Irradiated poultry promises longer shelf life

Only the Netherlands has given unlimited clearance for sale of radiation pasteurized poultry. Yet recent developments indicate that irradiated poultry soon will move in international trade on a big scale. U.S. approval may come late this year, according to food irradiation experts at Army's Natick Laboratories. Final confirmation of safety awaits FDA approval.

By Ari Brynjolfsson, Radiation Preservation of Food Division,
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Q. Dr. Brynjolfsson, what is irradiated poultry?

Radiation used for preserving poultry is closely related to light, and it kills bacteria in much the same way. Light, especially ultraviolet light from mercury lamps or sun lamps, often is used by industry for surface sterilization. For sterilization of poultry and meat, light is practically useless, however, because of its limited penetration, which makes it possible for bacteria to hide just under the surface. X-rays and gamma rays, on the other hand, penetrate a whole turkey or a 12" thick case of poultry. Bacteria no longer can hide under the surface, and the food is sterilized easily. This method sometimes is named "cold sterilization method" because the energy used is so small that the product does not heat up appreciably.

Q. What is the process?

It consists of moving product through an irradiation facility, just like blast-freezing consists of moving product through a blast freezer. Think of cut-up chicken parts on a tray, wrapped in plastic ready for the supermarket. The wrapped chicken, usually iced, is packed in a carton which rolls on a conveyor out to the cold storage for subsequent shipment. Today, some processors send the cartons through a blast freezer before entering the cold storage rooms. It is at this juncture that irradiation is done. We may think of replacing the blast freezer with an irradiation unit. Instead of a stream of cold air as in a blast freezer, the cartons will get a stream of radiation, in much the same way your handbag is x-rayed before you board a plane. The irradiation process is simple and reliable. The medical industry has switched almost completely to sterilization by irradiation, because in most cases, it is the simplest, most reliable, and least damaging method. Most poultry processors today could install an irradiation unit at the end of their processing plant, just as many of them a few years back installed a blast freezer at the end of their processing line. Processors can buy the finished irradiation units, installed at their plants, from companies that specialize in their manufacture. That's the way medical companies have converted to irradiation sterilization.

Q. Why should we be thinking about irradiation?

We should irradiate poultry because:

a) Small amounts of irradiation (pasteurization) can free poultry from common spoilage microorganisms, such as pseudomonas and also from salmonella, E-coli, and other pathogens that often remain on poultry, in spite of hygienic handling.
b) Irradiation saves energy when compared with other methods that obtain the same objectives.
c) Irradiation will help boost poultry exports. It makes possible the exporting of fresh and frozen salmonellae-free poultry.
d) Irradiation makes it possible to produce a great variety of ready-to-eat chicken products by using sterilizing amounts of radiation, and thereby gives consumers a greater variety of good products.

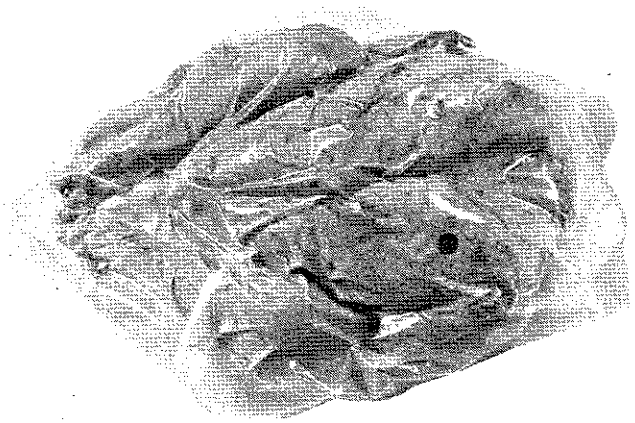
Q. What can it do for the poultry industry?

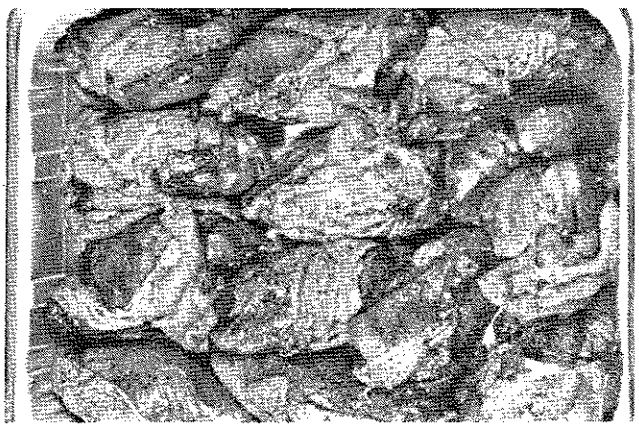
The American poultry industry will adapt easily to this new technology. The reason: Because U.S. poultry plants are larger than those abroad, and because our distribution system already is more advanced than that of overseas countries.

