



MICROWAVE COOKING OF BACON

2016



MICROWAVE COOKING OF BACON

A Short History

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- The 1970s
 - Continuous microwave precook bacon equipment introduced in the late 1970s
 - Early operations were niche operations producing custom product for HRI customers
 - The equipment was relatively crude
 - Slicing was done at slow speeds – approximately 200 slices/minute
 - Available microwave power – 100kW
 - Packaging was done by hand

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- The 1980s
 - By the mid-1980s major food companies took an interest in the process and requirements grew
 - Equipment manufacturer meet the challenge by introducing:
 - High speed 3-lane slicer – 750 slices per minute
 - More powerful microwave systems – 300kW
 - Some packaging area automation – conveyors

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- The 1990s
 - Microwave precook installations reach 50 worldwide
 - Equipment manufacturers now offer
 - Slicing equipment operates at 1,100 slices per minute
 - Microwave power increased to an average 450kW
 - Automatic case packing

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- The 2000s
 - Precook bacon sales spike up dramatically
 - Retail packaged bacon introduced to the public
 - Widespread acceptance in the fast food industry of using precooked bacon as a flavor enhancer
 - Precooked slices and bits
 - Microwave precook installations reach over 100 worldwide
 - Equipment manufacturers now offer
 - Slicing equipment operating up to 2,000 slices per minute
 - Microwave power exceeds 800kW per system and ventilation optimization introduced
 - Slicing, microwave and packaging equipment controls integrated into more unified system

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- Today
 - Retail annual bacon sales we're over US\$2 billion in 2006 (#)
 - But in 2013, bacon sales climbed 9.5% to an all-time high of nearly \$4 billion (^)
 - Forty-four percent of in-home bacon usage is precooked (*)

(#) Meat and Deli Retailer Year 2006 Special Report on Bacon

(^) "Bacon sales sizzle to all-time high" MarketWatch, April 18 2014

(*) National Pork Board Research

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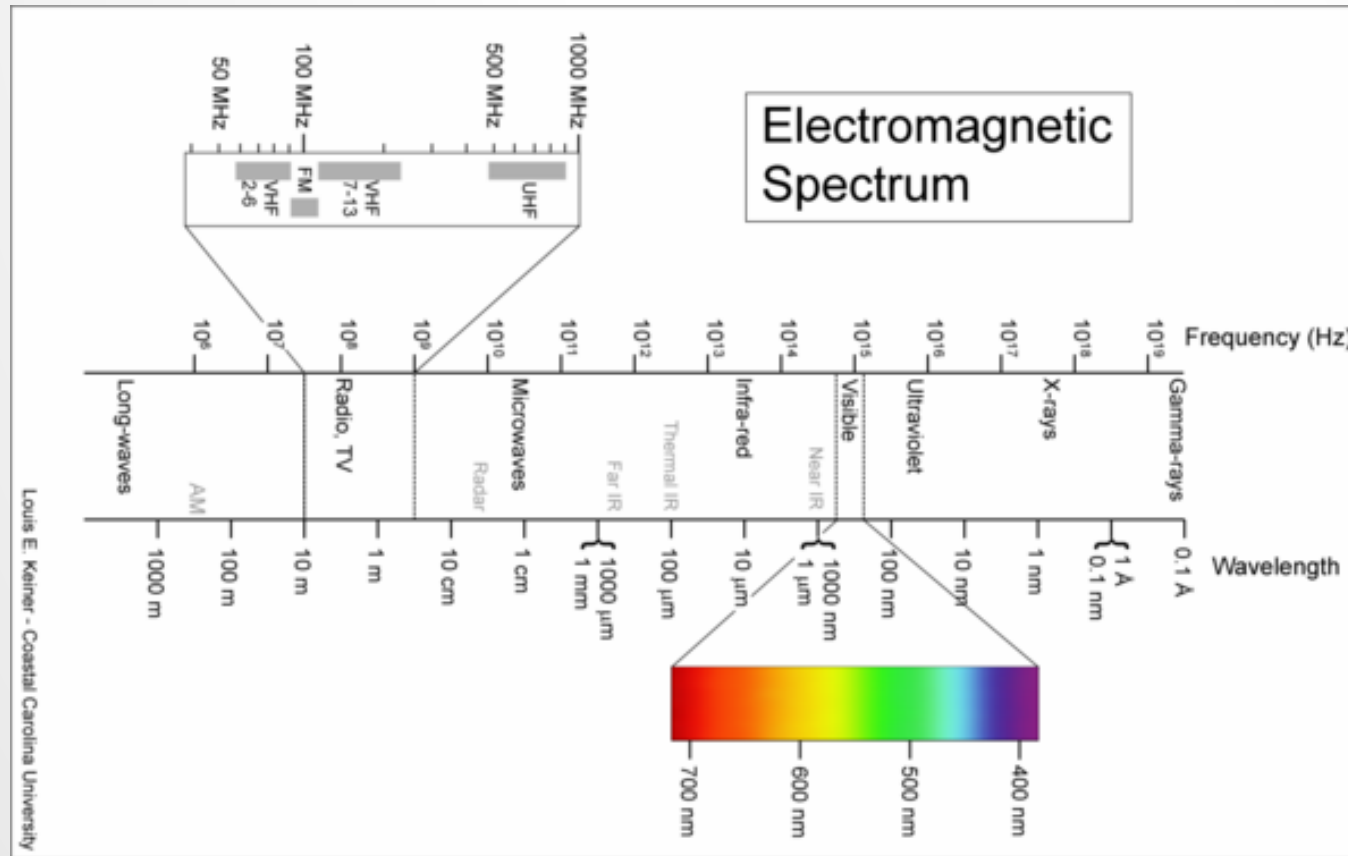
Microwave Heating 101:

