Photoionization as an Anti-Microbial

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A review of the efficacy, safety and perception of photohydroionization / advanced oxidation as a anti-microbial versus traditional chlorine and radiation.

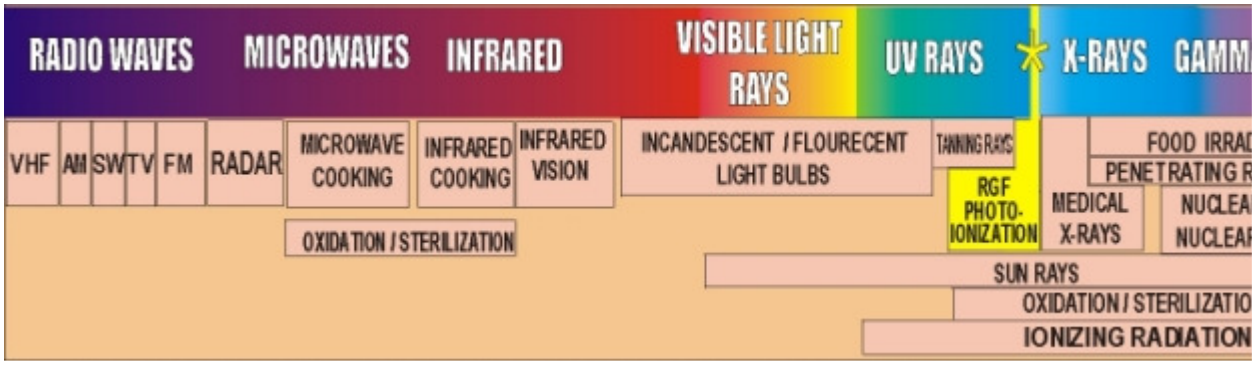
PhotohydroionizationTM is a chemical-free, advanced oxidation technology utilizing high intensity ultraviolet light rays targeted on hydrated tri-metalic targets in a safe, low-level, humid ozone atmosphere. The resulting non-penetrating, ionizing UV radiation in an advanced oxidation atmosphere is a very effective and safe food sanitation method. The concept of photohydroionizationTM is to utilize the efficiency of radiation without the traditional problems

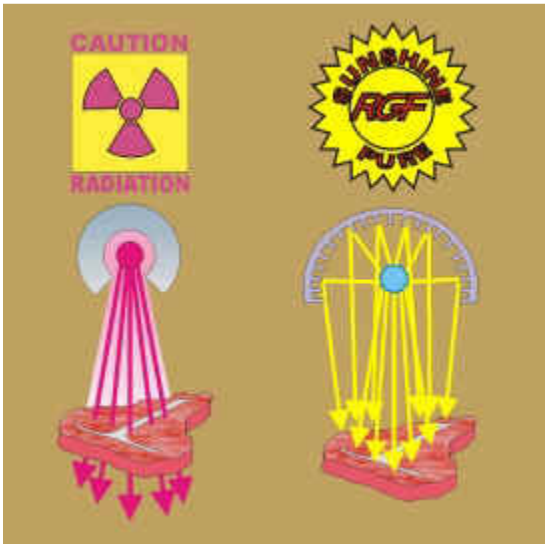
associated

with penetrating radiation such as x-rays and gamma rays. The unique characteristics and wavelength of photohydroionizationTM places it right on the line between UV radiation and X-radiation. The effectiveness of photohydroionizationTM as an anti-microbial on food surfaces is basically the same as penetrating radiation: 99.9% surface microbial reduction up to 6 log reductions. The main difference is that penetrating X-Gamma Ray radiation has the ability to penetrate through the packages and through the food surfaces. This is an advantage when treating ground meats since most meat contamination is on the surface; and the grinding operation mixes any surface contamination throughout the mixture. Aside from ground products, surface contamination is the main concern of food processors. Whole muscle meat and poultry bacteria contamination is virtually always found on the surface. Meat with microbial contaminants inside the fiber should not make it to the processing facility in the first place.

