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Using nature's disinfectants

The photohydroionization disinfection process combines several non-chemical, non-penetrating radiation approaches, which together can effectively kill harmful microorganisms in food, air and water.

Bill Svec, vice president of water and food products at RGF.
Source: RGF.

Eliminating bacteria, viruses, mold and fungus on food products is paramount to all food processors. Chemical treatment, penetrating radiation and oxidation are traditionally the most utilized methods to accomplish this goal.

But now, there is an alternative to these technologies—photohydroionization, a disinfection process that has been approved in food processing plants inspected by the USDA, FDA and FSIS. Developed by RGF Environmental Group, a south Florida-based designer and manufacturer of industrial environmental technology, photohydroionization combines several non-chemical, non-penetrating radiation approaches, which together kill harmful microorganisms in food, air and water more efficiently than any single approach.

RGF offers several versions of the technology to treat food surfaces, plant air and water. Custom systems designed for other markets such wastewater recycling and the marine industry also are available, according to Bill Svec, vice president of water and food products at RGF. The company holds all the patents for the PHI technology and has installed various sanitation systems at meat, dairy, fruit and vegetable processing facilities.

Bill Svec has a background in quality control in the nuclear power industry and has been with RGF since its inception in 1985. He has been involved in the development, production, application and sales of industrial wastewater treatment and elimination technologies, food sanitation applications and indoor air quality products.

At last year's PROCESS EXPO in Chicago, RGF announced the latest version of the system with a PHI and UV approach that sterilizes product in a 360° treatment process and can destroy any single-celled organism that resides in a food plant.

FE: What does PHI offer?

Svec: It is a natural disinfection step that provides a final, non-chemical, antimicrobial treatment and protects the product from human error or other cross-contamination events that may have occurred earlier during processing.

PHI can reduce contaminants on the surface of a product by more than 99 percent. It does not change the product's look, taste, color, aroma or organoleptic properties; leaves no chemical or other type of residue; and can increase product shelf life by up to 40 percent. It is ideal for many food products including precooked foods such as ready-to-eat lunch meats and some raw meat and poultry products. The dry process has low energy consumption and has been validated for the control of Salmonella, Listeria monocytogenes, Escherichia coli 0157:H7 and Staphylococcus aureus, as well as molds, yeast and viruses.

FE: What are the limitations with existing treatments?

Svec: Many foods are routinely cleaned with 50 to 600 parts per million of chlorine, which converts to the known carcinogens, trihalomethanes. If product is treated with penetrating radiation such as X-rays or Gamma rays, it must be labeled as irradiated. Treating product solely with ultraviolet light is time intensive since the processor has to make

RGF's PHI Treatment Plus system is a new, 360° version that kills pathogens on product surfaces without chemicals or penetrating radiation. Source: RGF.

the product stationary and then shine the UV on it for a few minutes at a time. Plants operating at high speeds don't have the time and budget to run just with UV.

FE: Why choose PHI?

Svec: The PHI process produces strong purification and oxidizing agents. The catalyst reacts with UV light in an air environment to create molecules called hydroperoxides. This hydroperoxide-filled atmosphere washes over the product and sanitizes its surface and the air surrounding it. After killing the microbes, the hydroperoxides, which are considered friendly oxidizers, revert to oxygen, hydrogen and carbon.

FE: How does it work?

Svec: A key to the process is the UV light which is used not to treat the product, but as an energy source, producing advanced oxidizers when it interacts with the catalyst. RGF uses specially designed UV lamps that generate wavelengths from 100 to 380 nm. (A wavelength of 185 nm generates ozone, while a wavelength of 254 nm produces germicidal UV rays.)

Sterilization takes place inside a treatment tunnel enclosure mounted around a self-contained, variable-speed conveyor designed for the weight load, size and shape of the product volume to be treated. Specially designed stainless steel supports and FDA-approved, high-impact polymer shrouds protect each emitter and prevent non-product items from entering the work environment.

The internal surfaces of the photohydroionization tunnel are made of mirror-polished stainless steel to maximize reflectivity and reduce shadowing. UV emitters are placed strategically throughout the internal chamber. The PHI process requires a catalyst, which is comprised of four metal compounds housed in a stainless steel module attached to the chamber, and has its own blower.

High-intensity, broad-spectrum UV light rays, utilized in conjunction with a catalytic target, generate the oxidizing gases that reach every corner of the treatment chamber. The hydroperoxides created by the process attack the pathogens in the air and on the surface of the product.

This method is safer than traditional ozone generators, since it does not produce nitric oxide gas or nitric acid. It also has a very high efficiency rating.

FE: Who is using PHI?

Svec: The new PHI Treatment Plus system features a two-stage, stainless steel open-mesh belt; the second belt section is offset by 50 percent to eliminate product shadowing where the part of the product in contact with the belt isn't treated. Valley Meats, a Coal Valley, IL meat processor, installed an 18-ft.-long PHI Treatment Tunnel Plus system that provides 360° decontamination of its beef trim products with tough-to-treat, angular surfaces and ridges.

At one of the nation's largest pork producers, an RGF PHI system has reduced surface bacteria by 80 percent and increased shelf life up to 20 percent, while at a number of vegetable processors, the technology has cut surface bacteria on corn, peas, carrots and celery by more than 90 percent. Another system has trimmed E. coli in commercial ice machines by up to 99.99 percent when PHI was used on the air and water. And an RFG PHI system pared down surface bacteria at one of the nation's largest seafood wholesalers by more than 80 percent and increased product shelf life up to 50 percent.

FE: Can PHI treat all types of food products?

Svec: PHI is a non-penetrating radiation technology, so it cannot be used with product that is ground, since grinding mixes any surface contamination throughout the product. The tunnel is typically placed at the end of the process line just prior to packaging, or in the case of meat processing, prior to grinding. The effectiveness of photohydroionization as an antimicrobial on food surfaces is basically the same as penetrating radiation, reducing surface microbials up to 6 logs.

FE: Is a PHI system expensive?

Svec: Advanced oxidation and photohydroionization systems are less costly to operate and maintain than an irradiation system. Plus, the expense and danger of using and storing chemicals are eliminated when a PHI system is used. ❖

To view a video on this technology, visit http://www.youtube.com/watch?v=wpoplFJPvUw