

New Energy-saving Process for the Production of Fast Cooking Rice

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A new process for the production of fast cooking rice, based on the use of microwave energy, reduces process time, energy- and water consumption and improves quality.

Microwaves

Microwaves are electromagnetic waves, comparable with radio waves, which can be used for drying and heating. The advantage of microwaves in comparison to many other heating methods is that the microwaves can penetrate into the product and therefore induce the heat in the inside of the product. Due to this fact, heat up times of conventional processes in which the heat is conducted slowly from the surface to the inside of the product can be avoided.

As the microwaves can penetrate into the product, they heat up the complete volume of the product at the same time, so that a very homogeneous heating in comparison to conventional heating methods is achieved. The temperature profile generated by the microwaves is inverse to conventional heating, the inside of the product has the highest temperature and the surface has somewhat lower temperatures. The heat up times can be reduced significantly and damage to the product due to long time exposure to high temperatures and overheating of the surface are avoided.

In the food technology, microwaves are mainly used for drying, heating and sterilisation.

Use of microwaves for the production of fast cooking rice

The conventional processes for the production of pre-treated rice for the reduction of cooking time can be divided in three areas: parboiled rice, fast cooking rice and instant rice.

The general procedure for all three processes is similar. First the still un-hulled rice will be watered to rise the water content to 30-40%. Then the surplus water is removed and the rice will be rested to homogenise the humidity. After that a heat treatment is done, usually a cooking at approx. 100°C. Finally the rice will be dried until it has a final humidity of approx. 14%. These processes are all very time consuming and have a high energy consumption for the cooking and drying processes and water consumption for the cooking process.

Alternatively to these procedures, a new process was developed, which is essentially based on the use of microwaves for heat treatment. The use of microwaves for the production of fast cooking rice is not new, but most of the previous methods are limited to the substitution of the conventional heat treatment step through microwaves. The other process steps are mainly still the same, therefore the advantages of these procedures are minimal.

With the newly developed procedure the whole production process is significantly shortened, which gives immense improvement of the process.

The rice is first hulled and then directly packed into cooking bags. After that, the microwave treatment is done, which is effected without water addition. Due to the microwaves and a special process technology, the water content of approx. 14% is sufficient to get the fast cooking effect. After the microwave treatment, the rice only needs to be cooled down and can then be packed directly. The achieved cooking time of 10 - 11 min. is comparable with that of the conventional procedure.

Reduction of energy consumption

To analyze the energy saving of the microwave process, it is compared to a conventional gas-fired treatment process.

The conventional process has an energy requirement of approx. 560 m³/t gas for cooking and drying and approx. 70 kWh/t for transport and cooling. Please note that these values are estimations and may be different for actual processes, depending on the efficiency of the process. The 560 m³/t gas is equal to an energy of approx. 5000 kWh/t, so the total energy requirement for the conventional process is about 5070 kWh/t rice.

For the microwave process the energy requirement is about 130 kWh/t for the microwave heating and about 15 kWh/t for the cooling. The total energy requirement for the microwave process is therefore about 145 kWh/t.

Comparing the two energy consumptions shows that the microwave treatment reduces the energy requirement by about 97%. When considering the different costs for gas and electrical energy, the microwave process reduces energy costs by up to 90%.

Beside the energy reduction, also improvements in the taste and colour in comparison to the conventional treated rice are realised, as the process time and therefore the stress for the rice is reduced significantly. The fragility, meaning the tendency of the rice to break, will not be increased by the microwave treatment and is therefore comparable to the values of non-treated rice.

Use in the production

This new procedure was developed in the scope of a research project of the Pannon University Veszprém, Hungary. The development time to the production-ready process was about 2 years.

In August 2003 a first production line, which is working with the new procedure was put into operation, at the company Alföldi Malomipari RT, Hungary, the industrial partner of the development project. This plant (see picture) has a microwave power of approx. 21 kW and has a production capacity of approx. 300 kg/h.



Picture 1: Microwave continuous belt furnace, MDBT 21, Linn High Therm

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