TECHAPPLICATION

Food Processing Using Microwaves

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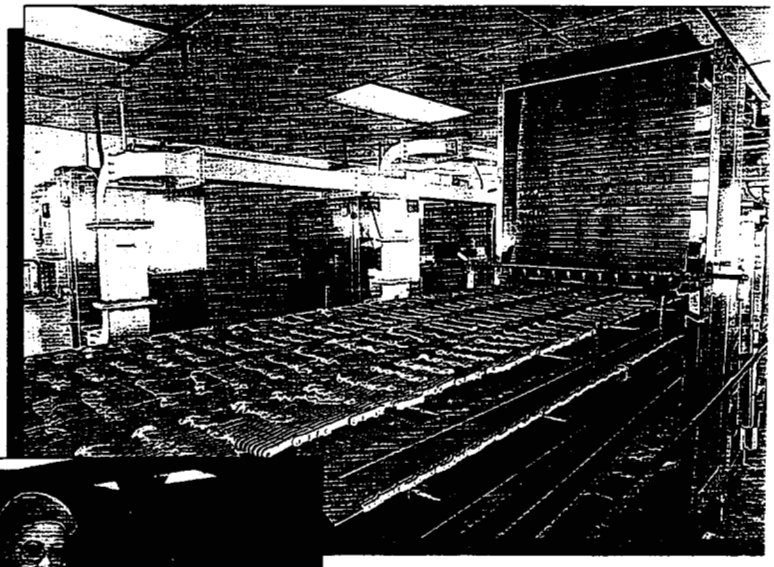
Food processors who want to improve throughput and quality without expanding their physical plant should consider adding microwave cooking units to their processing lines. Such a desire to improve productivity to keep up with increasing customer demand led Purity Group's bacon packing plant to pursue more efficient production methods.

Purity manufactures precooked bacon to exacting specifications for fast-food restaurants, prepackaged food manufacturers, and the military. Some customers want a completely finished, crispy bacon, while others want to finish cooking the bacon at their own facility. Once precooked, the strips are either vacuum-packed and refrigerated or canned and then shipped to the customer. The rendered fat is sold to pet-food manufacturers for use as a flavoring.

The advantages of precooked bacon have boosted demand:

- Precooking shrinks three pounds of uncooked bacon to one, reducing freight costs as well as customer preparation time.
- Precooked bacon requires 50% less storage space and reduces the disposal problem for waste fat.

In an effort to meet increasing sales, Purity Group's bacon packing plant turned to microwave cooking.



Purity's bacon emerges from the microwave oven, uniformly cooked to the desired degree of "doneness." Microwave energy is generated by six 50-kW transmitters and sent to the cooking cavities through the rectangular wave guides visible in the background.

A packer places cooked bacon on parchment prior to packing.

Purity sliced bacon slabs onto a continuously moving conveyor belt. Infrared heaters on either side of the conveyor belts cooked the sliced bacon. These large, hot conventional ovens could only cook about 80,000 strips of bacon a shift and could not keep up with customer orders. In addition, grease splattering onto the hot, exposed heating elements occasionally started fires and cleaning was difficult and time-consuming. Nightly cleaning required two employees per line for a full shift.

Purity looked for alternatives and decided that microwave cooking was the answer.

In 1985 Purity added its first microwave line and found that it increased throughput, decreased energy costs, and improved uniformity of the finished product. Today Purity has two microwave process lines and runs two shifts per line per day. Each line has three process oven cavities with two 50 kW microwave transmitters each for a total of 300kW of power. Each line can produce 175,000 strips of bacon for a total of up to 700,000 strips of cooked bacon per day.

The slicing, cooking, and packing process follows the same steps as before except that the microwave line required replacement of the old stainless-steel conveyor with "microwave invisible" polypropylene conveyor belts. Since the polypropylene belt is smoother with smaller links, cooked bacon is removed more efficiently, further helping to boost productivity.

A single conventional oven is still in use for round bacon because a customer prefers the better browning it gives.

Results: Improved Throughput and Uniformity

Faster Cooking: Microwave ovens have reduced the average cooking time of a bacon strip from seven minutes to a minute and a half.

Increased Production: The microwave system increased production by 218%, enabling Purity to keep up with customer demand.

Lower Labor Costs per Strip: By increasing productivity and keeping labor costs the same, Purity reduced the labor costs per strip by 54%.

Energy Savings: One microwave line cooks more bacon than two conventional lines and uses 40–50% less electricity per strip.

Improved Uniformity/Less Rework: Bacon not meeting a customer's specifications must be sent back to be cooked further or not sold as a #1 product. The microwave system distributes the heat more uniformly throughout the product and gives Purity better control over the cooking process. The result is a more uniformly cooked strip and more consistency from strip to strip. Rework has been reduced by over 50%.

Reduced Cleanup Time: The smooth stainless steel sides of the microwave ovens clean more easily than the coils, nooks, and crannies of the conventional ovens. Now a single worker cleans a microwave line in 4.5 hours; nightly cleanup time has been reduced by 72%.

Reduced Cleanup Cost: Cleaning the microwave line required a less caustic detergent which is also less expensive.

Improved Safety: Exposed heating elements in the conventional oven offered a high potential for fire. With the microwave unit, danger from fire is no longer a problem. Cleanup is safer too since smooth surfaces are less hazardous to clean than the convoluted heating elements and supports. Interlocking access doors and passive microwave suppression tunnels securely protect workers during operation.

Less Downtime: The conventional oven required 40 to 50 minutes to heat up before the line could start and 1½ hours to cool before it could be cleaned. On windy days cooking was erratic, necessitating line shut downs. On extremely cold days the ovens could not even reach cooking temperatures. Poor weather does not shut down the microwave line.

Added Flexibility: Should one microwave unit go down, power can be increased to the other five in the line to maintain line speed and the desired degree of "doneness."

What Did It All Cost?

The total equipment cost in 1986 for one line with three cavities, six microwave transmitters, and the conveyor system was approximately $750,000.

The Bottom Line: Greater Efficiency

Because of their increased capacity, Purity has been able to accept more orders. And the bacon they produce improved in quality and overall appearance. Purity anticipates adding a third microwave line and additional sales staff in the near future.

Other Microwave Applications

In the food processing industry, microwaves are used to temper frozen meat, fish, poultry, or fruit; defrost frozen bulk products; cook meat, poultry, and fish products; and dry such foods as cereals and pastas. Microwave technology also has applications in the manufacture of rubber, pharmaceutical, ceramic, and wax products.

Company Profile

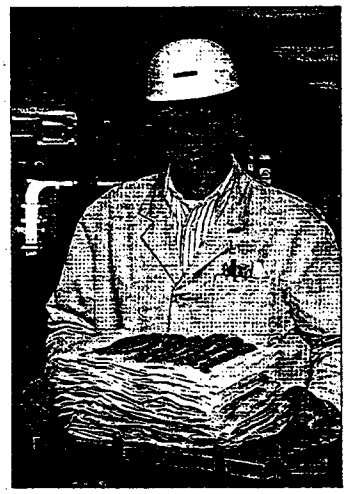
Purity Group, Salisbury, Maryland

President—William Richard Margerm

100 employees

Slices and cooks bacon for restaurant chains, prepackaged food manufacturers, and the military.

Company philosophy: Total Quality Control is our way of business.



Plant Manager Noel Hall proudly displays a small part of the shift's production.

John Shelton and Laura Cahill of Delmarva Power, which provides electric service to Purity Group, made valuable contributions to this issue.

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