HOW DOES IT WORK?

The UV light wavelengths range between 100 and 400 nm and can be divided into the following four classifications: vacuum UV (100–200 nm), UV-C (200–280 nm), UV-B (280–315 nm), and UV-A (315–400 nm). Shorter wavelengths of UV-C have a more detrimental effect on microbial cells since it disrupts the structure and functionality of the intercellular components of microbial cells (e.g., RNA, DNA, and proteins). This critical damage to the microbial cells prevents replication and long-term survival.

APPLICATION

A variety of lamps can emit UV light onto food surfaces. The most common UV-C light sources are low-pressure (LPM) and medium-pressure (MPM) mercury lamps. LPM lamps deliver a monochromatic light at 254 nm and MPM lamps emit a polychromatic light between 200–300 nm. The lamps are usually mounted above the conveyor belts that are passing under and are continuously being treated with UV-C light to inactivate microorganisms on the surfaces while the conveyor belts are in use. This technology is frequently used in food industry to treat air or water; and there are also applications, approved by FDA, used for treatment of juices and surfaces of foods. Other possible application that is less commonly used in the food industry, but common in hospitals and research facilities, is mounting LPM or MPM lamps above a specific large area or entire rooms to inactivate microorganisms on surfaces and in air during times when surfaces and rooms are not in use.

WHAT IS THIS USED FOR?

Inactivation of spoilage and pathogenic microorganisms on food surfaces.

ASSESSMENT OF EFFECTIVENESS

The low costs for installation, maintenance, and operation as well as the low energy usage lends to the advantages of UV light application. However, this technology relies strongly on optimal exposure of surfaces to UV light and sufficient duration of exposure. Rough surfaces could already cause micro-shadowing effect where UV light does not reach and treat the surfaces completely. UV light is also not able to penetrate into material and is limited to only exposed surfaces, which makes it difficult to inactivate microorganisms that are part of biofilms or covered with soils or food residues. Different microorganisms are differently susceptible to inactivation by UV light; bacterial spores are known to be highly resistant to UV light while other microorganisms can build resistance using other mechanisms. UV light can also be detrimental to some materials used in food industry; for example, certain rubber parts. The key to effective use of this technology is to validate the method and UV treatment regime for specific application in specific facility and not to deviate from validated procedures and parameters when using the technology.

REGULATORY IMPLICATIONS

Certain UV light wavelengths are responsible for generating toxic ozone which is why FDA has limited the type of UV irradiation to light sources that do not produce any ozone. Surface disinfection is not currently seen as a stand-alone sanitizing method within the food industry but might be used as a subsequent step in conjunction with chemical cleaning and sanitation.

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Want more information on this or other novel technologies? Contact Aljosa Trmcic (at543@cornell.edu) in the Milk Quality Improvement Program or visit our website at https://foodsafety.foodscience.cornell.edu/mqip/.

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