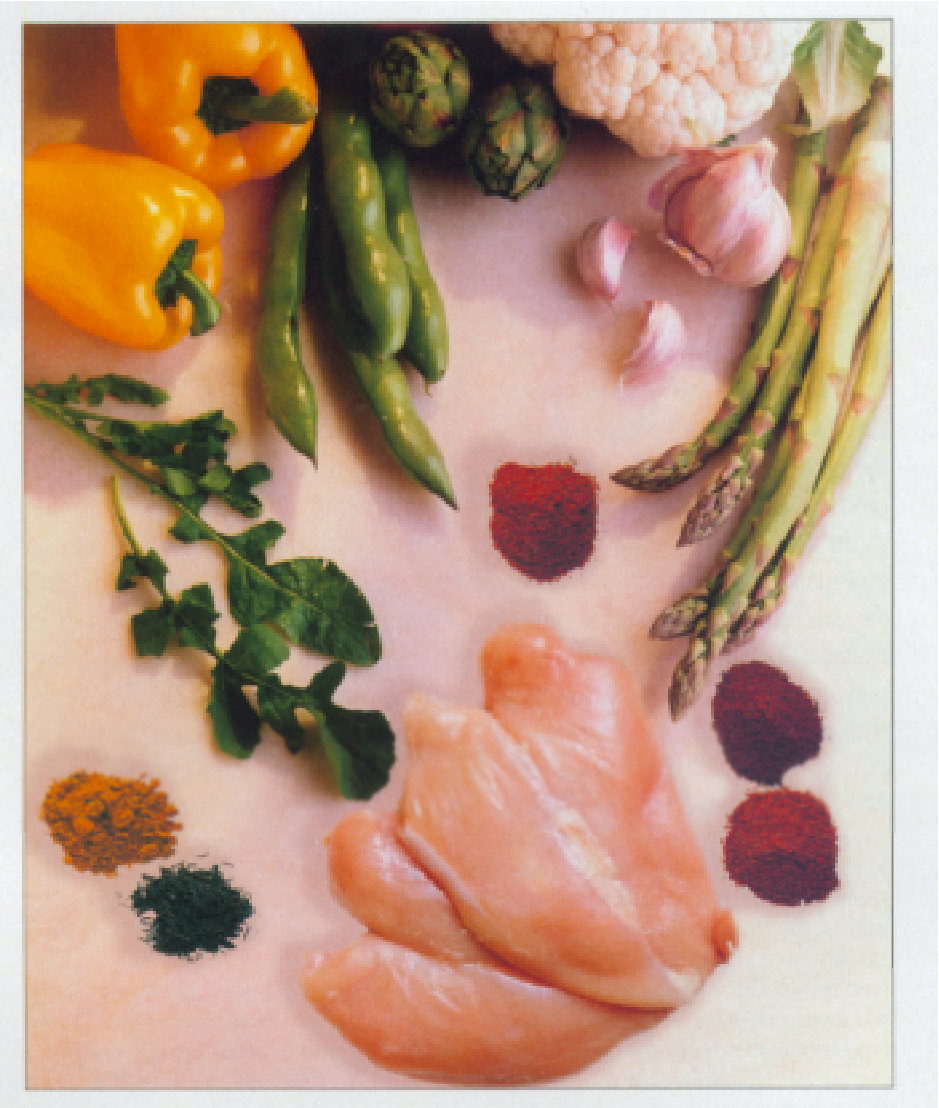
Perspectives:
Irradiating the Future



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Foods contaminated with pathogens cause hundreds of thousands of illnesses per year in the United States. according to statistics by the Centers for Disease Control and Prevention (CDC) Atlanta. These statistics also note that on a yearly basis. 5,000 people die from foodborne diseases. Food companies have recalled millions of dollars worth of products due to contaminated supplies.

Here's where food irradiation can help. By irradiating foods. harmful pathogens can be practically eliminated. including *Listeria, Salmonella* and *E. coli.* Parasites and insect pests, which can cause problems with fruits and vegetables, also can be controlled through the irradiation process.

The USDA and the FDA have approved irradiation use on many foods. including fruits, vegetables, spices, and most recently, raw meats and poultry. The USDA also is expected to approve irradiation of "ready-to-eat" meats in the near future. With the effectiveness of irradiation to penetrate the entire package, manufacturers may look at this technology as a way to improve food safety, especially since other food processing technologies cannot get to the center of already-packaged food. Irradiation is a valuable safety tool with raw meat as well, but its use in this application has been limited, since with raw meat, the subsequent cooking process can kill the pathogens (unless one eats meat cooked medium to rare).

Three methods —one goal

Dosage levels for the irradiation process vary. ranging from 0.1 kilogray (kGy) to destroy parasites and pests, to 3.0 kGy for the destruction of pathogens. Presently, three irradiation processes have FDA/USDA approval. One method uses electron beam, or

Although its use in raw meats has been somewhat limited, irradiation has been approved for utilization on these and other food products, and usage approval on ready-to-eat meats is expected shortly.

