METHOD FOR THE ACCELERATED AGING OF RICE

Described is a method for the accelerated aging of rice, comprising the steps of: a) selecting and dividing the paddies into uniform batches as a function of one or more of the following parameters: moisture, processing yield, amylase content and gelatinization temperature, b) humidifying a paddy batch so that the grain reaches a moisture content of 15-25%, preferably 18-20%, c) heating the paddy batch by applying a treatment using microwaves so that the grain reaches a temperature of 50-70°C, preferably of 55-63°C, without significant moisture loss, d) gelatinizing-pre-drying in closed environment and at a temperature of 2-4°C higher than the gelatinization temperature of the variety processed, while keeping the temperature, moisture and ventilation controlled so as to cause a controlled and partial gelatinization of the grain, limited only to the outer layer, e) drying with ventilation and with air temperature of the air of 30-35°C, f) resting or tempering without ventilation with temperature of the air of 30-35°C, g) rapid cooling with air in forced closed circuit.
DESCRIPTION

METHOD FOR THE ACCELERATED AGING OF RICE

Technical field
This invention relates to a method for the accelerated aging of rice, in particular starting from paddy rice.

Background art
The term paddy rice refers to rough rice resulting from the threshing and drying, still wrapped in husk.

It is known that paddy rice just harvested is poor in terms of quality and process characteristics relative to aged rice. Newly harvested rice cooks with a soft or sticky consistency, loses more solid materials in the cooking water when cooked and is less digestible compared with aged rice. The cooking and process characteristics improve during storage and the aging requires on average 4-6 months.

More specifically, during storage there are changes to both the chemical-physical properties of the rice, for example the processing yield, and the cooking properties, for example the consistency, expansion in volume and absorption of water. These changes are due to modifications in the lipids, proteins and other substances which are produced by the enzymatic activities and they are significant for the first two-four months after harvesting and they then stabilize.

In some industrial processes, the use of rice aged up to ten months may also be requested.

The lengthy aging times have a negative effect on the cost of the end product and on the times for managing the rough rice from the harvesting to the production.

A method for aging rice is known from patent US 3,258,342 and comprises processing refined rice obtained from the rough rice newly harvested and...
heating it for a period of from 2 to 8 hours in a closed container at a temperature of between 90°C and 110°C, without loss of moisture. The container and the contents are then cooled and held at ambient temperature for several hours in order to balance themselves. Whilst the results obtained were satisfactory in terms of quality, with regard to appearance, colouring of the grain, consistency and stickiness, they are not applicable to an industrial production comprising the use of a container for heating/cooling the grains. Subsequent attempts to use electromagnetic waves have also not produced the desired results, obtaining a discolouring of the grains similar to that of parboiled rice.

**Disclosure of the invention**

In this context, the technical purpose which forms the basis of this invention is to propose a method for the accelerated aging of rice which overcomes the above-mentioned drawbacks of the prior art. More specifically, the aim of this invention is to provide a method for the accelerated aging of rice which is capable of obtaining aged grains presenting a natural appearance and improved in terms of industrial yield, cooking properties and final cost.

The technical purpose indicated and the aims specified are substantially achieved by a method for the accelerated aging of rice comprising the technical features described in one or more of the appended claims. The dependent claims, also in combinations not expressly indicated, correspond to different embodiments of the invention.

More specifically, the method for the accelerated aging of rice according to this invention achieves the preset aims by means of a partial gelatinization of only the outer part of the grain, in order to reproduce the conditions of the aged paddy, obtaining the strengthening of the walls of the cells without the gelatinization of the starch.
**Detailed description of preferred embodiments of the invention**

Further features and advantages of the invention are more apparent in the non-limiting description which follows of a preferred non-exclusive embodiment of a method for the accelerated aging of rice.

At the time of harvesting it is preferable to use "green" paddy rice, not dried, for which the method for the accelerated aging of rice according to this invention may comprise preferably a preliminary step a') of preparing the "green" paddy rice, not dried, to be subjected to the subsequent steps of the method.

According to a preferred embodiment, the method for the accelerated aging of rice comprises a step a) for selecting and dividing the paddies into uniform batches as a function of one or more of the following parameters: moisture, processing yield, amylose content and gelatinization temperature.

More specifically, the varieties of paddy rice are analysed accurately, measuring the following parameters: moisture content, processing yield, amylose content and gelatinization temperature. The paddy is then placed in silos in uniform batches after selection using apparatuses such as: threshers, cleaning machines, destoners, densitometers.