The Nature of Microwaves

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- Microwaves refer to the electromagnetic waves in the frequency range roughly between of 30 to 300,000 MHz
- Electromagnetic waves are electrical and magnetic energy moving together through space
- Microwaves can pass through materials like glass, paper and some plastics and ceramics, absorbed by water and other biomasses, and reflected by metals

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Louis E. Keiner - Coastal Carolina University

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Microwave Heating Principles

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- The alternating electromagnetic field within a microwave “cloud” leads to excitation (rotation & collision) of dipolar molecules and ions with materials
- The molecular friction created by this rapid movement—915 million times a second at a standard microwave frequency—generates heat and caused temperatures to rise

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Microwave Oven Components

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All microwave ovens are comprised of:

- Power supply
- Magnetron
- Applicator
- Stirrer
- Waveguide
- Suppression system
- Control box

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75kW Microwave Power Supply (Generator or Transmitter)

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75kW Magnetron



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Microwave Cooking Applicator 04/12/2005

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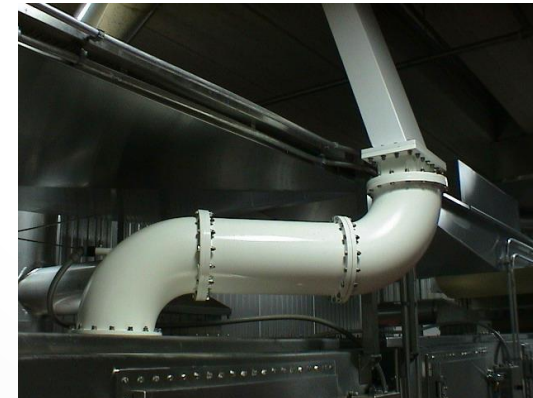


Radaring

Microwave Stirrers



Rotawave



Polarizer

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Waveguide for 915MHz Frequency

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Suppression System

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Microwave Control Center

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What is precooked bacon?

- By USDA definition, bacon which has been cooked to a finish yield of 40% or less
- In other words, if 1 pound of raw bacon is cooked to 0.4 pounds or less, it then may be labeled as fully cooked
- Most precooked bacon is considered shelf stable because water activity is low enough to prevent outgrowth of pathogenic organisms

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Precook markets

- HRI
 - Case counts of 300 slices
 - Largest users are fast food restaurants
 - Used on sandwiches and hamburgers to add flavor
 - Cooked bits sold in bulk for pizza and salad toppings
- Retail
 - Packages of 12 to 20 slice counts
 - Usually found in the dairy/deli sections of the grocery
 - Positioned as a convenience food

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Why precooked bacon with a microwave?

- Easy to do
- Quality not compromised
- By-products result in value not waste
- Profit

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Bacon provides very good conditions for rapid microwave cooking

- It's thin in cross-section
- It contains dissolved salts (ionic compounds)
- It's got plenty of water (dipolar molecules)

A 100g slice of raw bacon contains:

- 40 g of water
- 45 g of fat
- 833 mg of salt

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Quality

- Texture closely controlled
- Taste not compromised
- No burning or curling of the edges

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By-products

- With the exception of water removed, nearly all the by-products are recovered and sold or used
- Fat is collected and sold as flavoring ingredient, to pet food and cosmetic processors and/or used for supplemental power generation
- Bacon end and pieces and rejected slices
 - Ends and pieces can be fully coked for use as bits and pieces
 - Rejected slices are reduced in size and sold as bits and pieces

