Surface sanitation by UV radiation

Identification

Key words UV, radiation, surface, microorganism
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How does it work?

Primary objective Rapid and effective sanitation of surfaces.
Working principle There are many ways to sterilize surfaces and materials to kill bacteria and other harmful organisms. One way is through the use of ultraviolet, or UV radiation, also called UV light. UV light is a form of electromagnetic radiation and should not be confused with nuclear radiation. For disinfection, hard UV-C (280 nm–100 nm, short wave, or germicide), is suitable. UV-C is used for sterilization of different types of material (metal surface of machine, drinking water, food etc.) before packaging or for sanitizing of equipment. Main role is to minimize possible post-production contamination. UV-C directly damages the DNA of microorganisms. UV-C is effective mainly in inactivation of vegetative bacteria but for reduction of spores a longer time and energy is necessary [5]. For non food material, such as rubber conveyor belts, the reduction for L. monocytogenes was 7 log (5.95 mW/cm² for 3 s) [4].

Additional effects Ozone is a secondary product during UV-C technology using. It also has a sterilization effect. UV treatment systems are important in the food and dairy industry where the chemical dosing of incoming process water can compromise flavors and changes the physical chemical properties of the food products.

Important process parameters power of UV lamp, time of exposition (energy dissipated), distance from surface, wave length of UV source

Examples of efficiency of reduction of microorganisms:
- UV-C (100 μW/cm²) decreased the number of Listeria monocytogenes on Tryptose Agar (TA) about 7 log/g in 4 min. Dry cell are more resistant than moist cells [1].
- UV-C at doses of 0.5-4.0 J/cm² inactivates pathogenic microorganisms by from approximately 0.5 log/g on raw meat and poultry to almost 4 log/g on tomatoes, while the pathogens were not recovered from stainless steel at a UV-C dose of 0.4 J/cm² [2].

Important product parameters area of surface, type of food
What can it be used for?

**Products**
- Sterilization of different types of material (e.g. surface of machine, drinking water, food, air...).
- Bacterial decontamination of low-density polyethylene surfaces used for fluid food packaging.

**Operations**
Pasteurisation, sterilisation

**Solutions for shortcomings**
- High speed of sterilisation.
- Previous disinfection of packaging materials before aseptic filling or packaging of product.

What can it NOT be used for?

**Products**
- Very dry products

**Operations**
- -

**Other limitations**
Dry cells of microorganisms (e.g. L. monocytogenes) are more resistant to irradiation than moist cells [1]. Bacterial sensitivity to UV radiation is affected by several factors such as medium pH and bacterial growth phase.

**Risks or hazards**
Direct exposing of humans to UV-C is dangerous to the extent that it will mutate RNA and DNA.

Implementation

**Maturity**
UV-C sterilization is widely used in food industry.

**Modularity**
There is no problem with the implementation of these technologies in industry. It is easily applicable and it has a low operational cost. The implementation depends mostly on cases: somewhere has to be inserted a new UV unit to the product line and somewhere can be installed only germicide UV lamp to the existing equipment namely for batch processing.

**Consumer aspects**
UV-C is a well accepted technology that is known from medicine.

**Legal aspects**
The use of ultraviolet (UV) light, as an alternative to traditional thermal processing, has been adopted by some juice processors as a mean of reaching the HACCP 5-log performance standard.

**Environmental aspects**
UV has no residual effect (does not leave residues on the radiated surface).

Facilities that might be interesting for you

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<th>Title</th>
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<tr>
<td>Lab scale oven for infrared and impingement heating - SP</td>
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<td>Pilot scale tunnel oven for infrared and impingement heating - SP</td>
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<td>Pulsed light labscale IRTA</td>
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<td>UV irradiation - FRIP</td>
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Further Information

Institutes
Auburn Uni. Dep. Poultry Science, TU Cartagena, CSIC - IATA, Max Rubner Institute

Companies
UVC.Corp. Vaclav Novak, Dr. Hönle AG, UV Light Technology Limited, BÄRO Lighting Ltd.

References

Source: