HSR (LONDON),
HOUGHTON STREET REVIEW JOURNAL
ISSN: 2058-5519|Impact factor-15.9
http://houghtonstreetreview.com/index.php/hsr

ANALYSIS OF RESEARCH WORK ON RICE DRYING TECHNOLOGIES AND DEVICES

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Doi: https://doi.org/10.5281/zenodo.21777588

Abstract: Due to the increasing consumption of rice in Uzbekistan, measures have been developed to further develop rice production [18]. One of the most important tasks to ensure the sustainable development and food security of our country is to increase rice production by reducing production costs. It is necessary to solve the task of increasing rice production not only by increasing the gross yield, but also by eliminating some deficiencies in the processes of drying and storing rice after harvesting.

Keywords words and phrases: harvest, rice, dryer, microwave, air, perfect, temperature

One of the shortcomings in the drying of cultivated rice is that in the drying process, the operating temperature and the humidity of the rice being dried are not controlled.

Below, we will get acquainted with the analysis of some of the scientific and research works carried out on existing grain drying technologies and devices.

In particular, researched the issues of improving the quality of rice during drying in an energy-saving device for rice-growing countries. The purpose of this research is to develop a small-sized microwave device to control the quality of rice based on energy analysis. The device was microwaved for 5, 10, and 15 minutes at powers of 500, 1000, 1500, 2000, and 2500 W.

The following were taken into account when creating the design of the microwave dryer: the drying capacity of the microwave dryer is 2 kg of rice, ultrasonic treatment of rice before drying in the microwave dryer, the developed dryer consists of three magnetrons and the drying process is continuous, the drying time is 4 min, the speed of the drying air along the drying chamber is 0.5 m/s, the overall dimensions are 200x300x500 mm (Fig. 1).



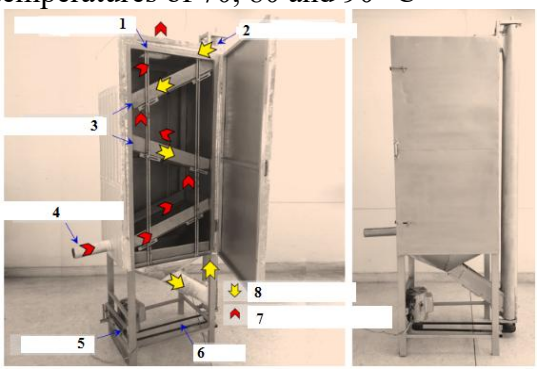
Figure 1 Microwave drying device

According to the experimental results, cracks appeared in the rice grains during drying at relatively high microwave power values. This leads to an increase in the number of broken grains during mechanical processing of rice grains dried in a microwave dryer.

In addition to the lack of control over the rice drying process in the open air, traffic accidents occur due to the limited space for drying. Therefore, in order to reduce and prevent such problems for rice farmers, a special mechanism was used in the study that can improve the movement of rice grains

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during drying. The structure is equipped with a trough that ensures the rice flows downwards due to gravity and the rice moves laterally during the descent. The studies were carried out under various parameters, including the location of the trough at 30° and 35° relative to the horizon, rice flow rates of 0.025, 0.032 and 0.037 kg/s, and hot air
temperatures of 70, 80 and 90 °C



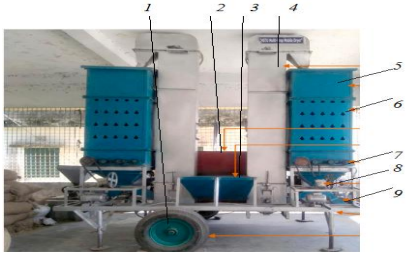
1-hot air outlet; 2-screw feeder; 3-drying channel; 4-hot air inlet; 5-conveyor; 6-belt; 7-hot air direction; 8-rice direction

Figure 2 . Rice drying device

In the operation of the rice dryer illustrated in Figure 1.8, 15 kg of rice was placed in the drying chamber in each cycle. The door of the drying cabinet was closed, the air supply and heating system were connected, and the tests were carried out. Then, the screw conveyor motor was turned on to lift the rice up and ensure that the rice fell from the top to the bottom along a predetermined trajectory. The dried rice was collected at the bottom of the drying cabinet after the first cycle and transferred to the screw conveyor for the next cycle. During the drying process, hot air is blown in the opposite direction to the movement of the rice.

The results showed that higher values of flow rate and hot air temperature reduced the drying time. Higher values of the angle of rice movement relative to the horizon improved grain movement and reduced moisture content.

Proper and complete drying of harvested rice is one of the main problems of rice growers. In a rice drying device (HDD) developed by Haji Muhammad Danesh University of Science and Technology (HSTU) was presented. It was found that the HMD device was capable of drying 720 ± 10 kg of rice in one batch. The drying time of rice was 7 to 8 hours at a hot air temperature of 65 °C.



1-wheel;2-heating device;3-loading bunker;4-elevator;5-storage chamber;6-drying chamber;7-gearbox;8-exhaust device;9-frame

Figure 3. Rice drying device (HDD) created by Haji Muhammad Danesh University of Science and Technology (HSTU)

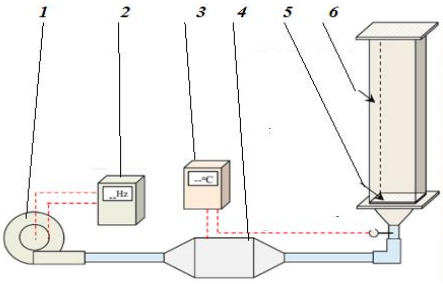
The drying of rice in the HMD device depicted in Figure 1.9 is carried out as follows: Before starting the drying operation, an air compressor is used to clean the device and the working area. The

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parameters such as the speed and temperature of the drying air were selected based on previous studies in the HMD device. The drying air temperatures for rice and seeds were selected as 65 °C and 40 °C, respectively. A sample of rice to be dried (Sumon Swarna variety) is placed in the device. After the loading is completed, the fan is started and the hot air speed is recorded at different values using a digital anemometer (Anemomaster, Model-6162, Japan). After achieving stable conditions with the selected drying temperature, the unloading rotor is turned on and the drying process is carried out until the rice moisture content reaches the desired moisture content (12 ± 1%). During the drying process, its moisture content is measured every 1 hour until the drying is complete.

The HMD dryer integrated with a dual heating system is recommended for use in farms in Bangladesh and other subtropical countries with harsh climates for fast and efficient drying of high-moisture grains and seeds.

This study presents a novel and simple method for improving the drying process of rice in a fluidized bed dryer. In addition, artificial neural network methods are used to control the drying behavior. The experiments were conducted with two different characteristics of the drying chamber (a conventional chamber and a chamber with the ability to control the fluid flow) and four different air flow rates (3.03, 3.52, 4.12, and 4.85 m/s) at a drying air temperature of 60 °C. The experimental conditions and the calculated moisture content presented in this work were used as input and output data for the artificial neural network to determine the drying characteristics.



1-fan; 2-inverter; 3-temperature control unit; 4-air heating section; 5-air distributor; 6-drying chamber.

Figure 4. Fluidized bed dryer for rice.

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