A big advantage that photohydroionizationTM has over penetrating radiation is customer acceptance. Penetrating radiation (X or Gamma) must be labeled with the radiation symbol, which, according to many surveys, is not widely accepted.
PhotohydroionizationTM, on the other hand, is related to sunrays. Labeling is not required, although labeling could be used to project a value-added image to the product. Something like a "Sunshine PureTM" label would be far more appealing to consumers. Due to recent publicity, doctors have been flooded with colonoscopy exams. They result in approximately 50% of the patients having internal polyps, which the doctors will matter of factly state is caused by food additives or chemicals or chemicals. In general the public will avoid, when possible, chemical additives in food. Chemicals are on all the current "what's out" lists, and consumers are becoming more and more educated on the hidden, long-term

dangers of chemical consumption through food. This is evidenced by the increase in the popularity of organic foods. Many foods are routinely cleaned with chlorine, which converts to trihalomethanes, known carcinogens. Foods are washed with anywhere from 50 to 600 parts per million (ppm) of chlorine. Compare that with a typical swimming pool, which is treated with 2-3 ppm of chlorine. Pools with over 5 ppm will have a strong chlorine odor and tend to burn your eyes and turn blonde hair green! Photohydroionization is a chemical-free advanced oxidation process utilizing only friendly oxidizers that revert back to oxygen and hydrogen after they react with organics such as food-borne pathogens.





RADIATION **PHOTOIONIZATION**

CHEMICAL OXIDIZERS
(In order of Strength)

1. Fluoride
2. Hydroxyl Radical
3. Ozone*
4. Hydrogen Peroxide
5. Permanganate
6. Chlorine Dioxide
7. Chlorine
8. Bromine
9. Iodine
10. Oxygen*

* Elements of the RGF Advanced Oxidation Process. Friendly oxidizers do not use chemicals and revert back to oxygen and hydrogen.

RGF utilizes other advanced, friendly oxidizers to provide a food processor with a total anti-microbial package, such as ozone, which has been receiving a lot of attention in the

food industry as a friendly replacement for chlorine. Ozone is 3,000 times faster killing bacteria and 150% more powerful than chlorine. RGF's three-part food sanitation process utilizes ozone in water for safe, friendly and chemical-free food washing. RGF's photohydroionizationTM ozone installations have been very successful in a wide range of food products.

Food surfaces can be contaminated from airborne microorganisms within the food processor's facility. RGF's photohydroionizationTM process has been adapted for use on airborne microorganisms, especially mold and bacteria. Most air treatment systems consist of filters, which is fine; however, indoor air pollution consists of three categories:

•Particulate - dust and particles
•Gases, fumes and odors
•Microbial - mold and bacteria.

Air filters traditionally only filter particulates, which is good and a necessary part of an overall air cleaning program, however, it pays little or no attention to gases, odors or microorganisms. Particulate air filters can actually act as a breeding ground for microbials, a filter will collect particulates. In a moist, dark atmosphere molds and bacteria will grow.

By passing the plant's air through a photohydroionizationTM chamber, airborne microbial reductions in excess of 90% have been achieved in actual plant applications. In addition, fumes and odors are neutralized.

RGF has worked closely with the Electric Power Research Institute (EPRI) designing, building and installing RGF's ozone and photohydroionizationTM systems for air, water and food surfaces. The following are examples of successful applications:

Independent Laboratory Tests of RGF's Non-Chemical Photohydroionization, Ozone and UV Targeted Technology in Plant Applications:

Grain: RGF has replaced traditional anti-microbial chemicals such as chlorine (450-600 ppm) with non-chemical processes and further reduced bacteria by 80% at a grain plant.

RGF's Photohydroionzation of Grain 80% Bacteria Reductions

Pork: RGF has reduced surface bacteria by 80% and Increased shelf life up to 20% at one the nation's largest pork producers.

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Vegetables: RGF has reduced surface bacteria on corn, peas, carrots and celery by more than 90% at a number of vegetable houses.

RGF's Advanced Oxidation of Celery

Chicken Processing using Photohydroionization
90+% Bacteria Reduction

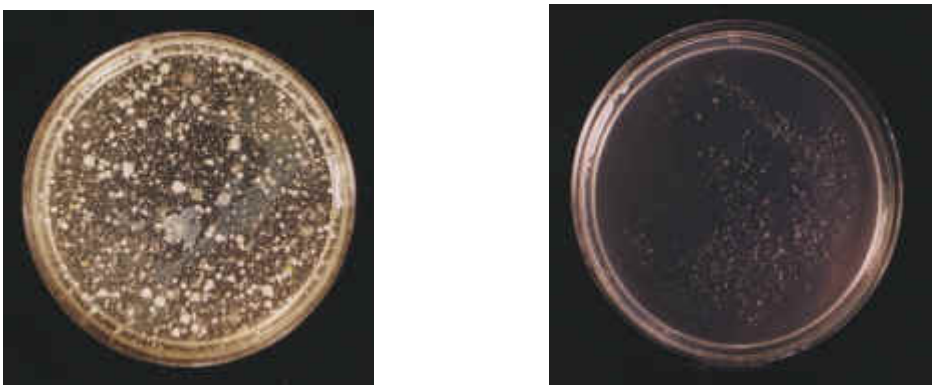
Poultry: RGF has reduced surface bacteria by over 90% and increased shelf life by up

to 25% at a poultry processor.

Ice: RGF has reduced E-coli by up to 99.99% in commercial ice machines. Photohydroionzation was used on the air and water of the ice machines.

Seafood: RGF has reduced surface bacteria by more than 80% and increased shelf life by up to 50% at one of the nation's largest seafood wholesalers.

Frozen Tortellini: RGF has eliminated listeria and E-coli at a pasta company.



Petri dish samples showing before and after photohydroionization process results

Conveyor Belts and Plant Equipment: RGF has reduced food spoilage bacteria levels on conveyors and plant equipment by more than 90% over traditional chemicals and reduced plant corrosion at meat processor plants.

The main advantages of PhotohydroionizationTM, as part of a total advanced oxidation program, include:

Liability Reduction: By utilizing a state-of-the-art, proven safe technology, your legal liability will be reduced. Mistakes and accidents will happen, but a processor who has incorporated state-of-the-art technology to prevent potential problems will be viewed in a more favorable light by a jury than a company that is not proactive and maintains a "status quo".

Low Cost: Advanced Oxidation and PhotohydroionizationTM Systems are far less expensive and less costly to operate and maintain than irradiation systems. A typical photo-ionization chamber is less than $50,000 whereas irradiation systems cost $2-4 million. An advanced oxidation wash down system costs $40,000 or more depending on flow rate requirements. Air systems cost even less. In addition to lower capital cost, you can eliminate the cost and dangers of chemicals.

Positive Public Relations: By promoting an Enviro-VisionTM or Sunshine PureTM Program, a processor can gain valuable marketing positions. "Chemical free" products are one of the fastest growing promotional phrases. Organically grown and processed foods command up to double the price of traditionally grown and processed foods.

A Safer Product: PhotohydroionizationTM and Advanced Oxidation have outperformed traditional chemical sanitation technology in every field application in which RGF has installed them. This includes chicken, beef, pork, vegetable, grains, fish, brine and ice.

The nation's news organizations are increasing their coverage of food contamination problems. A PhotohydroionizationTM Chamber treating all products as they leave the plant will provide a low-cost, extra level of food safety, and restaurants could utilize a smaller unit to treat all products as they are off loaded before storing. Redundancy will also provide assurance from cross-contamination, thereby reducing the risks to the consumer and liabilities to the producers.

Authors

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