

COOKING APPLIANCE AND MULTI-STAGE COOKING METHOD USING SAME

FIELD OF TECHNOLOGY

[0001] The present invention relates to the field of kitchen appliances, in particular to a cooking appliance and a multi-stage cooking method implemented through the cooking appliance.

BACKGROUND

[0002] Cooking appliances are one of the important kitchen appliances. When a cooking appliance is used to cook ingredients, heat may be transferred to the ingredients inside a steamer basket through a surface of the steamer basket, but the efficiency of transferring heat through the surface of the steamer basket is affected by thermal conductivity of materials of the steamer basket, the surface area that is in contact with the steamer basket, the orientation in which the steamer basket is exposed to high-temperature steam, etc. Steamer baskets are usually made of stainless steel and other materials which generally have high thermal conductivity (e.g., reported thermal conductivity of about $17 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$). Since the transfer of heat may decrease gradually with a path of movement thereof, an inner pot of a rice cooker is disclosed in CN 101406359B where an outer layer with low thermal conductivity is additionally provided outside an inner layer with high thermal conductivity, thereby inhibiting heat release of the pot and storing heat inside the pot.

[0003] However, in typical ingredient steaming configurations, a bottom layer of the ingredients receive the most heat output during cooking because the bottom of the steamer basket is directly exposed to high-temperature steam by a large area, resulting in a top layer of the ingredients receiving much less heat than the bottom layer of the ingredients as a whole. As a result, in the typical steaming configurations, the temperatures of the cooked ingredients may show a large difference between vertical layers, which is further magnified when cooking a large number of ingredients. To this end, some steamer baskets are designed with voids at the top to allow high-temperature steam to enter and transfer heat to the ingredients, but the amount of high-temperature steam thus entering the steamer basket and subsequently coming into contact with the ingredients to release heat is limited, so the problem is not well addressed.

SUMMARY

[0004] The present disclosure is provided to present in simplified form some of the concepts that will be further described in the following specific implementations. The present disclosure is not intended to identify key features or essential features of the claimed subject matter, nor is it intended to be used to help determine the scope of the claimed subject matter.

[0005] One of the objectives of the present disclosure is to provide a cooking appliance and a multi-stage cooking method implemented through the cooking appliance. The heat transfer efficiency of the cooking appliance is changed by additionally providing, at a bottom of a steamer basket, a material with different thermal conductivity from a material of the steamer basket, so that more uniform heating for ingredients in the steamer basket in a vertical direction is achieved. On the other hand, by adopting the cooking appliance with more uniform heating and in conjunction with the multi-stage cooking method, the temperature of the ingredients is controlled to be within different temperature ranges at different periods of time for cooking, and more resistant starch (RS) may be obtained when rice is steamed.

[0006] According to one aspect of the present disclosure, a cooking appliance is provided. The cooking appliance includes an inner pot and a steamer basket removably disposed in the inner pot, and a bottom of the steamer basket has a closed bottom surface facing a heat source. The cooking appliance further includes a heat insulating layer disposed between a bottom of ingredients in the steamer basket and the heat source, and the heat insulating layer is made of a non-metallic material with thermal conductivity lower than that of the steamer basket. In this solution, by additionally providing the layer with low thermal conductivity between the steamer basket and the heat source, heating in a vertical direction of the steamer basket is more uniform.

[0007] In one embodiment of the present disclosure, the heat insulating layer is disposed on an outer side of the bottom surface of the steamer basket. In this solution, the structure is simple, and the heat insulating layer is additionally provided on the outer side of the bottom surface of an existing steamer basket, which is easy to manufacture and low in cost.

[0008] In another embodiment of the present disclosure, the heat insulating layer is disposed on an inner side of the bottom surface of the steamer basket, and the heat insulating layer is made of a food-grade material. In this solution, the structure is simple, and the heat insulating layer is additionally provided on the inner side of the bottom surface of an existing steamer basket, which is easy to

manufacture and low in cost.

[0009] In yet another embodiment of the present disclosure, a ratio of the thermal conductivity of the heat insulating layer to the thermal conductivity of the steamer basket is less than or equal to 20%. Under the relative relationship between the thermal conductivity of the heat insulating layer and the thermal conductivity of the steamer basket, a good uniform heating effect may be achieved.