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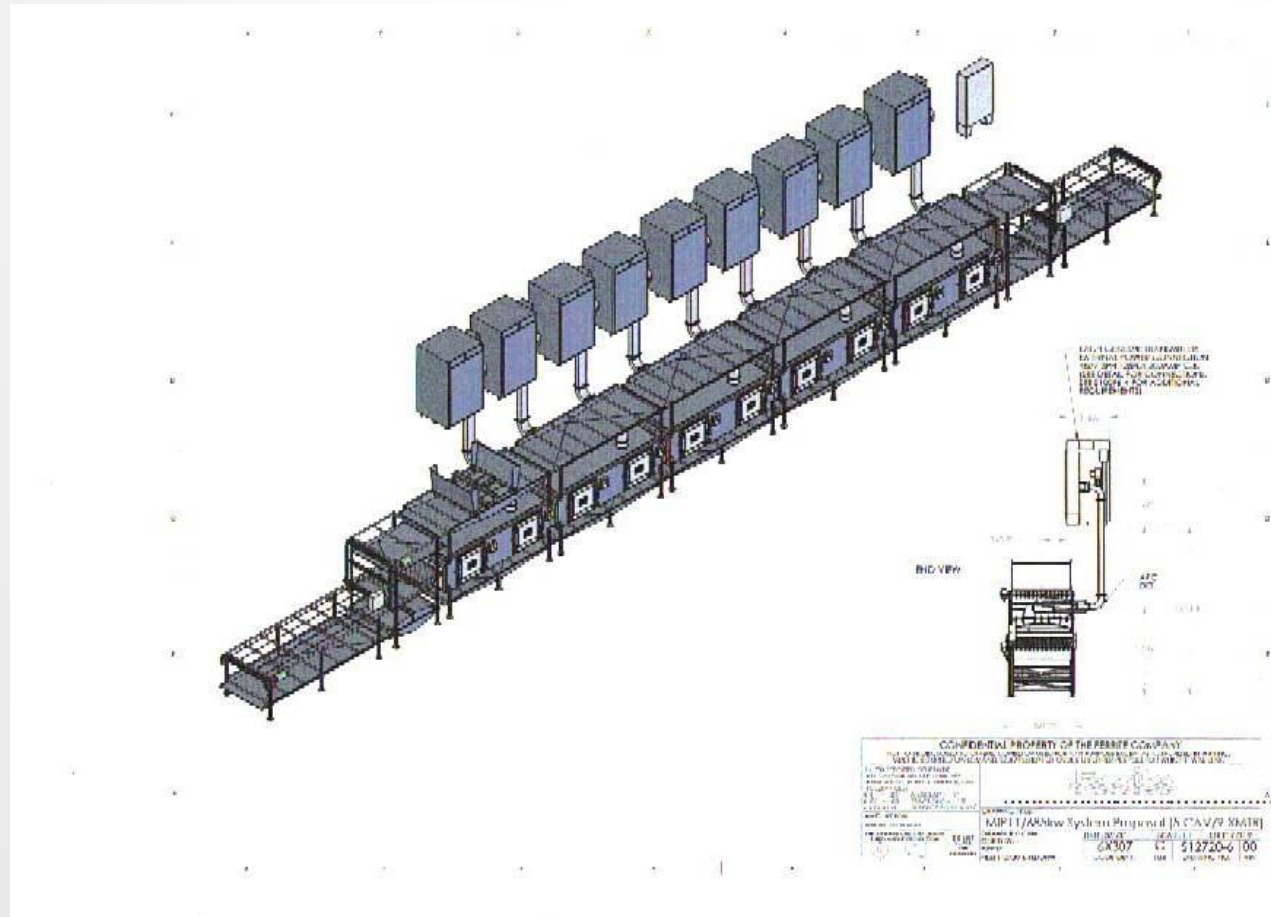
Profit

- The use of microwaves to process fully cooked bacon has been shown to be more cost effective than other methods that have been or are being used

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Microwave Bacon Cooker

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Microwave Cooking System

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High Speed Slicer

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Pack-off Area

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Microwave Transmitters

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Raw Bacon Entering Microwave

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Cooked Bacon Exiting Microwave

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Processing Variables

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Microwave processing variables

- Belly temperature
- Slice thickness
- Number of slices per minute
- Product density on belt
- Belt speed
- Microwave power
- Ventilation

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Microwave processing variables