"e-beam" technology, which involves equipment that produces a curtain of high-energy electrons. Food is processed on conveyors passing through the curtain of electrons that eliminate the pathogens or pest from the food product. These electrons are the same as the electrons created in electrical-generating plants. Televisions work on the same principle as an electron-beam machine. The primary difference is the power used to accelerate the electrons within the vacuum tube. TV's have a power of about 30,000 volts, whereas electron-beam accelerators for food have a power of up to 10 million volts. In a television, the electrons strike the fluorescent screen, creating different colors for the picture; the electrons do not have enough energy to escape past the screen. With food-based use, the electrons have such high energy (speed) that the electron curtain comes out of the machine and food can be penetrated to a depth of several inches.

E-beam technology recently was used by the United States Postal Service to deal with the terrorist anthrax scare. Though the dose level selected for anthrax was about twenty times higher than the level required for foodsafety. the premise of the function was the same: using electron beams to eliminate pathogens from solids.

The second irradiation method utilizes X-rays. X-ray technology is an outgrowth of e-beam technology and uses the same technology found in hospitals and dental offices. X-rays are produced when the electrons strike a thin plate of metal, producing X-rays that come out the other side. The X-ray radiation then penetrates the food as it passes by on a conveyor, destroying the pathogens. And though X-ray technology has a relatively low efficiency in producing X-rays because of its high cost, X-rays penetrate several times deeper into food as compared to e-beams.

Though e-beam and X-ray technologies are referred to as irradiation, this reference should not be confused with irradiation from radioactive sources. Neither X-ray nor e-beam irradiation involve nuclear radiation or radiation produced from radioactive materials.

However, a third method to irradiate foods does use a radioactive source, utilizing the gamma rays emitted by these materials, typically cobalt or cesium. Even though the source of irradiation is from a radioactive substance, the food that has been irradiated does not have any residual radioactivity. The radioactive source is kept in a water bath (absorbing all of the radiation) inside a vault until the food is ready for processing. The source is then brought out of the water and the food is brought into the vault and moved around the source for exposure. The process can be either batch or continuous. Once the food receives the required dose, the product is removed from the vault. Compared to e-beam and X-ray methods (where the exposure time is seconds), gamma irradiation typically takes several hours. This longer exposure time is seen by some as a disadvantage compared to e-beam use. On the other hand, gamma irradiation allows entire pallets of food to be processed intact.

Moving forward

It's important that consumers get proper information in order to make intelligent decisions regarding the purchase of irradiated food products. The government has made it easy for consumers to tell whether products have undergone irradiation. All irra-


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diated products must be labeled as "treated with radiation" or "treated by irradiation." The USDA has approved a "radura" symbol that must be present on all irradiated food.

Like many new technologies irradiation has its critics. However, organizations that have endorsed food irradiation include the CDC, FDA, USDA, World Health Organization (WHO). New York, the American Medical Association (AMA), Chicago. and the Mayo Clinic, Rochester, MN.

Critics of food irradiation often attack the issue of radioactive irradiation, voicing concern about residual nuclear radiation. However, as explained. none of the three processing methods leave any type of radioactivity in foods.

Another complaint is that the irradiation process reduces the level of nutrients. Studies published in The *Journal of Food Processing and Preservation* 2:229 (1978) noted that in 1 kg of cooked chicken, vitamin A (IU) measured 2,200 in the control sample and 2,450 in the irradiated sample. Vitamin E measured 3.30 mg in the control sample versus 2. I5 mg in the irradiated sample. and Riboflavin measured 2.10 mg in the control sample, while measuring 2.25 mg in the irradiated sample. This and other studies have shown that any nutrient reduction is similar to, or in many cases, less than, the nutrient reduction that results from cooking.

A third complaint is that the FDA did not require toxicology studies before approving irradiation. Because no toxicology studies were required, the critics charge that many harmful chemicals may be byproducts of the irradiation process. However, food irradiation has been studied and reviewed for more than 40 years, and after considering these issues before approving food irradiation the FDA concluded that no chemicals are formed that differ in character or concentration versus what can be expected from the ordinary cooking of foods.

The future

Food irradiation will not, in itself, eliminate or solve all food-safety concerns. However, as a safe and effective tool, it has a definite role to play and is used more widely for certain foods that can be prone to contamination.

Irradiation is a powerful food-safety tool for manufacturers, strong enough to penetrate food to depths of several inches with the ability to eliminate pests and pathogens in already-packaged food.

Recently, a pair of home-delivered food product companies, Omaha Steaks, Omaha, NE, and Schwan's Foods, Marshall, MN, successfully introduced irradiated food products for the in-home delivery market.

With the likely acceptance of irradiation for use in ready-to-eat meals, irradiation technology will continue to grow in interest with manufacturers. And with the increased focus on security and safety for the food supply, new technologies, such as irradiation for food pathogens and pests, will be at the forefront. ▮

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