

SEMI-AUTOMATIC PROCESSING SYSTEM AND METHOD FOR PREPROCESSING A DUCK CARCASS BEFORE ROASTING

FIELD OF THE INVENTION

5 The present invention relates to the technical field of automatic apparatus for preparing roast duck, and more specifically, to a semi-automatic processing system and method for preprocessing a duck carcass before roasting.

BACKGROUND OF THE INVENTION

10 Roast duck is a classic dish famous in the whole world for its shiny golden brown color, delicate texture, crisp skin, delicious flavor, and non-greasy taste. As people's living standard rises, there is a growing demand for roast duck.

15 However, preprocessing of duck carcasses before roasting includes operations such as removal of visceral residue, addition of mixed spices, stitching, spraying, and sauce-spraying on a duck carcass, followed by a few hours of air-drying at ambient temperature. The operations are traditionally performed manually, which is time-consuming and incurs a lot of labors and costs.

SUMMARY OF THE INVENTION

20 To resolve the foregoing problems so as to realize the systemization and automation of the preprocessing procedures of roast duck and to improve the production efficiency and quality, the present invention provides a semi-automatic processing system and method for preprocessing duck carcasses before roasting. The technical solution adopted in the present invention to resolve the problem is as follows:

 The present invention provides a semi-automatic processing system for preprocessing duck carcasses before roasting, the system includes:

25 a first processing unit, configured to perform the following processing on the duck carcass therein: removing visceral residue from the duck carcass, injecting mixed spices and/or tenderizer into duck muscle from inside the duck carcass and stitch-closing the cavity of the duck carcass;

 a first spray unit, configured to spray hot water on the duck carcass for cleaning;

 a first air-drying unit, configured to perform primary air drying on the duck carcass;

 a second spray unit, configured to spray sauce on the duck carcass;

30 a second air-drying unit, configured to perform secondary air drying on the duck carcass; and

a conveying mechanism, configured to convey the duck carcass,

wherein the first processing unit, the first spray unit, the first air-drying unit, the second spray unit, and the second air-drying unit are sequentially arranged along the conveying mechanism, and the conveying mechanism is configured to sequentially convey the duck carcass from the first processing unit to the first spray unit, the first air-drying unit, the second spray unit, and the second air-drying unit, to perform the corresponding processing.

Preferably, the system further comprises a second processing unit located between the first processing unit and the first spray unit in the conveying direction of the duck carcass, the second processing unit comprises an air pump configured to inflate the duck carcass so as to allow the air to fill the entire duck carcass by pushing the air to enter between the skin and muscle through a cut on the neck of the duck carcass.

Preferably, the first processing unit is provided with a cutting device which comprises a cylindrical cutting head, a conduit, and a vacuum cleaner, the cutting head is connected to the vacuum cleaner through the conduit, and a V-shaped notch is arranged on the cutting head to remove the visceral residue.

Preferably, convex scrapers are arranged on the cutting head to further scrape off the visceral residue.

Preferably, a lighting device is further arranged on the cutting device.

Preferably, a hot-water sprayer is arranged on the cutting device to rinse off the visceral residue.

Preferably, the first processing unit further comprises an injection machine configured to inject mixed spices and/or tenderizer into the muscle from inside the duck carcass.

Preferably, the first spray unit and the second spray unit respectively comprises: a spray nozzle, a pipe, a solenoid valve, a water pump, and an liquid tank, the liquid tank is connected to the spray nozzle through the pipe, and liquid in the liquid tank is controlled by the solenoid valve to be pumped to the spray nozzle by the water pump to spray on the duck carcass.

Preferably, the liquid tank is provided with a heating device, a liquid inlet, and a liquid outlet, and the liquid can be maintained at a preset temperature and automatically filled under the control of a control system.

Preferably, the second air-drying unit is configured to perform secondary air drying on the duck carcass between 20 ° C and 80 ° C.

Preferably, the conveying mechanism is a chain conveying mechanism, comprising a conveying

chain, a transmission chain wheel, and a hanging device arranged on the conveying chain, the hanging device is provided with hanging holes on at least one side thereof for hanging the duck carcass, and the transmission chain wheel is driven by a variable-speed motor to drive the conveying chain to convey the duck carcass.

