

STUDY OF THE INFLUENCE OF IR RADIATION ON THE DRYING PROCESS OF MELON SHEETS

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ABSTRACT

The article is devoted to the technology of drying melon slices and intensification of this process.

It is known that many fruits and agricultural products are pre-processed before the drying process. These include blanching, sulfitation, fumigation, or electrophysical methods of exposure: microwave generation, IR irradiation, etc. [1]. All these methods to one degree or another intensify the process and reduce the drying time of products.

In order to reduce the drying time, improve the appearance and taste of dried melon, taking into account the specific properties of the melon as an object of drying, the conditions for preparing it for the dehydration process, the choice of a particular drying method and the design of the drying unit, we have carried out experimental studies to study the effect of IR - irradiation on the process of drying annular melon slices. The specified drying method is disclosed in work [2] and is recommended for implementation in the farms of the Republic of Uzbekistan. For research, we have developed an experimental setup (Fig. 1)

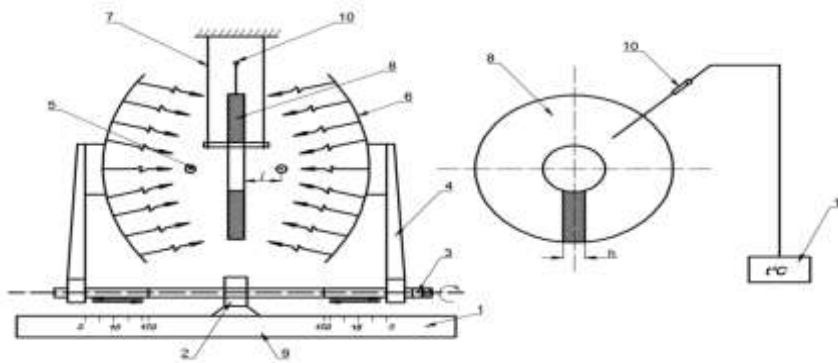


Fig. 1 Experimental setup for IR irradiation of melon slices

It contains a support box 2 installed on a platform 1, through which a shaft 3 with a right and left thread is passed. Two pylons 4 are mounted on the shaft with an IR generator 5 and a reflector 6 mounted on them. Between them, on flexible threads 7, an annular piece of melon 8 of thickness h is suspended on a wooden rod. By rotating shaft 3, you can change the distance of the IR lamps to the slice and fix it along the ruler 9. As a source of infrared rays, commercially available KGT-500 coherent lamps with a parabolic reflector were used, and the temperature measurement of a melon slice sample was measured with a needle chromel-copel thermocouple 10 and an indicating millivoltmeter 11.

The tasks of the research included: studying the effect of infrared rays on the drying process of slices, depending on the distance of the source, determining the optimal time and cyclicity of exposure to melon slices of different cutting thickness.

The experiment was carried out in the following sequence. Ring-shaped slices 15, 18, 21 mm wide were harvested from several varieties of melons and weighed each batch of slices separately. Before the start of the experiment, rotating shaft 3, pylons 4 with IR lamps were installed at a distance of 100 mm from the studied segment and the lamps were turned on. Irradiation was carried out at right angles with directed and diffusion

beams of rays for various time intervals. The duration of IR-irradiation was recorded and simultaneously the heating of the pulp of the lobule was controlled with a thermocouple.

Thus, all batches of slices were irradiated in the interval of 3 min and 6 min (with exposure) and the distance of the IR lamps from the slices at a distance of 100-150 mm. The results of the experiments are summarized in table 1.

Table 1

Slicing thickness of slices, mm	Distance to IR source, mm	Pulp heating temperature, 0C during the irradiation period					
		irradiation time, sec					
		60	120	180	240	300	360
15	100	35	40	44	45	55	60
	125	33	37	40	44	44	55
	150	33	33	33	33	33	44
18	100	33	41	44	44	55	55
	125	33	33	44	44	44	55
	150	33	33	33	33	33	33
21	100	30	33	44	44	55	55
	125	28	33	33	33	44	55
	150	26	27	28	28	28	33

Drying of melon slices after IR irradiation was carried out in an experimental setup based on an electric heater PGS-023 (000 PGS, Tashkent). The schematic diagram of the installation is shown in Fig. 2.

