MYTH & FACTS ABOUT FOOD IRRADIATION

Myth

"Any commercial irradiator can be used for any food irradiation process."

Reality:

Technically true. Economically uncomfortable.

Goldilocks was presented with various choices of meals and lodging. Most of these choices provided nourishment and rest. However, only one of each of the options was "just right".

Many food and non-food products are irradiated. The properties of these products vary greatly as does the purpose of irradiating these products. Further, the logistics for handling different products vary from one industry to another and even from one company to another. It is important that the design, location and operation of the irradiator is "just right" to minimize costs, or at least right enough to make the use of a facility economically feasible.

The following are some of the key product and process variables that factor into the type of irradiator that would minimize costs:

Dose: There are many different reasons for irradiating different products. To achieve the desired effect, different doses are required. For example, to stop potatoes from sprouting, a minimum dose of as little as 30 Gray is required. However, NASA requires a minimum dose of 44,000 Gray to irradiate meat for astronauts. Imagine an irradiator with a continuous conveyor system optimized to irradiate the astronaut's meals. To process potatoes in that same irradiator would require the conveyor to travel roughly 1,500 times faster. There might be ways of running the potatoes, but they would not be optimal. Similarly, irradiating the astronaut's turkey would take 1,500 times longer when processed in an irradiator designed for potatoes.

Density: The density of different products varies greatly. Generally speaking, as the density of the product increases, the penetration of the radiation through the product becomes more difficult. In essence, the inside of the product is shielded by the outside of the product. The effect of this shielding is a function of density. This property ultimately affects the dose uniformity throughout the product. It can be compensated for by configuring the thickness of the product being irradiated, but that might affect how the product is normally handled and thus not optimal. For many products, dose uniformity is not an issue. However, for some products, such as food, dose uniformity is a major factor. The design of the irradiator is dependent on the dose uniformity requirements of the products serviced. Another role that density plays in the design of an irradiator is related to how the product is conveyed through the irradiator. Higher density products are, by definition, heavier for the same volume of material. A conveyor system designed for high density (heavy) products could be used for both high and low density products. However, the construction of physically stronger conveyor systems requires more and heavier structural components. These conveyor components will absorb a portion of the radiation intended for the product. For this, and similar reasons, a unit designed for heavy products will not treat low density products as efficiently as an irradiator designed specifically for low density products. On the flip side, to run the same volume containers of high density products in a low density irradiator would overload the conveyor system's weight limits. Smaller volumes of the high density product could be run, but this would not be optimal.

Flexibility: Dose and density are key factors in the design of an irradiator. There are many more. Ideally an irradiator would be solely designed and optimized for one product at one dose, one density, one package size/configuration, and the specific production volume of that product to run the irradiator 24/7/365. [An irradiator designer's dream!] Unfortunately, for the irradiator designer, the current food products being irradiated do not have the production volumes for a dedicated unit. So, some flexibility needs to be incorporated into the design of irradiators to accommodate similar products and similar processes. The irradiation of perishable foods presents new issues that require greater design flexibility. The current logistics of perishable foods dictate that irradiators need to be able to run both very small and very large lots of products and to be able to efficiently change from one product to another. For some perishable foods such as fruits and vegetables, seasonality becomes a major factor. Generally speaking, the more flexible the design and operation of an irradiator, the higher the costs.

A commercial irradiator that can be used for any process will not be as viable as an irradiator dedicated to one specific product. But an irradiator designed for one specific food product would not currently be commercially viable.

When Goldilocks looks for an irradiator to process her porridge, she needs to factor in the specific processing and logistics of her porridge and determine what is "just right".

Russell N. Stein
GRAY*STAR, Inc.
www.GrayStarInc.com
GrayStarGenesis@aol.com