[0010] In a further embodiment of the present disclosure, the non-metallic material is silica hydrogel. Silica hydrogel has low thermal conductivity and is a safe material that may be in contact with the ingredients, which may play a good role in reducing heat transfer at the bottom of the steamer basket.

[0011] In yet another embodiment of the present disclosure, one or more vent holes are provided in an upper portion of a side wall of the steamer basket to allow steam to enter the steamer basket from a top of the ingredients in the steamer basket. By additionally providing the vent holes in the upper portion of the steamer basket, high-temperature steam is allowed to enter the steamer basket via the vent holes, and heat is transferred to the ingredients, thereby increasing the temperature of a top layer of the ingredients and further reducing a temperature difference between the top layer and a bottom layer of the ingredients.

[0012] In yet another embodiment of the present disclosure, an upper edge of the steamer basket has a protrusion, and the protrusion matches an upper edge of the inner pot, such that the steamer basket is placed onto a side wall of the inner pot. By directly placing the steamer basket on the inner pot, the structure is simple, and therefore the steamer basket may be used without a holder.

[0013] In yet another embodiment of the present disclosure, the cooking appliance further includes a steamer basket holder, and the steamer basket holder is removably disposed in the inner pot, such that the steamer basket is placed on a placement surface of the steamer basket holder. By using the holder to place the steamer basket, the steamer basket is simple in shape and easy to manufacture.

[0014] In a further embodiment of the present disclosure, the heat insulating layer is disposed on a side, facing the steamer basket, of the placement surface of the steamer basket holder. In the case that the steamer basket holder is adopted, the heat insulating layer may be additionally provided in this way to reduce heating for the bottom layer of the ingredients.

[0015] In a further embodiment of the present disclosure, the heat insulating layer is disposed on a side, facing away from the steamer basket, of the placement surface of the steamer basket holder.

In the case that the steamer basket holder is adopted, the heat insulating layer may be additionally provided in this way to reduce heating for the bottom layer of the ingredients.

[0016] According to another aspect of the present disclosure, a multi-stage cooking method is provided. The multi-stage cooking method is implemented by means of the cooking appliance described in the present disclosure, and includes: in a first stage, heating water at a bottom of an inner pot to generate steam to heat ingredients in a steamer basket, so as to make a temperature of the ingredients rise and be maintained within a first preset temperature range; and in a second stage, heating, with the steam, the ingredients in the steamer basket to make the temperature of the ingredients rise and be maintained within a second preset temperature range, the second preset temperature range being higher than the first preset temperature range. A heat-moisture treatment (HMT) stage is omitted, which saves the cooking time. Moreover, good temperature control may be achieved by applying the cooking appliance described in the present disclosure to the multi-stage cooking method.

[0017] In one embodiment of the present disclosure, the first stage lasts for 20-45 minutes and the first preset temperature range is 60°C-70°C. With the duration and the temperature range, the temperature of the ingredients may rise and be maintained at a desired annealing temperature in this stage, to achieve annealing treatment of the ingredients, which is conducive to generation of resistant starch.

[0018] In another embodiment of the present disclosure, the second stage lasts for 10-20 minutes and the second preset temperature range is 85°C-95°C. With the duration and the temperature range, the temperature of the ingredients may rise and be maintained at a desired cooking temperature in this stage, which is conducive to generation of resistant starch.

[0019] In yet another embodiment of the present disclosure, heating the ingredients in the steamer basket at first power in the first stage to make the temperature of the ingredients rise and be maintained within the first preset temperature range further includes: heating the ingredients in the steamer basket at the first power; in response to the temperature of the ingredients reaching a lower limit value of the first preset temperature range, stopping heating for a first duration; continuing to heat the ingredients at the first power; and in response to the temperature of the ingredients reaching a median value of the first preset temperature range, stopping heating until the end of the first stage. During heating, the temperature of the steam in the pot changes rapidly, and is usually difficult to control accurately. With this solution, the temperature in the pot may be controlled within the desired

temperature range only through specific power output and time.