5 Preferably, the conveying mechanism is a turntable conveying mechanism.

The present invention further provides a semi-automatic processing method for preprocessing a duck carcass before roasting, wherein the method comprises:

10 A. removing visceral residue from the duck carcass, injecting mixed spices and/or tenderizer into the muscle from inside the duck carcass and stitch-closing the cavity of the duck carcass, by using a first processing unit;

 B. spraying hot water on the duck carcass for cleaning by using the first spray unit;

 C. performing primary air drying on the duck carcass by using the first air-drying unit;

 D. spraying sauce on the duck carcass by using the second spray unit;

 E. performing secondary air drying on the duck carcass by using the second air-drying unit; and

15 F. sequentially conveying the duck carcass from the first processing unit to the first spray unit, the first air-drying unit, the second spray unit, and the second air-drying unit by using the conveying mechanism, to perform the corresponding processing.

20 Preferably, the method further comprises: after performing Step A, inflating the duck carcass by an air pump so as to allow the air to fill the entire duck carcass by pushing the air to enter between the skin and the muscle through a cut on the neck of the duck carcass.

 Preferably, Step E comprises: performing secondary air drying on the duck carcass between 20 ° C and 80 ° C.

 The beneficial effects of the present invention are:

25 1. By providing the semi-automatic processing system for preprocessing a duck carcass before roasting, the integration and semi-automation of the preprocessing procedures of roast duck are realized, thereby improving the production efficiency.

 2. By providing the unique cutting and rinsing devices, not only the efficiency of removing visceral residue can be improved, but also the visceral residue can be sucked out in time, thereby greatly reducing the visceral residue rate and effectively improving the product hygiene quality.

30 3. The automatic spraying of hot water and malt-vinegar solution is realized without manual operation, thereby greatly overcoming the problems of low efficiency, the uneven spraying caused by

traditional manual operations, and workers can stay away from the hot, damp and hazardous working environment.

4. Instead of the traditional method of manually filling the cavity of the duck carcass with mixed spices, these and/or tenderizer can be injected into the muscle from inside the duck carcass to improve the efficiency and the meat quality.

BRIEF DESCRIPTION OF THE DRAWINGS

The present invention is further described below with reference to the accompanying drawings and embodiments. It should be understood that the accompanying drawings are schematic but are not drawn to scale, wherein:

FIG. 1 is a schematic diagram of an embodiment of a semi-automatic processing system for preprocessing duck carcasses before roasting according to the present invention;

FIG. 2 shows an embodiment of a conveying mechanism according to the present invention;

FIG. 3 is a schematic diagram taken along A-A in FIG. 1, wherein FIG. 3a to FIG. 3c show different ways of hanging duck carcasses on a hanging device of a conveying mechanism;

FIG. 4 shows another embodiment of the conveying mechanism according to the present invention;

FIG. 5 shows an embodiment of a cutting device according to the present invention;

FIG. 6 is a front view of an embodiment of a cutting head according to the present invention;

FIG. 7 is a side view of an embodiment of the cutting head according to the present invention;

FIG. 8 shows an embodiment of a brine injection machine according to the present invention;

FIG. 9 shows an embodiment of a tail needle according to the present invention;

FIG. 10 shows an embodiment of a first spray unit and a second spray unit according to the present invention;

FIG. 11 shows an embodiment of a first air-drying unit and a second air-drying unit according to the present invention;

FIG. 12 is a schematic diagram of another embodiment of a semi-automatic processing system for preprocessing duck carcasses before roasting according to the present invention;

FIG. 13 shows an embodiment of an air pump according to the present invention.

DETAILED DESCRIPTION OF THE EMBODIMENTS

The concept, specific structures, and technical effects of the present invention will be described clearly and thoroughly below with reference to the embodiments and the accompanying drawings for thorough understanding of the objectives, features, and effects of the present invention. It should be noted that the embodiments and features of the embodiments may be combined with each other without causing any conflict, and specific embodiments should not be construed as a limitation to the scope of the present invention.

