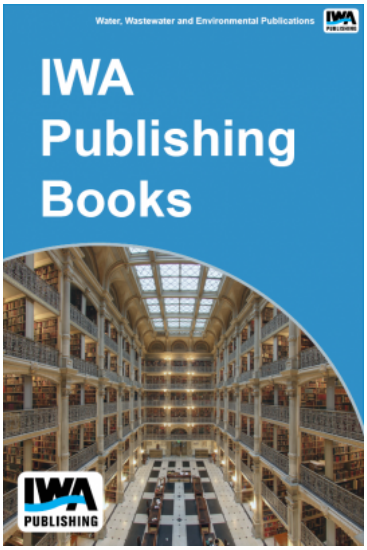
Disinfecting and Stabilizing Biosolids Using E-Beam and Chemical Oxidants



Municipal sewage and sludges can harbor a variety of infectious microorganisms as well as estrogenic compounds and their metabolites. Biosolids and other residuals generated from municipal wastewater treatment facilities need to be used for beneficial purposes such as land application. To reduce the potential for adverse environmental and human impacts, it is critical that novel approaches be investigated so that municipal biosolids can be disinfected and stabilized to reduce the pathogen loads and levels of estrogenic compounds. The overall objective of this project was to demonstrate the disinfection and enhanced stabilization of municipal biosolids when high energy (10 MeV) Electron Beam (e-beam) technology is coupled with oxidants such as chlorine dioxide and ferrate.

High energy E-Beam is effective as a disinfection technology. Significant reductions of all target organisms can be achieved in municipal biosolids depends on the dose that is employed. An e-beam treatment system utilizing 15 kGy e-beam dose has been designed and mathematically modeled and validated. Based on these engineering design considerations, e-beam treatment was shown to be cost-effective. There was synergistic disinfection of pathogens when e-beam is coupled with oxidants such as chlorine dioxide and ferrate. E-Beam at 8 kGy was unable to destroy estrogenic activity in the sludge samples. Ferrate (100 ppm) was capable of destroying estrogenic activity in the biosolid samples with or without the addition of e-beam irradiation. Chlorine dioxide (100 ppm) was not effective at destroying the estrogenic activity either by itself or in combination with e-beam. The combination of 100 ppm of ferrate with 8 kGy of e-beam promoted the stabilization of aerobic and anaerobic sludge samples as indicated by BOD, VSS and SOUR test results. The results demonstrate that 10 MeV e-beam is capable of cost-effectively inactivating a variety of bacterial and viral pathogens in aerobically and anaerobically digested biosolids. Overall, these results suggest that when e-beam is combined with ferrate significant reductions of microbial pathogens, estrogenic compounds and biosolid stabilization can be achieved.

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