[0020] In a further embodiment of the present disclosure, heating the ingredients in the steamer basket at second power in the second stage to make the temperature of the ingredients rise and be maintained within the second preset temperature range, the second power being greater than the first power, further includes: heating the ingredients in the steamer basket at the second power; and in response to the temperature of the ingredients reaching a median value of the second preset temperature range, heating the ingredients at the second power and at a non-full duty cycle to maintain the temperature of the ingredients to be within the second preset temperature range. In this solution, after the temperature in the pot rises to the desired temperature range, temperature control is achieved easily by controlling the duty cycle of power output.

[0021] These and other features and advantages will become apparent by reading the following detailed description and referring to the associated accompanying drawings. It should be understood that the preceding general description and the following detailed description are illustrative only and do not limit the aspects for which protection is claimed.

BRIEF DESCRIPTION OF THE DRAWINGS

[0022] In order to understand in detail the manner in which the above features of the present disclosure are used, the above briefly outlined content may be described in more detail with reference to embodiments, some of which are shown in the accompanying drawings. It should be noted, however, that the accompanying drawings only show some typical aspects of the present disclosure and should not be considered as limiting the scope thereof, as the description may allow for other equally valid aspects.

[0023] FIG. 1 illustrates a schematic diagram of a cooking appliance according to an embodiment of the present invention.

[0024] FIG. 2a illustrates a schematic diagram of a steamer basket according to an embodiment of the present invention.

[0025] FIG. 2b illustrates a schematic diagram of a steamer basket according to another embodiment of the present invention.

[0026] FIG. 3 illustrates a schematic diagram of a cooking appliance according to another embodiment of the present invention.

[0027] FIG. 4 illustrates a schematic diagram of a cooking appliance according to yet another embodiment of the present invention.

[0028] FIG. 5 illustrates a partial enlarged view of the cooking appliance shown in FIG. 4 according to the present invention.

[0029] FIG. 6 is a flowchart of a multi-stage cooking method implemented through a cooking appliance described in the present disclosure according to an embodiment of the present invention.

[0030] FIG. 7 illustrates a variation curve of temperature of ingredients versus time according to an embodiment of the present invention.

[0031] FIG. 8a illustrates a hardness measurement result according to an embodiment of the present invention.

[0032] FIG. 8b illustrates an RS measurement result according to an embodiment of the present invention.

[0033] FIG. 9 illustrates a schematic diagram of a steamer basket according to an embodiment of the present invention.

[0034] Description of reference numerals:

[0035] 102. Steamer basket; 104. Inner pot; 106. Steamer basket holder; 108. Heat insulating layer; 110. Vent hole; 112. Fixing member; 114. Protrusion; 116. Upper edge; 118. Buckle;

[0036] 1002. Closed bottom surface; and 1004. Placement surface.

DESCRIPTION OF THE EMBODIMENTS

[0037] Embodiments of the present disclosure will be described in more detail below with reference to the accompanying drawings. While some embodiments of the present disclosure are shown in the accompanying drawings, it is to be understood, however, that the present disclosure may be implemented in various forms and should not be construed as being limited to the embodiments set forth herein; rather, these embodiments are provided for a more thorough and complete understanding of the present disclosure. It is to be understood that the accompanying drawings and embodiments of the present disclosure are merely for exemplary purposes and are not intended to limit the scope of protection of the present disclosure.

[0038] In the description of the present disclosure, it is to be noted that, unless otherwise indicated, "a plurality of" means two or more; and the terms "top", "bottom", "left", "right", "inner",

"outer", etc., indicate an orientation or positional relationship only for the purpose of facilitating the description of the present disclosure and to simplify the description, and are not intended to indicate or imply that the device or element referred to must be of a particular orientation, be constructed and operated with a particular orientation, and therefore are not to be construed as limitations of the present disclosure. In addition, the terms "first", "second", "third", etc. are used for descriptive purposes only and are not to be construed as indicating or implying relative importance. "Perpendicular" is not strictly perpendicular, but within the error allowed. "Parallel" is not strictly parallel, but within the error allowed.

[0039] Orientation words appearing in the following description are orientations shown in the drawings and are not intended to limit the specific structure of the present disclosure. In the description of the present disclosure, it is also to be noted that, unless otherwise expressly specified and limited, the terms "mounted", "connected" and "connecting" are to be understood in a broad sense, for example, it may be a fixed connection, or a removable connection, or an integral connection; or it may be a direct connection or an indirect connection through an intermediate medium. For those of ordinary skill in the art, the specific meaning of the above terms in the present disclosure may be understood depending on the particular circumstances.