In an aspect of the present invention, referring to FIG. 1, the present invention provides a semi-automatic processing system for preprocessing duck carcasses before roasting, including a conveying mechanism 1, a first processing unit 2, a first spray unit 3, a first air-drying unit 4, a second spray unit 5, and a second air-drying unit 6. The first processing unit 2, the first spray unit 3, the first air-drying unit 4, the second spray unit 5, and the second air-drying unit 6 are sequentially arranged along the conveying mechanism 1. One or more duck carcasses are hung on the conveying mechanism 1, and the conveying mechanism 1 sequentially conveys the duck carcasses from the first processing unit 2 to the first spray unit 3, the first air-drying unit 4, the second spray unit 5, and the second air-drying unit 6, to perform corresponding processing.

Referring to FIG. 2, in a preferred embodiment, the conveying mechanism 1 is a chain conveying mechanism, including a conveying chain 11, a transmission chain wheel 12, and a hanging device 13 arranged on the conveying chain 11. As shown in FIG. 1, the hanging device 13 is provided with hanging holes 131 on both sides thereof for hanging one or more duck carcasses by using a hook. As shown in FIG. 3a, one duck carcass may be hung on each side of the hanging device 13. As shown in FIG. 3b, three serially connected duck carcasses may be hung on each side of the hanging device 13. By using the hanging holes 131 provided on both sides of the hanging device 13 and the shown connecting method, the carrying capacity of the conveying mechanism 1 is greatly increased. Preferably, as shown in FIG. 3c, the hanging device 13 may further include an extension member 132 so that more hanging holes 131 may be provided on both sides of the hanging device 13, thereby increasing the carrying capability of the conveying mechanism 1 and maintaining the stability of the carrying. The transmission chain wheel 12 is driven by a variable-speed motor (not shown), to drive the conveying chain 11 to convey the duck carcasses hung on the conveying chain 11. The conveying chain 11 may be activated and deactivated by a control system to control the conveying speed and direction. The conveying mechanism 1 is adopted to replace the conventional on-foot transportation of the duck carcasses to corresponding processing units for processing, so that the labor costs for

transportation is reduced, and the production efficiency is improved.

As shown in FIG. 4, in another embodiment, the conveying mechanism 1 may alternatively be a turntable conveying mechanism.

According to the present invention, the system begins with a duck carcass to be processed. The duck carcass is a duck with feathers and viscera removed. However, the duck carcass usually still has visceral residue, and further processing is needed to remove the visceral residue. Conventionally, scissors or forks are used for removing visceral residue, which is low in efficiency. Besides, visceral residue cut off may easily be stuck in the cavity of the duck carcass again, and as a result, the removal is not thorough. As shown in FIG. 5, a cutting device 21 configured to remove visceral residue from a duck carcass is arranged in the first processing unit 2 of the present invention. The cutting device 21 includes a cylindrical cutting head 211, a conduit 212, and a vacuum cleaner 213. The conduit 212 connects the cutting head 211 and the vacuum cleaner 213. A V-shaped notch 2111 is arranged in the cutting head 211, which may cut off the visceral residue by rotating the cutting head 211. The notch 2111 is designed to be suitable for cutting off visceral residue and making it easy for the visceral residue cut off to be accommodated in the cavity of the cutting head 211. In this case, as long as the vacuum cleaner connected to the cutting head 211 is turned on, the visceral residue within the cavity of the cutting head 211 can be sucked to the vacuum cleaner 213 through the conduit 212, thereby facilitating the processing. Preferably, as shown in FIG. 6 and FIG. 7, convex scrapers 2112 may be arranged on the cutting head 211 along an opening edge to further scrape off the visceral residue. The convex scraper 2112 may be of triangular or trapezoidal shape.

Preferably, a lighting device 2113, for example, a button-type miniature flashlight, may further be integrated on the cutting device 21, to facilitate the removal of visceral residue hidden in corners. Preferably, a hot-water sprayer (not shown) may further be integrated on the cutting device 21 to facilitate rinsing off the visceral residue cut loose in the cavity of the duck carcass. By using the unique cutting device 21, not only the efficiency of cutting off the visceral residue can be improved, but also the visceral residue can be sucked out in time, thereby greatly reducing the visceral residue rate and effectively improving the product hygiene quality.

As shown in FIG. 8, the first processing unit 2 further comprises a brine injection machine 22 configured to manually inject mixed spices and/or tenderizer into the muscle from inside of the duck carcass. For example, the mixed spices may be a mixed solution including coarse salt, allspice, anise, cinnamon and so on. As shown in FIG. 9, the first processing unit 2 further comprises a tail needle 23 for stitch-closing the cavity of the duck carcass. The brine injection machine and tail needle are

known in the art and their use will not be described in detail herein.

In a preferred embodiment, the duck carcass that has been processed by the first processing unit 2 is conveyed to the first spray unit 3. As shown in FIG. 10, the first spray unit 3 includes a spray nozzle 31, a pipe 32, a solenoid valve 33, a water pump 34, and a liquid tank 37. The liquid tank 37 is a liquid storage tank filled with hot water (preferably boiling water) and is provided with a heating device 35, a liquid inlet 38 and a liquid outlet 39. The water can be automatically filled and be maintained at a preset temperature and volume under the control of the control system. The liquid tank 37 is connected through the pipe 32 to a plurality of spray nozzles 31 used to spray water onto the duck carcass. Preferably, three rows of spray nozzles 31 are provided, among which the middle row of spray nozzles 31 vertically face the duck carcasses below that are hung on the conveying mechanism 1. The other two rows of spray nozzles 31 provided on both sides face the duck carcasses at a 45-degree angle. Preferably, the orientation of the spray nozzles 31 is adjustable, so that it can be ensured that the duck carcasses are sprayed more precisely. When the duck carcasses are conveyed to the first spray unit 3, hot water in the liquid tank 37 is controlled by the solenoid valve 33 to be pumped to the spray nozzles 31 through the water pump 34, and is suitably sprayed on the duck carcasses. The entire spraying process is automatically completed under the control of the control system without manual operation, thereby greatly overcoming the problems of low efficiency, uneven spraying and the like caused by traditional manual operations, so that workers can stay away from hot, damp and easily injured working environments.

In a preferred embodiment, the duck carcasses that have been processed by the first spray unit 3 are conveyed to the first air-drying unit 4 which performs air-drying on the duck carcasses. As shown in FIG. 11, the first air-drying unit 4 uses a blower with temperature adjustment and humidity adjustment, so that the time required for air drying can be greatly reduced as compared to conventional natural air drying, thereby improving the production efficiency.

In a preferred embodiment, the duck carcasses that have been processed by the first air-drying unit 4 are conveyed to the second spray unit 5 which is similar to the first spray unit 3. As shown in FIG. 10, the second spray unit 5 includes: a spray nozzle 51, a pipe 52, a solenoid valve 53, a water pump 54, and a liquid tank 57. The liquid tank 57 is a liquid storage tank filled with a mixed sauce solution, for example, a malt-vinegar mixed solution. The liquid tank 57 is provided with a heating device 55, a liquid inlet 58, and a liquid outlet 59. The mixed sauce solution can be automatically filled and be maintained at a preset temperature and volume under the control of the control system. The liquid tank 57 is connected through the pipe 52 to a plurality of spray nozzles 51 used to spray

malt-vinegar solution on the duck carcasses. Preferably, three rows of spray nozzles 51 are arranged, among which the middle row of spray nozzles 51 vertically face the duck carcasses below that are hung on the conveying mechanism 1. The other two rows of spray nozzles 51 provided on both sides face the duck carcasses at a 45-degree angle. Preferably, the orientation of the spray nozzles 51 is adjustable, so that it can be ensured that the malt-vinegar solution is sprayed on the duck carcasses more precisely. When the duck carcasses are conveyed to the second spray unit 5, the mixed sauce solution in the liquid tank 57 is controlled by the solenoid valve 53 to be pumped to the spray nozzles 51 through the water pump 54, and is suitably sprayed on the duck carcass. The entire sauce-spraying process is automatically completed under the control of the control system without manual operation, thereby greatly overcoming the problems of low efficiency, uneven spraying and the like caused by traditional manual operations, so that workers can stay away from hot, damp and easily injured working environments.

In a preferred embodiment, the duck carcasses that have been processed by the second spray unit 5 are conveyed to the second air-drying unit 6 which is similar to the first air-drying unit 4 and uses a blower with temperature adjustment and humidity adjustment, so that the time required for air drying can be greatly reduced as compared to conventional natural air drying, thereby improving the production efficiency. Preferably, the second air-drying unit 6 is configured to perform secondary air drying on the duck carcass between 20 ° C and 80 ° C.