Irradiation will help industry adjust to market fluctuations, and reduce the number of shipments to stores. It also opens up the possibility of developing a great many highly acceptable ready-to-eat items which don't require refrigeration. The fact that refrigeration is not needed simplifies transportation and marketing of poultry items and saves energy.

Q. We understand it's being used overseas. Is that true? Where is it being used, and what results are being achieved?

No country is irradiating poultry on a large industrial scale. Only one country, the Netherlands, has given





Whole turkey (left) and chicken were sterilized by radiation at U. S. Army Natick Laboratories. The first food irradiation process most likely to be approved is pasteurization which raises the product temperature less than 1 degree C.

unlimited clearance (1976) for sale of radiation pasteurized poultry. However, recent developments make it likely that irradiated poultry soon will move in international trade on a big scale. An unconditional approval of irradiated poultry was recommended by a toxicological "Expert Committee on Food Irradiation." At the request of the United Nations World Health Organization, Food and Agricultural Organization, and the International Atomic Energy Agency, that committee evaluated the wholesomeness aspects of several irradiated food items, including irradiation pasteurized poultry. The committee's recommendation is a very important international recognition of the wholesomeness of irradiated poultry. Subsequent to WHO acceptance, the influential Codex Alimentarius Commission began to proceed most speedily to obtain international acceptance of: (a) "General Standard for Irradiated Foods," and (b) "Draft Code of Practice for Operation of Radiation Facilities used for Treatment of Foods." Those two standards already have moved through 8 steps of the 11-step procedure. After the ninth step, irradiated poultry will be permitted into international trade.

Q. How soon might we get a go-ahead in the U.S.?

The important approval at the ninth step of the Codes Alimentarius Standards may come as early as December 1979. This approval will signal the start for movement of irradiated poultry on a big scale in international trade. It takes industry and trade usually about 10-25 years to make full use of a new technology. Introduction of poultry irradiation will be no exception.

These above-mentioned international clearances are only for pasteurization of iced or frozen, eviscerated raw poultry. Clearance of sterilized poultry products, on the other hand, will not be obtained before the present studies are completed in 1982, which, if all goes well, should result in FDA clearance in 1983.

In 1982, the World Health Organization's Expert Committee on Irradiated Foods again will consider clearance of many more irradiated foods. Following that, the Codex Alimentarius will move for international acceptance in 1983. We then will see irradiated foods in international trade — about 1990. Before then individual countries can clear irradiated foods and countries can make bilateral or multilateral agreements.

Q. Is irradiated food totally safe?

It is our belief that irradiated foods are safe; however, final confirmation of this belief must await approval by FDA of current tests of wholesomeness of chicken. When these foods are marketed, it will be clearly indicated that they are irradiated. To me, that label will be a sign of quality, just as the irradiation sign on surgical devises is a sign of quality to the medical doctor.

However, just because food has been irradiated, does not mean it is safe, unless we also are assured that the process has been controlled, inspected and approved by reliable individuals or an authority. We must know that someone has taken care of other factors important for food quality and food stability. Radiation only kills bacteria and parasites, but there is much more to preparing high quality food.

Q. What about economics of irradiating poultry?

Irradiation reduces hazard from salmonella and E-coli; it can facilitate distribution, reduce losses, facilitate exports and reduce energy cost. The consumer also may prefer the product when he or she finds it to be more convenient to use. Industry also will have the opportunity to develop a great many new items. These beneficial effects are difficult to estimate, and usually are not known until after many years competition with other methods.

Costs of irradiation processes are easy to evaluate. Cost of pasteurization is on the order of a half cent per pound for an industrial scale operation, and about 4¢ per pound for sterilizing ready-to-eat items. If the ready-to-eat item is irradiated in the frozen state, a better quality product is obtained. Freezing cost adds about 3¢ a pound. These irradiation costs are similar to any other analogue processing cost. The bigger the plant size, the smaller the irradiation costs per unit of product. Competition in the U.S. already has forced processors to increase the size of their plants well beyond 50 million pounds a year. U.S. processors therefore, already are well equipped to adopt this new technology.

Sailor-scientist thrives on irradiated chicken breasts

Hot on the trail of the commercial aspects of food irradiation is Dr. Martin Welt, president of Radiation Technology, Rockaway, NJ, whose laboratory includes a machine that can pasteurize a quarter of a million pounds of chicken a day. That means double shelf life for standard ice-pack or deep-chill.

Dr. Welt, a nuclear reactor pioneer, formerly with the Atomic Energy Commission, has filed four petitions with FDA for permission to use the irradiation equipment and process. One of them is for poultry use.