[0040] Reference herein to "embodiment" means that a particular feature, structure, or characteristic described in connection with the embodiment may be included in at least one embodiment of the present disclosure. The phrase at various locations in the description does not necessarily refer to the same embodiment, or an independent or alternative embodiment mutually exclusive of another embodiment. It is to be expressly and implicitly understood by a person of ordinary skill in the art that the embodiments described herein may be combined with other embodiments.

[0041] In the description of the embodiments of the present disclosure, the term "and/or" is merely an association relationship describing associated objects, meaning that there may be three relationships, for example, A and/or B may indicate: there are three cases of A alone, A and B together, and B alone. In addition, the character "/", as used herein, generally indicates that the associated objects are of an "or" relationship.

[0042] FIG. 1 illustrates a schematic diagram of a cooking appliance according to an embodiment of the present invention. The cooking appliance includes an inner pot 104 and a steamer basket 102 removably disposed in the inner pot 104. A bottom of the steamer basket 102 has a closed bottom surface 1002 facing a heat source (not shown). When cooking is required, water may be placed

in the inner pot 104 and ingredients may be placed in the steamer basket 102. During cooking, the water in the inner pot 104 is heated to form high-temperature steam, to transfer heat to the closed bottom surface 1002 at the bottom of the steamer basket 102, thereby cooking the ingredients in the steamer basket 102. In order to achieve more uniform heating for the ingredients in the steamer basket 102 in the vertical direction, the cooking appliance may further include a heat insulating layer disposed between a bottom of the ingredients in the steamer basket 102 and the heat source. The heat insulating layer may be made of a non-metallic material with thermal conductivity lower than that of the steamer basket 102.

[0043] As a non-restrictive embodiment, a ratio of the thermal conductivity of the heat insulating layer to the thermal conductivity of the steamer basket 102 may be less than or equal to 20%. The experimental results show that when the ratio of the thermal conductivity of the additionally provided heat insulating layer to the thermal conductivity of the steamer basket 102 is less than or equal to 20%, the cooking appliance may better adjust a temperature difference between a top layer and a bottom layer of the ingredients during cooking, so that the ingredients are heated uniformly in the vertical direction.

[0044] Further, in order to reduce heat output of the steam to the bottom of the steamer basket 102, silica hydrogel may be additionally provided at the bottom of the steamer basket 102 to act as a heat insulating material between the bottom of the ingredients and the heat source. Silica hydrogel is chosen because of low thermal conductivity (e.g., $0.175 \text{ W} \cdot \text{m}^{-1} \cdot \text{K}^{-1}$) and common use as a food contact material thereof. However, it may be appreciated that other materials may be used to achieve similar results.

[0045] Moreover, as a non-restrictive embodiment, one or more vent holes 110 may be further provided in an upper portion of a side wall of the steamer basket 102 to allow steam to enter the steamer basket 102 from a top of the ingredients in the steamer basket 102. In this way, in the process of cooking, the high-temperature steam, in addition to directly heating the bottom of the steamer basket 102, may also enter the steamer basket 102 via the vent holes 110 and transfer heat to the ingredients, thereby increasing the temperature of the top layer of the ingredients in the steamer basket 102 and further reducing the temperature difference between the top layer and the bottom layer of the ingredients.

[0046] As another non-restrictive embodiment, a protrusion 114 may also be provided at an upper edge of the steamer basket 102, and the protrusion 114 matches an upper edge 116 of the inner

pot, such that the steamer basket 102 is placed onto a side wall of the inner pot 104. It may be appreciated that the steamer basket 102 may be placed in the inner pot 104 in other ways.

[0047] Further, it is also possible, for example, to provide one or more fixing members 112 on the side wall of the steamer basket 102, so that the steamer basket 102 may be better fixed in the inner pot 104, which facilitates positioning of the steamer basket 102 in the inner pot 104.

