Special Lecture

Pathogen control for global water and food safety

Presented by

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Open Hall
Faculty of Engineering, Hokkaido University

The conventional approach to disinfection system design is to use laboratory data obtained with surrogates for human enteric viruses or with a particular strain of human enteric viruses obtained from a standard collection. However, virus populations are genetically diverse in nature and constantly changing, which calls into question whether results obtained with a standard virus strain will apply to virus populations in natural environments globally. Our group has been studying rotavirus, which is the most common enteric virus that causes severe diarrhea, vomiting and acute dehydration among children. We showed that at least 2 rotavirus strains, human Wa and porcine OSU, have opposing trends for solar disinfection. Thus, we contend that one cannot extrapolate how a disinfection system will perform in a given locality from limited laboratory studies. We propose that the knowledge of the inactivation mechanisms of rotavirus in combination with viral genetics could be used to predict inactivation rates and allow for rapid optimization of treatment to achieve safe reuse water. We have found that hydroxyl radicals produced by organic matter in surface water irradiated by sunlight were responsible for rotavirus inactivation. In addition, full spectrum sunlight damages the rotavirus genome, resulting in rotavirus inactivation. We used the amino acid sequences of two rotavirus strains Wa and OSU, to explain their different susceptibility toward solar disinfection. We suggest that Wa encodes proteins that are susceptible to solar and heat disinfection, while the orthologous OSU proteins have small changes that make them more resistant to solar and heat disinfection. In a comprehensive study using 24 genotypes of leafy vegetables and tomato fruits commonly used in salads, we found that physical and chemical surface properties of the fresh produce need to be collectively considered for prediction of OSU rotavirus adsorption to produce surfaces.

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