FDA has made a preliminary response, he told Turkey World, which presents no major technical barriers. FDA agrees, he says, that the technique of irradiation offers no hazards in the areas of toxicology, chemistry, microbiology, wholesomeness and environmental impact.

He has been given to understand he may get a preliminary clearance for poultry use by "early summer," but others feel FDA will not move that rapidly into publication of proposed regulations for use of the method.

By way of an aside, Radiation Technology supplied "radappertized" precooked chicken breasts and other foods to a scientist who made an around the world trip in seven months without a refrigerated product on board. That person, Dr. Sims, is chief medical officer for the Fiji Islands and has told Dr. Welt that his own health at the end of the voyage offered eloquent testimony that there was absolutely no loss of vitamins and other nutrients in the sterilized foods.

Food that has been irradiated has been fed to hundreds of thousands of rats, cats, dogs and other laboratory animals, Dr. Welt said, without any ill effects. "They've eaten more irradiated food, perhaps, than all other foods combined in a given year."

So confident is he that FDA will clear his petitions that Welt has begun to build three radiation units that will handle various kinds of foods in large volume. One of these would be capable of irradiating a million pounds of poultry a day.

The scientific name applied to the process, if pasteurizing product, is "radicidation." If sterilizing product, which requires about 15 times as much radiation, the process is called "radappertization."

At more simple levels, a product is "irradiated" and the equipment that does it is "radiation" equipment. Product is flooded with invisible gamma rays, inside a fail-safe chamber. It could be likened to food left in an X-ray room while the operator stands outside in safety to operate the radiation guns.

Some fact sheets on the nutritional, energy conservation and export potential for irradiated foods are available to processors. Write Radiation Technology Co., Lake Denmark Rd., Rockaway, NJ 07866. The telephone number is 201/627-2900.

Q. Is irradiation a possible substitute for nitrite in poultry and red meat?

Yes, irradiation is an excellent substitute for nitrite or any other chemical additive, if the chemical serves only to inhibit microbial growth. For instance, our tests showed that to most consumers, bacon without nitrite is just as good as bacon with nitrate. To prevent the botulinum hazard, we could irradiate nitrite-free bacon. Some bacon connoisseurs will miss the nitrite flavor. But, if we cure bacon with 20 ppm nitrite, instead of 120 ppm, even "expert" bacon tasters will not notice the difference. Irradiated, nitrite-free bacon contains no nitrosamines. Irradiated bacon with 20 ppm added nitrite has much less nitrosamines than fully cured bacon. A small amount of nitrite is necessary to give ham its cured flavor and color (without the nitrite, ham looks and tastes like pork). It is possible, however, to reduce the amount of nitrite to 25 ppm and 25 ppm nitrite in irradiated ham, compared with commercial use of 156 ppm of nitrite. Nitrite cure in poultry meat sausages is essential to some connoisseurs. To others, irradiated sausages without nitrites, but otherwise containing the same cure and spices, taste equally good.

Q. What does radiation do to the taste and color?

Irradiation, improperly done, causes unacceptable flavors. Properly done, irradiation flavors are reduced or eliminated. To a few, irradiation adds preferred flavor characteristics to meat.

Most of the present food irradiation technology, however, aims at eliminating completely the irradiation flavor. Pasteurization of raw chicken uses small amounts of radiation (about 200 kilorad) and flavor is not then a problem. (Some experts are able to pick up, just after the processing, an irradiation odor, but by the time the pasteurized poultry is on the market, the odor is gone.) At sterilizing doses of radiation, off-flavors are a problem. It is important to reduce or eliminate oxygen by vacuum packaging and heat the product to about 160° F before irradiation to inactivate enzymes that otherwise will destroy the food if stored for a long time at room temperature. Further improvements are obtained by irradiating at low temperatures. In this way, a series of highly acceptable ready-to-eat prodcuts has been developed by the U.S. Army. The astronauts have eaten these foods as delicatessen items in space.

Q. How much research is being done in U.S.?

Currently, research in the U.S. is limited to government supported wholesomeness studies on irradiated chicken. Those studies are done mostly on contracts. In-house studies at the U.S. Army Food Laboratories focus on radiation chemistry and food technology. These chemical studies, both in-house and on contracts with universities, are for broadening the FDA clearances. The ultimate goal is to have food irradiation cleared as a process.