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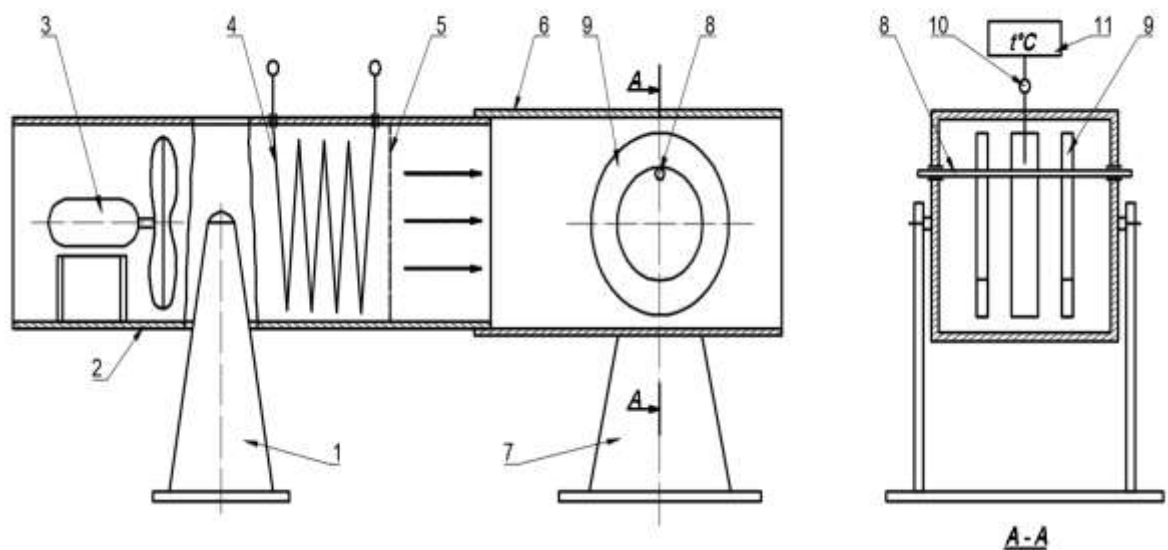


Figure: 2. Experimental plant for drying melon slices

The installation includes a rotary through box 2 mounted on a support 1, inside which an axial fan 3, electric heaters 4 and shutters 5 are installed. A drying chamber 6 with a section (200x200) mm adjoins the electric heater and mounted on a support 7. Inside the chamber, melon slices 9 are hung on a wooden pole 8. The heating temperature of the slices was monitored with a thermocouple 10 and a millivoltmeter 11. In the course of the experiments, the kinetics of drying was studied both for pretreated melon slices at different time ranges of irradiation, and control ones without irradiation.

Based on the results of the experiments, drying curves were constructed, which characterize moisture removal depending on the thickness of slicing slices and the duration of their preliminary irradiation (Fig. 3, Fig. 4.)