[0048] For the cooking appliance shown in FIG. 1, a non-restrictive way of providing the heat insulating layer is to provide the heat insulating layer 108 on an outer side of the bottom surface 1002 of the steamer basket 102, as shown in FIG. 2a. FIG. 2b illustrates another non-restrictive way of providing the heat insulating layer, i.e., providing the heat insulating layer 108 on an inner side of the bottom surface 1002 of the steamer basket 102, and the heat insulating layer 108 may be made of a food-grade material. By adopting the food-grade material as the heat insulating layer 108, the heat insulating layer may be in direct contact with the ingredients, for example, silica hydrogel may be adopted as the heat insulating layer. The above two ways of providing the heat insulating layer may be achieved by improvement on the basis of an existing steamer basket, so that the structure is simple, the cost is low, and a good effect of lowering the temperature at the bottom of the ingredients may be achieved. Of course, it may be appreciated that the heat insulating layer may also be additionally provided in the middle of the bottom material of the steamer basket, i.e., as long as the heat insulating layer is provided between the bottom of the ingredients in the steamer basket and the heat source, the heat insulating layer may contribute to the uniform heating of the ingredients.

[0049] FIG. 3 illustrates a schematic diagram of a cooking appliance according to another embodiment of the present invention. Unlike FIG. 1 where the steamer basket 102 is placed in the inner pot 104 by providing the protrusion 114 at the upper edge of the steamer basket 102, the cooking appliance shown in FIG. 3 further includes a steamer basket holder 106. The steamer basket holder 106 is removably disposed in the inner pot 104, such that the steamer basket 102 is placed on a placement surface 1004 of the steamer basket holder. However, it may be appreciated that the steamer basket 102 may be placed in the inner pot 104 by combining the protrusion 114 with the steamer basket holder 106 or in other ways.

[0050] As a non-restrictive embodiment, as shown in FIG. 4 and FIG. 5, one or more buckles 118 may be provided at an outer edge of the placement surface 1004 of the steamer basket holder 106 to better fix the steamer basket 102 to the steamer basket holder 106.

[0051] For the cooking appliance shown in FIG. 3, in addition to providing the heat insulating layer 108 on the outer side, middle, or inner side of the bottom surface 1002 of the steamer basket 102, the heat insulating layer 108 may also be provided on the steamer basket holder 106. For example, as shown in FIG. 4 and FIG. 5, the heat insulating layer 108 may be provided on a side, facing the steamer basket 102, of the placement surface (i.e., 1004 in FIG. 3) of the steamer basket holder 106, and/or the heat insulating layer 108 may be provided on a side, facing away from the steamer basket 102, of the placement surface (i.e., 1004 in FIG. 3) of the steamer basket holder 106.

[0052] It may be appreciated that the heat insulating layer 108 may be provided in at least one of the following positions: the outer side, middle or inner side of the bottom surface 1002 of the steamer basket 102, and/or the side, facing or facing away from the steamer basket 102, of the placement surface 1004 of the steamer basket holder 106. That is, as long as the heat insulating layer 108 is provided between the bottom of the ingredients in the steamer basket 102 and the heat source, the heat insulating layer may contribute to the uniform heating of the ingredients.

[0053] FIG. 6 is a flowchart of a multi-stage cooking method implemented through a cooking appliance described in the present disclosure according to an embodiment of the present invention. As shown in FIG. 6, the method 600 begins with step 602 where in a first stage, water at a bottom of an inner pot 104 may be heated to generate steam to heat ingredients in a steamer basket 102, so as to make a temperature of the ingredients rise and be maintained within a first preset temperature range.

[0054] As a non-restrictive embodiment, the first stage may be set to last for 20-45 minutes, and the first preset temperature range may be set to be 60°C-70°C. The experimental studies have shown that a better cooking effect may be obtained by setting the first stage to last for 20-45 minutes and the first preset temperature range to be 60°C-70°C.

[0055] As a further non-restrictive embodiment, the first stage may specifically include the following steps: the ingredients in the steamer basket 102 are heated at first power, for example, 1000 W; in response to the temperature of the ingredients reaching a lower limit value of the first preset temperature range, heating is stopped for a first duration; the ingredients then continue to be heated at the first power; and in response to the temperature of the ingredients reaching a median value of the first preset temperature range, heating is stopped until the end of the first stage.