By now, the preprocessing of the duck carcass is completed. This system adopts an integrated design in which, except that the first processing unit requires manual operations, all the other units can perform operations automatically under the control of a control system, thereby greatly improving the production efficiency and reducing the labor costs.

As shown in FIG. 12, in another embodiment, a semi-automatic processing system for preprocessing duck carcasses before roasting according to the present invention, further includes a second processing unit 7 located between the first processing unit 2 and the first spray unit 3 in a conveying direction of the duck carcasses, the second processing unit 7 comprises an air pump 71 (see FIG. 13) configured to inflate the duck carcass so as to allow the air to fill the entire duck carcass by manually pushing the air to enter between the skin and muscle through a cut on the neck of the duck carcass. Then the cut is stitch-closed.

In another aspect of the present invention, referring to FIG. 1, the present invention provides a semi-automatic processing method for preprocessing a duck carcass before roasting, including:

A. removing visceral residue from the duck carcass, injecting mixed spices and/or tenderizer

into the muscle from inside of the duck carcass and stitch-closing the cavity of the duck carcass, by using the first processing unit 2;

B. spraying hot water on the duck carcass for cleaning by using the first spray unit 3;

C. performing primary air drying on the duck carcass by using the first air-drying unit 4;

5 D. spraying sauce on the duck carcass by using the second spray unit 5;

E. performing secondary air drying on the duck carcass by using the second air-drying unit 6;
and

F. sequentially conveying the duck carcass from the first processing unit 2 to the first spray unit 3, the first air-drying unit 4, the second spray unit 5, and the second air-drying unit 6 by using the
10 conveying mechanism 1, to perform the corresponding processing.

After performing Step A, the duck carcass may be inflated by an air pump so as to allow the air to fill the entire duck carcass by pushing the air to enter between the skin and muscle through the cut on the neck of the duck carcass.

Preferably, Step E comprises: performing secondary air drying on the duck carcass between 20 °
15 C and 80 ° C.

It should be understood that the arrangement order of the processing units and the order of the steps in the method described in the embodiments of the present invention are not fixed. A person skilled in the art may make changes and modifications according to actual operations. Moreover, it should be understood that the present invention is also applicable to processing of other poultry (e.g.
20 chicken, goose, pigeons, pigs, cows, goats, etc.) for roasting, and/or processing/producing of other types of food (e.g. pipa duck, braised ducks, eight treasure duck, salted duck, saliva chicken, shredded chicken, white-cut chicken, princess chicken, salted chicken, roast pork and piglets, and barbecued pork, etc.) by appropriate modifications of the steps and ingredients, etc.

The foregoing descriptions are only preferred embodiments of the present invention and the
25 present invention is not limited thereto. All embodiments shall fall within the protection scope of the present invention as long as they achieve the technical effects of the present invention by the same means. Various different modifications and changes may be made to the technical solutions and/or embodiments of the present invention within the protection scope of the present invention.

CLAIMS

1. A semi-automatic processing system for preprocessing a duck carcass before roasting, comprising:

5 a first processing unit, configured to perform the following processing on the duck carcass therein: removing visceral residue from the duck carcass, injecting mixed spices and/or tenderizer into the muscle from inside of the duck carcass and stitch-closing the cavity of the duck carcass;

 a first spray unit, configured to spray hot water on the duck carcass for cleaning;

10 a first air-drying unit, configured to perform primary air drying on the duck carcass;

 a second spray unit, configured to spray sauce on the duck carcass;

 a second air-drying unit, configured to perform secondary air drying on the duck carcass; and

15 a conveying mechanism, configured to convey the duck carcass,

 wherein the first processing unit, the first spray unit, the first air-drying unit, the second spray unit, and the second air-drying unit are sequentially arranged along the conveying mechanism, and the conveying mechanism is configured to sequentially convey the duck carcass from the first processing unit to the first spray unit, the first
20 air-drying unit, the second spray unit, and the second air-drying unit, to perform the corresponding processing.