Subsequently, the method according to this invention comprises a step b) for humidifying a paddy batch so that the grain reaches a moisture content of 15-25%, preferably 18-20%. In step b), the paddy is wetted with hot water at the temperature of 40-70°C, preferably 55-65°C. The humidification step b) may be performed in a large diameter, slow moving Archimedeanscrew or in an apparatus provided with a section with vibrating plate for improving the dispersion of the water, and with a second section with rotating container for the tempering.

After the humidification step b), there may be a step b') of draining and drying, for example performed by unloading the moistened paddy onto a vibrating conveyor with perforated plate, with introduction of hot air, to eliminate the moisture left on the surface of the grains.
After the draining and drying step b'), there may be an intermediate stabilising step c') in insulating and preheated environments for a duration of approximately 30 minutes-24 hours, preferably of 45 minutes-2 hours, so as to obtain a controlled concentration of the moisture located on the desired outer layers of the grain. For the insulating environments it is possible to use silos equipped with insulating walls and preheated with hot air before introduction of the hot paddy to prevent undesired condensation phenomena.

After the humidification step b) and, if necessary, the draining and drying step b') and the intermediate stabilising step c'), there is a step c) for heating the paddy batch by applying a treatment using microwaves so that the grain reaches a temperature of 50-70°C, preferably of 55-63°C, without significant moisture loss. The frequencies, included between 300 MHz and 300 GHz, are, according to the ISM regulation 2.45 GHz.

More specifically, the microwave treatment may be performed with reverberant room with microwaves, comprising from two to eight emitters, preferably from four to six emitters, with power of 10 kW each.

Overall, the duration of the microwave treatment is approximately 1 minute and 45 seconds - 4 minutes, preferably approximately 2 minutes.

As part of the heating step c) it is possible to include some sub-steps including a sub-step for measuring the temperature of the paddy during the processing step using microwaves and a further sub-step for adjusting the power of the emitters and the conveying speed of the paddy on the basis of the temperature measured. The temperature may be measured using a thermal probe for example a Ti20 Fluke thermal camera, with temperature indication resolution of 0.1 °C.

The apparatus used may be the one described in patent application MI2009A001 823 in the name of Emitech Sri. The infeed and outfeed are insulated with electromagnetic filters, so as to avoid the escape of electromagnetic waves.
Ater the processing with microwaves, there is a gelatinizing-pre-drying step d) in a closed environment and at a temperature of approximately 2-4°C higher than the gelatinization temperature of the variety processed, while keeping the temperature, moisture and ventilation controlled so as to cause a controlled and partial gelatinization of the grain, limited only to the outer layer.

The gelatinizing-pre-drying step d) occurs continuously for example in a three-level dryer with a mesh roller table.

The conditions of execution of the gelatinizing-pre-drying step d) allow the gelatinization to stop when the paddy cools down due to the evaporation of the surface moisture.

After the gelatinizing-pre-drying step d) there is a step e) or drying with ventilation and with air temperature of the air of 30-35°C.

Preferably, the drying e) and resting or tempering f) steps are performed in a recirculating dryer wherein the drying step e) is performed in a first column for a length of time of approximately 8 hours and the resting or tempering step f) is performed in a subsequent column for a length of time of 6-10 hours, preferably 5-8 hours, so that the moisture is transferred from the moister heart of the grain towards the dryer exterior and is balanced.

The resting or tempering occurs hot, without cooling. The paddy which is still hot is cooled by a step g) for rapid cooling with air in forced closed circuit only after the resting or tempering step. The rapid cooling step g) may be performed in a progressive chiller with one passage, through a metal mesh conveyor of stainless steel, with air in forced closed circuit supplied, for example, from the cold water produced by a chiller.

The method according to this invention makes it possible to prevent tensions and cracks inside the grains, respecting the grain structure, with consequent excellent yield when refining. A substantially natural colour
and an accelerated aging of the paddy is also obtained, with the improvement of the cooking quality of the rice.
The yield of the processing is at least equal to that of paddy aged naturally and in many cases better. More specifically, the product obtained has
strength and consistency characteristics which can be estimated to be equal to those of a paddy aged for eight-ten months.
The humidification step facilitates the uniformity of the treatment with microwaves, allowing the use of relatively low temperatures and preparing the surface of the grains for the subsequent treatment by hot air.
The process data: water steeping temperature, microwaves treatment time and grain temperature, duration and temperature of gelatinization-pre-drying step are correlated with the variety of the paddy processed, its amylose content and its gelatinization temperature.
CLAIMS