[0056] In step 604, in a second stage, the ingredients in the steamer basket 102 may be heated with the steam to make the temperature of the ingredients rise and be maintained within a second preset

temperature range, the second preset temperature range being higher than the first preset temperature range.

[0057] As a non-restrictive embodiment, the second stage may be set to last for 10-20 minutes, and the second preset temperature range may be set to be 85°C-95°C. The experimental studies have shown that a better cooking effect may be obtained by setting the second stage to last for 10-20 minutes and the second preset temperature range to be 85°C-95°C.

[0058] As a further non-restrictive embodiment, the second stage may specifically include the following steps: the ingredients in the steamer basket 102 are heated at second power which is greater than the first power, for example, 1200 W; and in response to the temperature of the ingredients reaching a median value of the second preset temperature range, the ingredients are heated at the second power and at a non-full duty cycle to maintain the temperature of the ingredients to be within the second preset temperature range.

[0059] FIG. 7 illustrates a variation curve of temperature of ingredients versus time according to an embodiment of the present invention. It may be appreciated that the variation curve shown in FIG. 7 corresponds to the simplified multi-stage cooking method shown in FIG. 6. In FIG. 7, the first stage may be referred to, for example, as an annealing (ANN) stage, and the second stage may be referred to, for example, as a cooking stage.

[0060] In the first stage, the first preset temperature range in FIG. 6 is simplified to a target temperature T1, i.e., the ingredients are steam-treated under preset conditions (the temperature of the ingredients is controlled to be in the vicinity of T1, and the time of the first stage is controlled to be t_0 - t_1).

[0061] In the second stage, the second preset temperature range in FIG. 6 is simplified to a target temperature T2, i.e., the steam treatment process is adjusted based on preset conditions (the temperature of the ingredients is controlled to be in the vicinity of T2, and the time of the second stage is controlled to be t_1 - t_2).

[0062] As a non-restrictive embodiment, rice may be cooked by the multi-stage cooking method according to the present disclosure. It should be noted, however, that the example of rice as an ingredient is merely for descriptive purposes, and it will be appreciated by those skilled in the art that the embodiments and points of improvement of the present disclosure do not apply only to rice, but may be applied to any ingredient that may be placed in the inner pot for cooking.

[0063] The multi-stage cooking method omits heat-moisture treatment (HMT). Before being cooked, rice is cleaned and thoroughly drained and is then placed into the steamer basket 102. Next, a predetermined amount of water (for example, the amount of water required is predetermined by fixing a weight ratio of water to rice at 1:1) is added to the rice in the steamer basket 102. The steaming process may include two stages: (1) a 30-minute ANN stage at a first temperature range (e.g., 60°C-70°C); and (2) a 10-20-minute cooking stage. Specifically, for example, exemplary settings of a combination of the 30-minute ANN stage and a 10-minute cooking stage are as follows:

[0064] State 0: Start timing of the ANN stage, and heat at 1000-W full power and full duty cycle until the temperature at the bottom of the ingredients reaches 60°C. □

[0065] State 1: Continue timing of the ANN stage, and stop heating for 2 minutes and 20 seconds.

[0066] State 2: Continue timing of the ANN stage, and heat at 1000-W full power and full duty cycle until the temperature at the bottom of the ingredients reaches 65°C.

[0067] State 3: Continue timing of the ANN stage, stop heating, and when the total time (i.e., from State 0 to State 3) of the ANN stage reaches 30 minutes, jump to the next stage (e.g., the cooking stage).

[0068] State 4: Start the cooking stage, and heat at 1200-W full power and full duty cycle for 2 minutes.

[0069] State 5: Continue the cooking stage, turn on for 7 seconds at power of 1200 W and turn off for 3 seconds (i.e., heating at a non-full duty cycle), and end after maintaining for 8 minutes.

[0070] State 6: End cooking and proceed to keeping warm.

[0071] It may be appreciated that in the above settings, the time of State 5 may be extended for a longer cooking stage.

[0072] In the case of using the steamer basket described in the present disclosure, a temperature change of each layer of the ingredients in the steamer basket corresponding to the above-described settings is shown in Table 1. It may be seen that the temperatures of the top layer, a middle layer and the bottom layer of the ingredients after the ANN stage are relatively close to each other, that is, by implementing the multi-stage cooking method through the cooking appliance of the present disclosure, the temperatures of the ingredients may be relatively uniform in the vertical direction.