Q. What are the implications of irradiation for the poultry industry?

The poultry industry will continue to operate much the same way as it does today. A few companies will introduce low dose irradiation of raw, fresh, refrigerated, cut-up poultry to extend shelf-life from about 10 days to 20 days. A few companies also may export frozen, low-dose irradiated, salmonella-free poultry. Companies which have irradiation facilities also could produce enzyme inactivated chicken rolls irradiated with low dose for increased flexibility in marketing the product. Later, ready-to-eat sterilized dishes of chicken will be marketed. These changes will be gradual and coexist with present methods for a long time. The consumer will have a greater variety, the industry greater flexibility to meet market fluctuations, and the grower will have more stable production. The increased stability will become clear when irradiation sterilization is introduced. Sterilization of ready-to-eat poultry items results in more than two years' shelf-life at room temperature, much longer than the time needed for chickens to grow to market age.

Q. Will irradiation mean the end to frozen poultry?

No. When Nicholas Appert, in 1807, unveiled thermal canning for Napoleon's army, people did not stop eating fresh foods. When freezing was introduced, people did not stop eating fresh and thermally canned food. When irradiation processing is introduced, people will not stop eating fresh, thermally canned, or frozen food. Irradiation pasteurized chicken still will need refrigeration for storage up to 3 weeks, but for extended (over 20 days) storage, or for export, pasteurized poultry will have to be frozen. Irradiation sterilized poultry products will be a new product, a speciality item. They will not need refriger-

About Ari Brynjolfsson

A rich Scandinavian accent is a tip-off to the heritage of 52-year-old Dr. Ari Brynjolfsson, chief, radiation preservation of feed division, at the Army's Food Engineering Laboratory in Natick, MA.

Born in Akureyri, Iceland, Brynolfsson earned a doctorate in theoretical nuclear physics from the University of Copenhagen's Niels Bohr Institute. Later, he studied nuclear engineering and geophysics at West Germany's University of Gottingen. Later, in the U.S., Brynjolfsson completed Harvard University's Advanced Management Program. Prior to coming to the U.S. in 1965, he worked as a geophysicist for the Icelandic Government and headed radiation research laboratories for Denmark's atomic energy research establishment.

Brynjolfsson, who became a naturalized citizen in 1970, served as consultant to the Army Natick Laboratories from 1962 to 1963. He than went back to Denmark, but in 1965 returned here to become chief of Natick's radioaction sources branch. In 1972, he was named acting director of the food irradiation program. In 1974, Dr. Brynjolfsson was appointed director of the radiation laboratory and chief, radiation preservation of food division.

The irradiation specialist is a member of numerous professional societies, including the American Physical Society, the American Ass'n of Physicists in Medicine, American Nuclear Society, the Institute of Food Technology and New York Academy of Science and Arts. He has contributed numerous articles to professional journals on such subjects as nuclear physics, nuclear engineering and food technology. He's a past editor of International Journal of Radiation Engineering.

Brynjolfsson lives with his wife and five children in Wayland, MA, near the Natick headquarters laboratories.

ation once processed, and will be particularly good for export.

Q. What will irradiation mean to ice pack and chill pack poultry?

These processes will continue as they are today. They serve us well. If the industry needs to extend poultry shelf-life to 20 days, to reduce losses because of microbial growth, to reduce transport, extend the distribution radius, irradiation gives industry a new tool that will help do the job.

Q. What are the regulatory agencies saying?

I believe the regulatory agencies, FDA and USDA, will welcome food irradiation. The Food and Drug Administration has the major responsibility for clearing the food irradiation process because food irradiation is defined by law as a food additive. When the law was passed in 1958, some people were proposing to use, as the irradiation source, nuclear reactors and very high energy (more than 24 million volt) accelerators, both of which could introduce new nuclei and radioactivity to the food. This kind of radiation would then be equivalent to a food additive. Subsequently, when this kind of radiation was abandoned, FDA continued to consider radiation as an additive. The justification for this opinion is that irradiation can cause chemical changes, and those chemical changes constitute a food additive.

Results of the numerous studies in this country and abroad are now very convincing. I believe, therefore, that regulatory agencies soon will approve the process. We should keep in mind, however, that the main effect of irradiation is to kill bacteria and parasites, but there is much more to preserving food, such as preventing enzymatic breakdown, preventing oxidation, preventing bacterial recontamination and parasitic reinfestation, and making food palatable.

Q. What are the hang-ups?

The hang-ups or resistance to food irradiation have rested mainly with people who do not distinguish between irradiation of living organisms and irradiation of the food consumed by those organisms. Many people associate food irradiation with atomic fallout and atomic reactors. When humans discovered fire, they most likely were equally terrified; and when they discovered that the fire burned them and could kill them, they were most likely scared of food exposed to fire. But, time has changed that. These critics and their concern have challenged others to strengthen the evidence for the safety of irradiated food.

Until approved by FDA and USDA, industry must hold back practical applications. The food industries "wait and see attitude" makes some legislators believe that industry is not interested. These legislators have recommended, therefore, that the governmental support of the research should be terminated. Others, more familiar with the entire subject, have supported the project adequately.

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