MICROWAVE IMPACT ON AGRICULTURE PRODUCTS

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Abstract

The spots , on products are causes by the nonuniform heating of microwaves. They may be one of the important factors for the quality degradation of products after the microwave treatment. The germination percentage of grain are collected from normal heating zones after microwave treatment. The grain is 60 g in each experiment are processed at four moisture levels 10, 12, 16, and 20 % . Wet basis were subjected to microwave treatment .

At five power levels 10, 20, 30, 40, and 120 W and two exposures by 40 s and 60 s in a continuous time , in a industrial drier with microwave at 2,45 GHz. After microwave treatments, were collected data from the normal heating zones by viewing the live thermal images on the monitor of the data acquisition computer. I processed the image with a a thermal image processing software. At all moisture and power levels, germination percentages is significantly lower with 0,05 for samples collected from hot spots than by the those from normal heating zone. he germination percentage was near zero at 30 W for the samples collected from the spot.

At power levels of 40 and 120 W for a time 60 seconds, the percentage of the germination exposure was almost zero for the region normal and for the hot regions.The germination percentage was near zero at 30 W for the samples collected from the spot.

When the exposure time was increasead to 60 s and the initial moisture content was 16 and 20 %

Keywords: germination percentage, microwave dryng, thermal imaging.

INTRODUCTION

In this paper we made a study of the impact of microwaves on agricultural products processed from them.

Reads the four samples of 60 grams of seeds having a moisture content of 10, 12, 16, and 20 % were treated in a microwave field with five power levels of 10, 20, 30, 40, and 120 watts and two periods of exposure time of 40 seconds and 60 seconds. These four seed samples of 60 grams each were processed using microwave equipment which operates continuously at 2.45 GHz.

After microwave treatment of the four samples has followed the evolution of the moisture content of these using the computer. For this we use specialized software to monitor the moisture content during drying procesuli after these agricultural products. At a power of 120 watts and an exposure time of 40 seconds, the percentage of germination of the seeds had an inter avriatie 6 and 35 percent of each seed sample in hand. The percentage of germination of seeds at a power of 120 watts and an exposure time period of 60 seconds was a variation of 16 - 20 percent for each sample of seeds in hand .

The heat generated within food materials during microwave treatment is utilized to obtain desired changes in the product. Microwaves have been used in grain research for various applications.

It is difficult to determine the impact of a microwave system for a particular application in the grain industry due to other quality deteriorations. Non – uniformity of heating during microwave treatment produces hot – spots localized elevated temperature, and this may be one of the important factors for the quality deterioration of grains. The non – uniformity is the difference between maximum and minimum temperatures of surface temperatures of wheat at 60 g samples after microwave treatment was found to be in the range of 52.9 to 59.5 ^{0}C after exposing to 120 W for 60 s . The quality of the grain samples in the hot – spot and the normal heating zones after microwave treatment help to understand the thermal degradation of grain during microwave treatment. The objective of this study was to determine the germination percentage of the grain in a normal heating zones after microwave treatment.

MATERIALS and METHODS

Microwave treatment

Drying equipment consists of seeds - industrial microwave dryer working at a frequency of microwave drying equipment 2,45GHz seeds .This is operated at a voltage of 230 volts, with a frequency of 60 Hz and a current of 23 amp electric.

Microwave dryer consisted of - a carrier of seeds and a microwave applicator (Fig. 1) .Viteza conveyor and power output of the microwave generator can be performed at the desired level. Sustemul cooling fan from the equipment was switched on throughout the experiments and the air inlet temperature was set at 30 degrees Celsius.

Cereal seeds were treated on the level of four different moisture levels of 10, 12, 16, and 20 percent wet. Every preble of experiment - used an amount of 60 grams of cereal grains that were widespread on carrier whose surface is flat. Then they were placed in cuprorul microwave treatment. The approximate amount of cereal seeds under the conveyor during microwave treatment was 200 x 20 x 10 milimetri.In during drying - used two microwave exposure times of these cereal grains .This s - the achieved by changing the speed of travel of the conveyor.

Microwave treatment of cereal seeds was made at five levels of power equipment 10, 20, 30, 40, and 120 watts and two microwave field exposures of these seeds cereal for a length of time 40 and 60 seconds

.Semintele and grain were monitored using a thermal imager who viewed telltale seed sample output conveyor after treating them in the microwave field .Thus could view and areas of heating and temperature these seeds at the exit of the microwave field. Then they measured and the moisture content of their practical constatinduse lost moisture to these seeds of grain.

Thermal imaging

We represent images taken by the camera model thermal radiation temperature Grain seeds is converted into visible image.

The color of each pixel in a thermal image is a temperature value that is given on the right side of the temperature scale in Fig. 2. In a thermal image, bright colors and dark colors represent high temperatures and low temperatures, the scanned object, in our case the seeds of cereal because we .From uniform heating, hot spots were observed in one or two locations on the surface samples of wheat after treatment with the microwaves.