1. A method for the accelerated aging of rice, comprising the steps of:
   a) selecting and dividing the paddies into uniform batches as a function of
      one or more of the following parameters: moisture, processing yield,
      amylose content and gelatinization temperature,
   b) humidifying a paddy batch so that the grain reaches a moisture content
      of 15-25%, preferably 18-20%,
   c) heating the paddy batch by applying a treatment using microwaves so
      that the grain reaches a temperature of 50-70°C, preferably 55-63°C,
      without significant moisture loss,
   d) gelatinizing-pre-drying in closed environment and at a temperature of
      approximately 2-4°C higher than the gelatinization temperature of the
      variety processed, while keeping the temperature, moisture and ventilation
      controlled so as to cause a controlled and partial gelatinization of the
      grain, limited only to the outer layer,
   e) drying with ventilation and with air temperature of the air of 30-35°C,
   f) resting or tempering without ventilation with temperature of the air of 30-
      35°C,
   g) rapid cooling with air in forced closed circuit.

2. The method for the accelerated aging of rice according to claim 1,
   comprising a preliminary step a') of preparing "immature", undried paddy,
   to be subjected to steps a)-g).

3. The method for the accelerated aging of rice according to claim 1,
   wherein in the humidification step b), the paddy is wetted with hot water at
   the temperature of 40-70°C, preferably 55-65°C.

4. The method for the accelerated aging of rice according to claim 3,
   wherein the humidification step b) is performed in a large diameter, slow
   moving Archimedean screw or in an apparatus provided with a section
with vibrating plate for improving the dispersion of the water, and with a second section with rotating container for the tempering.

5. The method for the accelerated aging of rice according to any one of the preceding claims, comprising, after the humidification step b), a step b') of draining and drying, for example performed by unloading the moistened paddy onto a vibrating conveyor with perforated plate, with introduction of hot air, to eliminate the moisture left on the surface of the grains.

6. The method for the accelerated aging of rice according to any one of the preceding claims, comprising, before the heating step c), an intermediate stabilising step c') in insulating and preheated environments for a duration of approximately 30 minutes-24 hours, preferably of 45 minutes-2 hours, so as to obtain a controlled concentration of the moisture located on the desired outer layers.

7. The method for the accelerated aging of rice according to claim 5 and claim 6, wherein the draining and drying step b') precedes the intermediate stabilising step c').

8. The method for the accelerated aging of rice according to any one of the preceding claims, wherein the microwave treatment is performed with reverberant room with microwaves, comprising from two to eight emitters, preferably from four to six emitters, with power of 10 kW each.

9. The method for the accelerated aging of rice according to claim 8, wherein the duration of the microwave treatment is approximately 1 minute and 45 seconds-4 minutes, preferably approximately 2 minutes.

10. The method for the accelerated aging of rice according to claim 8 or 9,
wherein the heating step c) comprises the sub-steps of:
- detecting the temperature of the paddy during the treatment step using microwaves and
- adjusting the power of the emitters and the conveying speed of the paddy on the basis of the temperature detected.

11. The method for the accelerated aging of rice according to any one of the preceding claims, wherein the gelatinizing-pre-drying step d) occurs continuously for example in a three-level dryer with a mesh roller table.

12. The method for the accelerated aging of rice according to any one of the preceding claims, wherein the drying e) and resting or tempering f) steps are performed in a recirculating dryer wherein the drying step e) is performed in a first column for a length of time of approximately 8 hours and the resting or tempering step f) is performed in a subsequent column for a length of time of 6-10 hours, preferably 5-8 hours, so that the moisture is transferred from the moister heart of the grain towards the dryer exterior and is balanced.

13. The method for the accelerated aging of rice according to any one of the preceding claims, wherein the rapid cooling step g) is performed in a progressive chiller with one passage, through a metal mesh conveyor, with air in forced closed circuit.
**INTERNATIONAL SEARCH REPORT**

**A. CLASSIFICATION OF SUBJECT MATTER**

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

**INV. A23B9/02 A23L7/196**

ADD.

**B. FIELDS SEARCHED**

Minimum documentation searched (classification system followed by classification symbols)

A23B A23L

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

**C. DOCUMENTS CONSIDERED TO BE RELEVANT**

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Further documents are listed in the continuation of Box C.

**Date of the actual completion of the international search**

27 April 2016

**Date of mailing of the international search report**

13/05/2016

**Name and mailing address of the ISA/ European Patent Office, P.B. 5818 Patentlaan 2 NL-2280 HV Rijswijk**

**Authorized officer**

Munteanu, I
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