2. The semi-automatic processing system for preprocessing a duck carcass before roasting according to Claim 1, wherein the system further comprises a second processing unit located between the first processing unit and the first spray unit in the
25 conveying direction of the duck carcass, the second processing unit comprises an air pump configured to inflate the duck carcass so as to allow the air to fill the entire duck carcass by pushing the air to enter between the skin and muscle through a cut on the neck of the duck carcass.

3. The semi-automatic processing system for preprocessing a duck carcass before

roasting according to Claim 1, wherein the first processing unit is provided with a cutting device which comprises a cylindrical cutting head, a conduit, and a vacuum cleaner, the cutting head is connected to the vacuum cleaner through the conduit, and a V-shaped notch is arranged on the cutting head to remove the visceral residue.

5 4. The semi-automatic processing system for preprocessing a duck carcass before roasting according to Claim 3, wherein convex scrapers are arranged on the cutting head to further scrape off the visceral residue.

 5. The semi-automatic processing system for preprocessing a duck carcass before roasting according to Claim 3, wherein a lighting device is further arranged on the
10 cutting device.

 6. The semi-automatic processing system for preprocessing a duck carcass before roasting according to Claim 3, wherein a hot-water sprayer is arranged on the cutting device to rinse off the visceral residue.

 7. The semi-automatic processing system for preprocessing a duck carcass before
15 roasting according to Claim 1, wherein the first processing unit further comprises an injection machine configured to inject mixed spices and/or tenderizer into the muscle from inside of the duck carcass.

 8. The semi-automatic processing system for preprocessing a duck carcass before roasting according to Claim 1, wherein the first spray unit and the second spray unit
20 respectively comprises: a spray nozzle, a pipe, a solenoid valve, a water pump, and an liquid tank, the liquid tank is connected to the spray nozzle through the pipe, and liquid in the liquid tank is controlled by the solenoid valve to be pumped to the spray nozzle by the water pump to spray on the duck carcass.

 9. The semi-automatic processing system for preprocessing a duck carcass before
25 roasting according to Claim 8, wherein the liquid tank is provided with a heating device, a liquid inlet, and a liquid outlet, and the liquid can be maintained at a preset temperature and automatically filled under the control of a control system.

 10. The semi-automatic processing system for preprocessing a duck carcass before roasting according to Claim 1, wherein the second air-drying unit is configured to
30 perform secondary air drying on the duck carcass between 20 ° C and 80 ° C.

11. The semi-automatic processing system for preprocessing a duck carcass before roasting according to Claim 1, wherein the conveying mechanism is a chain conveying mechanism, comprising a conveying chain, a transmission chain wheel, and a hanging device arranged on the conveying chain, the hanging device is provided with hanging
5 holes on at least one side thereof for hanging the duck carcass, and the transmission chain wheel is driven by a variable-speed motor to drive the conveying chain to convey the duck carcass.

12. The semi-automatic processing system for preprocessing a duck carcass before roasting according to Claim 1, wherein the conveying mechanism is a turntable
10 conveying mechanism.

13. A semi-automatic processing method for preprocessing a duck carcass before roasting, wherein the method comprises:

A. removing visceral residue from the duck carcass, injecting mixed spices and/or tenderizer into the muscle from inside the duck carcass and stitch-closing the cavity of
15 the duck carcass, by using a first processing unit;

B. spraying hot water on the duck carcass for cleaning by using a first spray unit;

C. performing primary air drying on the duck carcass by using a first air-drying unit;

D. spraying sauce on the duck carcass by using a second spray unit;

20 E. performing secondary air drying on the duck carcass by using a second air-drying unit; and

F. sequentially conveying the duck carcass from the first processing unit to the first spray unit, the first air-drying unit, the second spray unit, and the second air-drying unit by using a conveying mechanism, to perform the corresponding processing.

25 14. The semi-automatic processing method for preprocessing a duck carcass before roasting according to Claim 13, wherein the method further comprises: after performing Step A, inflating the duck carcass by an air pump so as to allow the air to fill the entire duck carcass by pushing the air to enter between the skin and muscle through a cut on the neck of the duck carcass.

30 15. The semi-automatic processing method for preprocessing a duck carcass

before roasting according to Claim 13, wherein the Step E comprises: performing secondary air drying on the duck carcass between 20 ° C and 80 ° C.