cleaning and/or drying result and
 - means (4, 6) for selecting the at least one predetermined wash program sequence with a specific mechanical and/or thermal soiling removal energy, e.g. an intensive, low-temperature, automatic or standard program, characterized in that
at least one additional predetermined sequence of a wash program, e.g. a rapid intensive, rapid low-temperature, rapid automatic or rapid standard program, with approximately identical mechanical and/or thermal soiling removal energy can be executed to achieve the same or approximately the same specific cleaning and/or drying result, with a shortened wash program cycle.
8. The dishwasher as claimed in claim 7, characterized in that it is possible to execute an increase in water and/or preferably electrical energy consumption.
9. The dishwasher as claimed in claim 7, characterized in that it is possible to execute a higher water and/or preferably electrical energy consumption.
10. A dishwasher, in particular a domestic dishwasher as claimed in claim 7, 8 or 9, characterized in that an operating element (3, 7), e.g. a button or knob, can be used to execute and/or select as an additionally predetermined wash program sequence at least one predetermined wash program sequence, which can be selected by the means (4) for selecting the at least one predetermined wash program sequence.
11. The dishwasher as claimed in claim 7, characterized in that an operating element (7), e.g. a button, can be used to select and/or execute the at least one additional predetermined wash program sequence.

12. The dishwasher as claimed in one of claims 7 to 11, characterized in that a display element, e.g. an LED, is present, which indicates the operation or input of the additional predetermined wash program sequence to achieve the same or approximately the same specific cleaning result.