	Top layer	Middle layer	Bottom layer
Initial temperature	15.9 °C	15.9 °C	15.9 °C
Temperature after ANN for 30 minutes	61.1 °C	58.5 °C	62.4 °C

Table 1

[0073] On the contrary, when cooking with an original steamer basket with no heat insulating layer, the degree of cooking of rice may decrease from the bottom layer to the top layer due to a large difference in heat output at different positions of the steamer basket. The difference may be reflected in hardness measurement as shown in FIG. 8a. For example, cooked rice was subjected to texture and contour analysis through a TA-XT plus texture analyzer (Stable Micro Systems, UK) equipped with a 25-mm flat compression probe (SMSP/25P). The results of the analysis were as follows: rice sampled at the bottom layer showed a hardness of 716.475 g*force, while rice sampled at the top layer showed a hardness of 1241.34 g*force, which indicates that there is a 42.28% difference in hardness between rice at the bottom layer and rice at the top layer.

[0074] In addition, as shown in FIG. 8b, the difference between the top layer and the bottom layer of the rice after cooking may also be reflected in measurement of resistant starch (RS). For example, when the rice was sampled from the surface layer only, the reported RS level was 1.1% of the total starch. However, when the rice was re-sampled after been fully blended, the value dropped to 0.78%, which indicates a difference in cooking performance between the vertical layers.

[0075] As a non-restrictive embodiment, to further reduce heat transfer at the bottom of the steamer basket, a plurality of heat insulating layers 108 (e.g., multilayer silica hydrogel) may be additionally provided at the bottom of the steamer basket 102 to act as a heat insulating material between the steamer basket material (e.g., stainless steel) and the ingredients (e.g., rice), as shown in FIG. 9. It can be appreciated that a plurality of heat insulating layers may also be additionally provided on an inner side and/or an outer side of the bottom of the steamer basket 102, or on an upper layer and a lower layer of a placement surface of a steamer basket holder (if any).

[0076] The multi-stage cooking method was performed using the cooking appliance shown in FIG. 9, and then the hardnesses of the cooked rice sampled from the bottom layer and the top layer of

the steamer basket 102 were evaluated respectively to indicate the heat uniformity of the ingredients in the vertical direction, with specific comparative values shown in Table 2.

Cooking condition(s)	Hardness of top layer (g*force)	Hardness of bottom layer (g*force)	Difference in hardness
Steamer basket with no heat insulating layer	1241.34	716.473	42.28%
Steamer basket with one heat insulating layer	1143.019	810.591	29.08%
Steamer basket with four heat insulating layers	1066.332	945.309	11.35%

Table 2

[0077] The experiments show that when the rice was cooked in the steamer basket 102 with the heat insulating layer, the difference in hardness between the rice sampled in the top layer and the bottom layer was greatly reduced, indicating that the heat uniformity of the vertical layers is improved. Further, the difference in hardness between the top layer and the bottom layer of rice was further reduced from 29.08% to 11.35% when four layers of silica hydrogel were added as compared to the addition of a single layer of silica hydrogel, indicating that the thickness of the heat insulating layer further affects the heat uniformity of the rice. With the improved heat uniformity, the RS performance after using the multi-stage cooking method is further improved, and the RS value of cooked rice increases from 0.78% (using a steamer basket with no heat insulating layer) to 1.14% (using a steamer basket with a heat insulating layer).

[0078] It can be appreciated that the cooking appliances disclosed herein may be applied to rice cookers, pressure cookers, multi-functional cookers, etc., and that in combination with the multi-stage cooking method disclosed herein, the heat uniformity of the ingredients in the cooking appliance may be improved and the resistant starch (RS) content of the ingredients may be increased.

[0079] What has been described above includes examples of various aspects of the claimed subject matter. It is, of course, impossible to describe every conceivable combination of components or methods for the purpose of depicting the claimed subject matter, but a person of ordinary skill in the art

should recognize that many further combinations and arrangements of the claimed subject matter are possible. Therefore, the disclosed subject matter is intended to cover all such alterations, modifications and variations that fall within the spirit and scope of the appended claims.