Samples were collected were then subjected to a germination test.

Germination test

Seed germination test was conducted for grain samples collected from the hot spot and normal heating zones. It was not possible to perform tests baking quality because the amount of sample collected from the hot spot was less than about 10 grams to 20 grams in a sample of 60 grams of seed grain treated with microundelor.

To detect degradation of cereal seeds due to high temperatures, can achieve their germination test is a sensitive test, simple, and reproducible.

60 seed kernels of grain were placed on filter paper 3 into a vessel 90 mm in diameter filled with 15.5 milliliters of distilled water.

The plates were covered with a polyethylene bag and stored at a temperature of 25 ^{0}C for 7 days. Germinated seeds were counted every day and so we calculated the percentage of germination of seeds of cereals.

Fig. 1. Experimental setup

1 – grain , 2 – control , panel, 3 – microwave chamber, 4 – conveyor ,
5 – thermal camera , 6 – data acquisition system

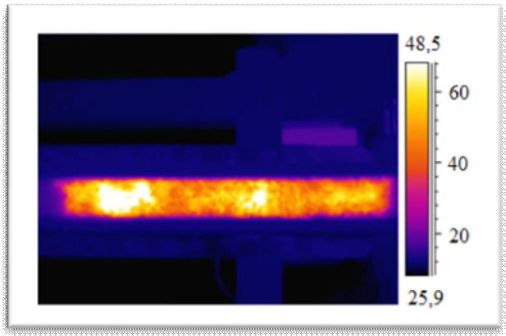

Fig. 2. Typical thermogram of wheat sample showing
after microwave treatment

Wheat samples were subjected to the germination test on the next day after microwave treatment. The entire experiment was replicated three times.

Statistical analysis

The effect of moisture content, microwave power, and sample location in 60 g grai on the germination percentage at each exposure time was analyzed. The analysis of variance method using a factorial experimental design 3 moisture content × 4 power control, 10, 20, 30, 40, and 120 × 2 sample locations normal heating zones.

The differences within the levels under each variable were tested using the least significant difference method of comparison of means. The general linear models procedure was used for all statistical analysis. For the germination percentage, the statistical significance between the samples collected from the hot spot and the normal heating zone at each power level was tested using an independent test (=0.05).

RESULTS AND DISCUSSIONS

The moisture content of the grain samples after microwave treatment is given in Fig. 3. Since the microwave treatment and exposure time were the same for all the grains , the samples were at different final moisture contents. When the microwave power was 10 W, the moisture loss was in the range of 1 to 1.1 % at 40 s exposure and 1.5 to 4.9 % at 60 s exposure. When the power level was increased to 120 W, the moisture loss was 9.7 to

18.9 % and 25.9 to 48.5 % when the exposure time was 40 and 60 s, respectively.

The germination percentages of samples collected from the hot – spot and normal heating zones after microwave treatments are shown in Figs. 4 and 5. Sample location had a significant effect on the germination percentage. The germination percentage was lower for the samples which were collected from the hot spot region than those from the normal heating zone, except for two treatments:

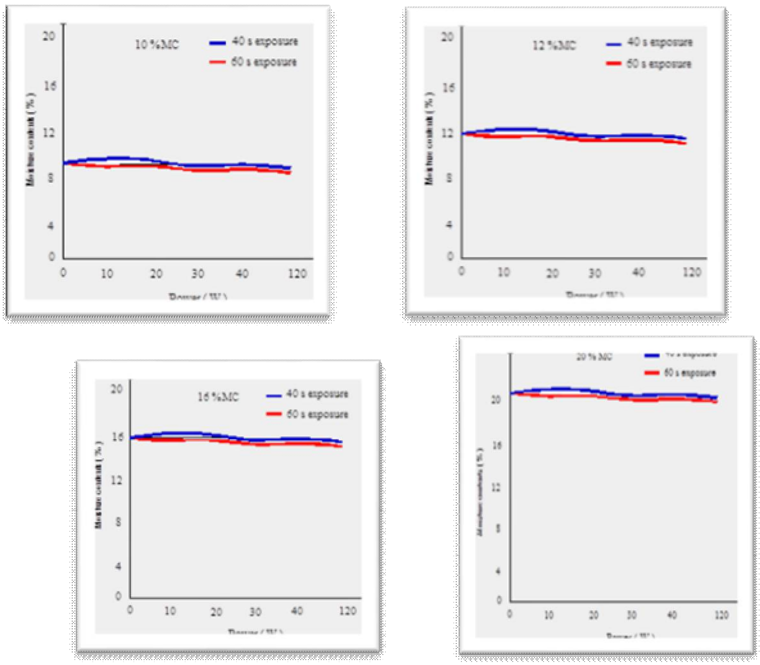

Fig. 3. Final moisture content of grain after microwave treatment

La 20 % moisture content grain at 10 W power and 40 s exposure time, and for 16 % moisture content grain at 10 W and 60 s exposure time. In these two treatments, there were no significant differences in the germination percentages.

