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Efficacy of Electron Beam Irradiation to Address Emerging Microbial Contaminants in Water Reuse Programs

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Water availability is a major challenge facing municipalities around the world. To meet growing residential and agricultural needs, there are major water reuse programs around the world. These reuse programs span all the way from indirect potable reuse to direct potable reuse. The underlying hypothesis was that eBeam technology can breakdown the emerging contaminants of concern in water reclamation and reuse projects. We also hypothesized that the inactivation and elimination of contaminants by eBeam technology can be achieved cost-effectively. Having this technology in the “tool-box” of water reclamation technologies would open up innovative high-value, commercially-viable, and environmentally sustainable solutions and strategies for water reuse

High energy electron beam irradiation was found to be effective in eliminating a variety of emerging microbial contaminants such as hepatitis A virus, norovirus, rotavirus as well as protozoa such as *Cryptosporidium parvum*. Additionally, eBeam was effective at achieving significant reductions of bacterial pathogens such as *Shigella* spp., *Aeromonas* spp., and *Salmonella* spp. Based on these studies, it was found that viral pathogens are the most resistant to eBeam irradiation and protozoan oocysts were the most sensitive. If 5 kGy eBeam is used for water reuse programs, greater than 50-log reduction of bacterial and protozoan pathogens can be achieved. The log reduction of viral pathogens however was significantly lower ranging between 1 and 3 logs. These results suggest that eBeam irradiation technology can be major cost saving for water reuse programs since it avoids the needs for other disinfection treatments and expensive membrane filters (to remove pathogens). The outcome of these analysis indicated that for large municipalities that require effluent treatment in the hundreds of millions of gallons per day, the minimum power requirement is at least 1 MW. Presently, commercial off the shelf (COTS) eBeam technology is available at significantly lower power ratings.

Country/Organization invited to participate

United States of America

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