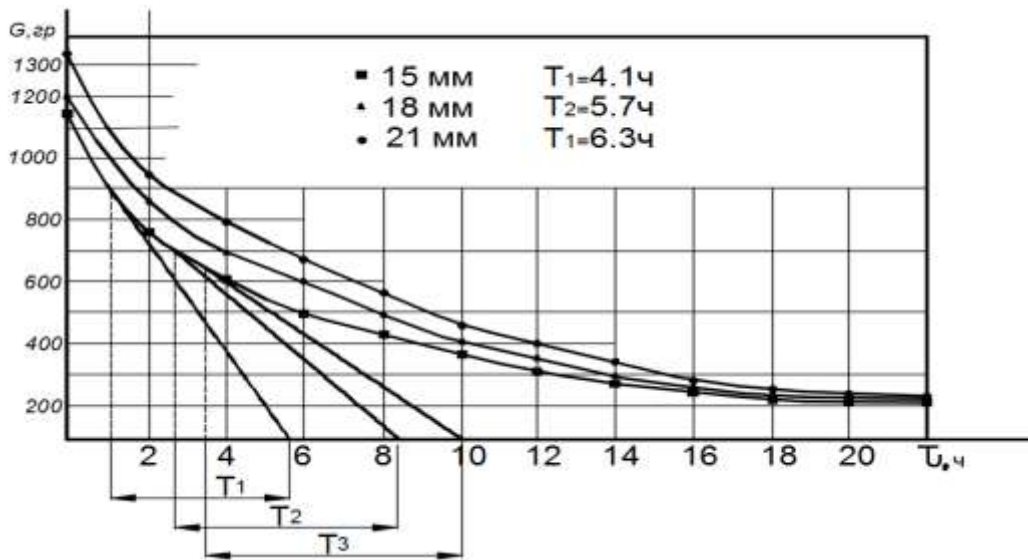


Fig. 3. Curves of changes in the mass of melon slices over time

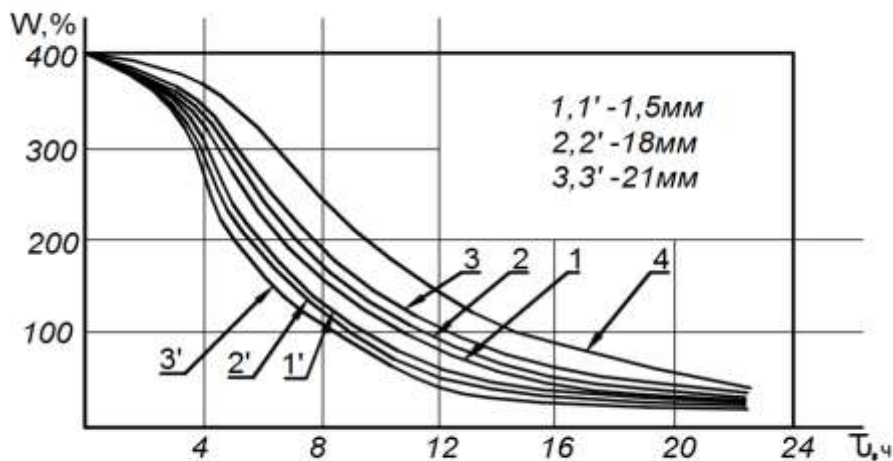


Figure: 4. Curves of drying of melon slices irradiated with infrared rays 1,2,3, –3 min; 11, 21, 31–6 min; 4 – unirradiated (control).

Comparing the group of curves, we can state that the nature of their change is identical. With an increase in the duration of irradiation, the drying time decreases markedly. With the combined version (irradiation - staying - irradiation), by analogy with the oscillation process, 3 min + (-4 min) +3 min, i.e. 3 min

irradiation, 4 min rest, 3 min. Irradiation, drying time is reduced by 20-30%. Under excessive irradiation (more than 8 minutes), the destruction of carbohydrates and other organic substances on the cut surface of the melon pulp is observed, which leads to a thermal “burn” and negatively affects the organoleptic qualities of dried melon. With the optimal selection of the IR-irradiation mode, exposure time and heat flux density, not only can you reduce the drying time, but also significantly improve the quality of the final product. If these technological requirements are met, dried melon turns out to be straw yellow in color with a golden hue.

Influence of IR-irradiation on the melon drying process is explained by the fact that IR-rays provide local destruction of parenchyma membranes, to which a thin layer of cytoplasm adjoins, which is the main obstacle to the removal of moisture from cells.

The analysis of the results of experiments on drying melon samples of varieties “Ichikizil” and “Ok-kavun” showed that for treated and untreated slices by IR irradiation, the presence of a period of constant drying rate and a period of decreasing rate is characteristic. The duration of the period of constant speed for untreated slices of both melon varieties is longer than that for treated ones, and during the period of decreasing speed, a decrease in the drying rate is observed. The decrease in the drying rate is explained by the deepening of the evaporation zone inside the flesh and, accordingly, an increase in the energy of binding with the product.

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