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Ultraviolet C (UV-C) - Novel Approach for Mitigating Airborne Risk in Food Processing Facilities

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Ultraviolet C (UV-C) light has emerged as a promising technology in mitigating airborne risks in food production facilities, particularly for reducing microbial contamination. UV-C light inactivates microorganisms, by altering the DNA or RNA of microorganisms including changes in gene expression. These genetic changes alter the replication cycle of micro-organisms. This study explores the effectiveness of UV-C irradiation in controlling airborne pathogens within food production environments, where the risk of contamination through the air can significantly impact product safety. The objective of this study was to test effectiveness of UV-C in inactivating bioaerosols of *Salmonella* Newport, *Escherichia coli*, *Listeria monocytogenes* and +(ss) RNA viruses such as (Hepatitis A virus (HAV). This was tested by means of an aerosolization generator (nebulizer), which dispersed and created fine droplets (bioaerosols). For bioaerosol generation, a 4 jet Blaustein Atomizing Module (BLAM) type atomizer was employed. Four ml of a test suspension was injected into the nebulizer using a syringe, aided by compressed air at 25 psi. The bioaerosols were exposed to UV-C in sealed test chambers at different UV-C intensities at varying velocities. Results demonstrated that the inactivation of bacterial pathogens occurred at low, middle, and high (4.8, 5.7,7 m/sec velocities); to corresponding flowrates of (955, 1135,1395 l/min). Results indicated that 4.85 log,6.15 and 8.22 log reduction was observed for of feline calicivirus (FCV) virus at low and medium flowrates. In contrast, no colonies were detected for *Salmonella* Newport and *E Coli* O157:H7 ATCC 700728 for both low and middle volumetric flow rates. At the highest flow rate, a 2.7-log reduction was observed. Complete inactivation occurred at UV-C doses of 20 and 30 mJ/cm², with partial log reductions at 10 mJ/cm². We hypothesize bacterial growth after 48 hours due to photoreactivation. Higher doses may be required to alter and damage enzymes involved in dark repair (excision repair). In summary, utilization of UV-C technology demonstrated its effectiveness in inactivation of vegetative bacteria and viruses in an aerosol. Our results could potentially be leveraged to develop innovative UV-based LED systems which may contribute to safer food environments, reduce health risks and a more sustainable option.