CLAIMS

1. A cooking appliance, comprising an inner pot (104) and a steamer basket (102) removably disposed in the inner pot (104), a bottom of the steamer basket (102) having a closed bottom surface (1002) facing a heat source, characterized in that the cooking appliance further comprises a heat insulating layer (108) disposed between a bottom of ingredients in the steamer basket (102) and the heat source, and the heat insulating layer (108) is made of a non-metallic material with thermal conductivity lower than that of the steamer basket (102).

2. The cooking appliance according to claim 1, characterized in that the heat insulating layer (108) is disposed on an outer side of the bottom surface of the steamer basket (102).

3. The cooking appliance according to claim 1, characterized in that the heat insulating layer (108) is disposed on an inner side of the bottom surface of the steamer basket (102), and the heat insulating layer (108) is made of a food-grade material.

4. The cooking appliance according to claim 1, characterized in that a ratio of the thermal conductivity of the heat insulating layer (108) to the thermal conductivity of the steamer basket (102) is less than or equal to 20%.

5. The cooking appliance according to claim 4, characterized in that the non-metallic material is silica hydrogel.

6. The cooking appliance according to claim 1, characterized in that one or more vent holes (110) are provided in an upper portion of a side wall of the steamer basket (102) to allow steam to enter the steamer basket (102) from a top of the ingredients in the steamer basket (102).

7. The cooking appliance according to claims 1 to 6, characterized in that an upper edge of the steamer basket (102) has a protrusion (114), and the protrusion (114) matches an upper edge (116) of the inner pot (104), such that the steamer basket (102) is placed onto a side wall of the inner pot (104).

8. The cooking appliance according to claims 1 to 6, characterized in that the cooking appliance further comprises a steamer basket holder (106), and the steamer basket holder (106) is removably disposed in the inner pot (104), such that the steamer basket (102) is placed on a placement surface (1004) of the steamer basket holder.

9. The cooking appliance according to claim 8, characterized in that the heat insulating layer (108) is disposed on a side, facing the steamer basket (102), of the placement surface (1004) of the steamer basket holder (106).

10. The cooking appliance according to claim 8, characterized in that the heat insulating layer (108) is disposed on a side, facing away from the steamer basket (102), of the placement surface (1004) of the steamer basket holder (106).

11. A multi-stage cooking method, characterized in that the multi-stage cooking method is implemented by means of the cooking appliance according to any one of claims 1 to 10, and comprises:

in a first stage, heating water at a bottom of an inner pot (104) to generate steam to heat ingredients in a steamer basket (102), so as to make a temperature of the ingredients rise and be maintained within a first preset temperature range; and

in a second stage, heating, with the steam, the ingredients in the steamer basket (102) to make the temperature of the ingredients rise and be maintained within a second preset temperature range, the second preset temperature range being higher than the first preset temperature range.

12. The multi-stage cooking method according to claim 11, characterized in that the first stage lasts for 20-45 minutes and the first preset temperature range is 60°C-70°C.

13. The multi-stage cooking method according to claim 11, characterized in that the second stage lasts for 10-20 minutes and the second preset temperature range is 85°C-95°C.

14. The multi-stage cooking method according to claim 11, characterized in that heating the

ingredients in the steamer basket (102) at first power in the first stage to make the temperature of the ingredients rise and be maintained within the first preset temperature range further comprises:

heating the ingredients in the steamer basket (102) at the first power;

in response to the temperature of the ingredients reaching a lower limit value of the first preset temperature range, stopping heating for a first duration;

continuing to heat the ingredients at the first power; and

in response to the temperature of the ingredients reaching a median value of the first preset temperature range, stopping heating until the end of the first stage.

15. The multi-stage cooking method according to claim 14, characterized in that heating the ingredients in the steamer basket (102) at second power in the second stage to make the temperature of the ingredients rise and be maintained within the second preset temperature range, the second power being greater than the first power, further comprises:

heating the ingredients in the steamer basket (102) at the second power; and

in response to the temperature of the ingredients reaching a median value of the second preset temperature range, heating the ingredients at the second power and at a non-full duty cycle to maintain the temperature of the ingredients to be within the second preset temperature range.