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Development of Indicators and Surrogates for Chemical Contaminant Removal during Wastewater Treatment and Reclamation

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Water Environment Research Foundation

Objectives

The objectives of this project were: (a) to identify surrogate parameters and indicator compounds for wastewater-derived chemical contaminants that might be useful in the assessment of indirect potable reuse systems; (b) to identify and assess the performance of analytical methods for the chosen surrogates and indicators; and, (c) to validate the ability of chosen surrogates and indicators to predict the occurrence and removal of wastewater-derived contaminants in indirect potable water reuse systems.

Highlights

This study provides guidance to the water reuse industry how to assure proper removal of wastewater-derived chemical contaminants in indirect potable reuse applications using a combination of tailored surrogate parameters and a select list of indicator compounds. The study also identified chemical contaminants that are commonly occurring in recycled water and are subject to degradation during various water treatment unit processes. Thus, findings can assist in tailoring appropriate monitoring programs for system performance assessments.

Results/Findings

For each treatment process, a master list of indicator compounds was provided by recruiting compounds, for which analytical methods existed, from a final list of viable indicator compounds present in secondary or tertiary treated wastewater effluents. The developed treatment removal categories for indicator compounds for each treatment process of interest (i.e., SAT, ozone, advanced oxidation, chlorination, carbon adsorption, and reverse osmosis) was validated through laboratory-, pilot-, and full-scale experiments. Findings of these studies confirmed the classification of indicator compounds into the different removal categories. As expected, results of these efforts also revealed that surrogate parameters are not strongly correlated with the removal of indicator compounds occurring at ng/L-level concentrations. Partial or complete change of select surrogate parameters, however, can demonstrate the proper operation of a unit operation or treatment train. Thus, to fully access the performance of unit operations regarding the removal of wastewater-derived contaminants, a combination of appropriate surrogate parameters and indicator compounds should be used. This framework is a conservative approach designed to detect failures in system performance regarding occurrence of wastewater-derived contaminants. Adopting the treatment categories framework can also assist in more properly tailor multiple-barriers of treatment processes with a demonstrated ability of remove wastewater-derived contaminants in indirect potable reuse applications.