The difference in germination between samples from the hot – spot and the normal heating zones was less at lower – power levels and increased as the power level increased. When the exposure time was 40 s at 120 W, the germination was almost zero in the hot – spot zone except for 10% moisture content grain, whereas it was 6 to 35 % for samples collected from the normal heating zone.

The germination percentage was almost zero at 30 W for the samples collected from the hot spot, when the exposure time was increased to 60 s and the initial moisture contents were 16 and 20 %. At 40 and 120 W power levels when the exposure time was 60 s, the germination percentage was near zero for samples collected from both normal regions except for 10 % moisture content.

Microwave exposure time and power level had a significant effect on the germination percentage of wheat.Germination percentage decreased with increasing power level and exposure time.

The variations in the germination percentage of wheat samples collected from the same microwave treatment were determined. The lower power levels as the treatment time was less than one minute. In our study, the moisture removal was higher at the higher power levels.

The exposure time and initial moisture content had a significant effect on the germination percentage. The variation in the effect of exposure time on the damage between

microwave heating and convection heating is because of the continuous increase in temperature during microwave treatment.

The grain temperature during microwave treatment increased with power level and exposure time. In another study, the average temperature, maximum temperature, on the surface of the wheat grain 60 g samples after exposing to five power levels 10, 20, 30, 40, and 120 W and two treatment times 40 and 60 s were determined .The maximum temperature on the surface of the grain was also increased with power levels and exposure time.

In correlation with these results, the germination percentage decreased with increasing microwave power levels in both hot-spot and normal heating zones.

The germination percentage was essentially determined by grain temperature. If the temperature exceeded this optimum level, the high temperatures damaged

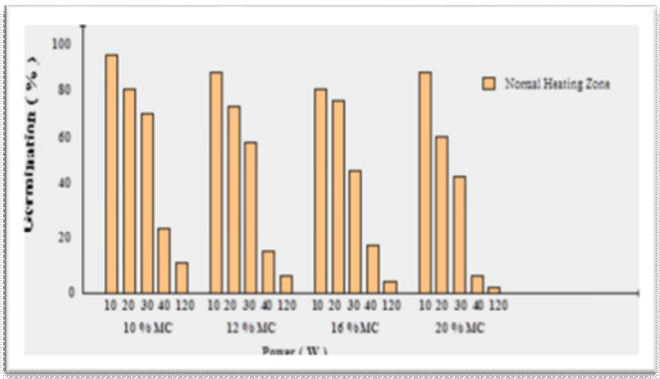

Fig. 4. Germination percentages collected from the normal heating zones after heating for 40 s.

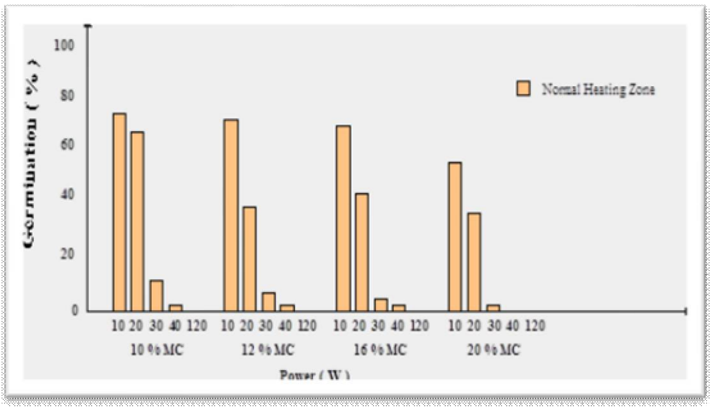

Fig. 5. Germination percentages collected from the normal heating zones after heating for 60 s

Hence, the microwave power and exposure time would be the important factors while using microwaves for seed processing. While using microwaves for seed - drying or processing, arrangements must be made to reduce the temperature in the hot spot in order to retain the germination ability at lower microwave power levels.

The temperature generated in the high moisture wheat was lower than that in the low moisture wheat, the high moisture grain was more heat – sensitive and hence a lower germination percentage was observed in high moistures at all power levels.

CONCLUSION

The germination percentage of wheat samples present in the hot spot region was significantly lower than that of the normal heating region in almost all moisture and power levels. Microwaves are not suitable for the drying of wheat which is to be used as seeds, even at low power levels, unless some provisions are made to ensure uniform heating. Apart from

germination, the other quality parameters which are sensitive to heat are also expected to be affected more in the normal zone than the remaining grain.

While evaluating the quality changes of grain after microwave treatment, testing grain in the normal zone would yield more realistic information about the damage due to microwave treatment of the grain.

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