- Belly temperature
 - Established in cooler prior to slicing
 - To ensure proper slice and blade life
 - Too warm
 - Results in poor slices
 - Too cold
 - Dulls slicer blade
 - Causes slices to curl

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Microwave processing variables

- Slice thickness
 - Set on slicer
 - To meet customer requirements
 - Usually set at slices per inch of belly

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Microwave processing variables

- Number of slices per minute
 - To meet production rates and proper cook
 - Function of microwave power and effective cavity length

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Microwave processing variables

- Product density
 - Function of belt speed, number of slices per minute and slice thickness

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Microwave processing variables

- Belt speed
 - Important to manage to maintain proper slice spacing into the oven
 - Balance between number of slices per minute and microwave power

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Microwave processing variables

- Microwave power
 - Established to achieve target yield
 - Color

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Microwave processing variables

- Ventilation
 - Proper ventilation effects energy efficiency
 - Effects uniformity of cook

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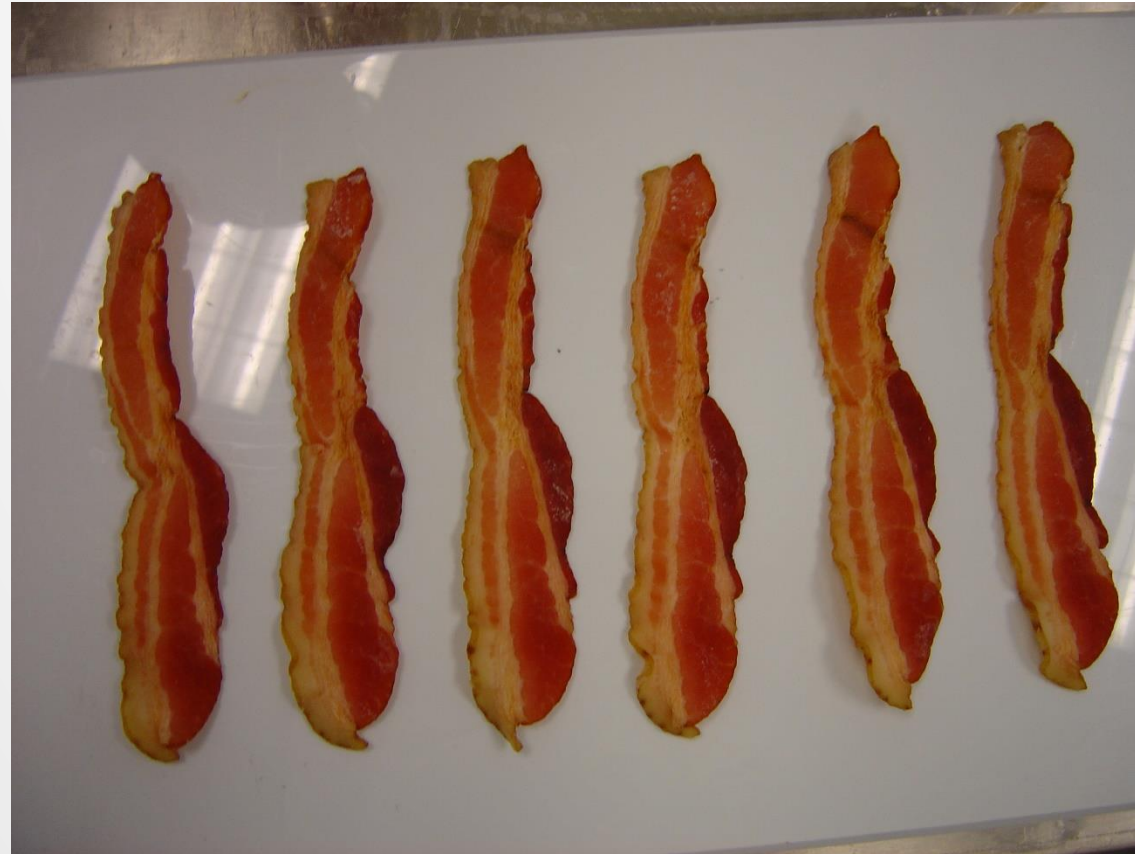
Quality Control Parameters

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Quality parameters

- Cooked yield percentage
 - Determined by weighing product prior and after cook
- Cook temperature
 - Thermometer used
 - Measured as fully cooked bacon exits the oven
- Water activity
 - Tested using standard lab equipment
 - Important for shelf stability
- Product appearance
 - Grease removed via air knives at exit end of oven
 - Targeted color uniformity

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High Quality Microwave Cooked Bacon

We thank you for your time and interest!
Please send any questions and comments to:

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