ACCELERATOR TECHNOLOGIES FOR FOOD SAFETY AND FOOD QUALITY: RESPONSE OF MICROBIAL POPULATIONS TO IONIZING TECHNOLOGIES.

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There have been major advances in accelerator technologies over the past two decades. Today, electron beam (eBeam) and X-ray accelerators of varying energies and beam power are commercially available. The technological advances in accelerator technologies are still on-going in terms of modularity, reduced footprint, self-shielding capabilities, advanced control and troubleshooting and compactness. There is a need for a greater adoption of these technologies in the food industry around the world. Presently, phytosanitary treatment applications are driving the adoption of accelerator technologies. However, reducing food spoilage by extending the shelf- life of foods and reducing the potential for pathogens in and on foods will also become major drivers for the adoption of these technologies. There is a significant diversity in the types of microbial pathogens and spoilage organisms that need to be addressed by this technology. The inherent resistance of enteric viruses (eg. Norovirus) to ionizing radiation is significantly greater than bacterial pathogens, and spoilage-causing fungal spores require higher doses vegetative bacterial cells. Still, spore-forming bacterial pathogens such as Cl. Perfringens are still major concerns to the food industry. The emergence of toxin producing algal cells is a also an emerging threat in foods from aquatic sources. Historically, traditional culture-based methods have been used as the cornerstone of identifying the response of microbial cells to ionizing radiation. However, today we know that even though cells when exposed to lethal doses and are unable to replicate and multiply (ie., inactivated), these microbial cells are exhibiting very defined metabolic processes several days post irradiation treatment. These Metabolically Active yet Non-Culturable (MAyNC) cells are of particular significance. We know that the transcriptomic and metabolite profiles of inactivated cells are different at varying days post irradiation treatment and completely different from the unirradiated cells. We, however, do not know the microbiological significance of MAyNC state especially because when low dose irradiation treatments are used on fresh produce (during phytosanitary treatment) and for shelf-life extension. There is an urgent need to better understand the microbiological relevance of metabolically active microbial cells that are expected to be present when food irradiation doses are utilized.