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Workshop on Application and Productization Design for Far Infrared Rays (FIR) Technology – Food Processing

Application of Far Infrared Radiation to Food Processing

Ir HN Lam
Associate Professor
Far Infrared Heating
Far Infrared Heating

- FIR heating can be classified into 4 major categories: baking, drying, thawing and pasteurization.
- Using FIR heating, baking time can be shortened, energy consumption can be reduced, and nutrition and appearance can be better preserved.
- FIR heating helps reduce beta-carotene and chlorophyll degradation in the heating process.
- FIR irradiation is more effective for pasteurization than NIR, killing bacteria and spores.

With the far infra-red radiation source, target core temperature was achieved at a lower surface temperature, with less surface drying and charring. The propane gas consumption when using the longer-wavelength infra-red source was reduced by 55% over that for the shorter-wavelength, higher-energy source.

Using vacuum alone was not enough to completely dry the food. Far infrared radiation provided the external heat source for continuous water evaporation.

At the 70W FIR heater power level, rehydration yielded fresh-like properties of the Welsh onion leaves.
Accelerated Vacuum Drying Using Far Infrared Radiation

Far infrared dryer with vacuum extractor
Comparison of effect on moisture content and material temperature by far infrared radiation and vacuum against a vacuum operation alone
Application to Drying of Scallop

Comparison of FIR vacuum drying with solar drying
Comparison of rehydration times for different drying methods
Drying of Banana Slices Using FIR and Superheated Steam


- Low-pressure superheated steam with far-infrared radiation (LPSS–FIR) was investigated as a novel drying method to shorten the drying time.

- LPSS–FIR at 80°C was found to be the best drying condition with a good compromise between drying time and colour of the product.
Drying of Banana Slices Using FIR and Superheated Steam

Drying curves of banana slices undergoing LPSS–FIR drying
Dehydration of Yam Slices Using FIR-assisted Freeze Drying

- The optimum drying processing could be established at 50 mm distance from the FIR plate.
- The drying temperature was controlled within the range of 34–37°C and slice thickness maintained at 7–8 mm for FIR-assisted freeze drying of products.
Dehydration of Yam Slices Using FIR-assisted Freeze Drying

Response surface of rehydration ratio as related to plate temperature and slice thickness
FIR for Surface Decontamination of Strawberry


- Post-harvest heat treatments have recently received much attention as a means to prevent fungal spoilage of strawberry during shelf life.

- FIR heating achieved more uniform surface heating than air convection heating, with a maximum temperature well below the critical limit of about 50°C at the same average temperature.
FIR for Surface Decontamination of Strawberry

Time–temperature profiles of the surface and center temperature of a strawberry during cyclic FIR heating
End – Thank You