

Moving closer to meeting strict nutrient limits while remediating trace organic compounds

Developing a Standardized Protocol for Assessing the Biodegradability of Trace Organic Compounds (U3R10)

The Central Issue

Nutrient removal and recovery are critical issues in the wastewater treatment process. Because nutrient removal technologies are similar to trace organic compound removal technologies, this research sought to identify a protocol for assessing the biodegradability of Trace Organic Compounds (TO_rC) with the intention of extrapolating those findings to address nutrient removal challenges as well.

Context and Background

The selection of technologies for the removal of TO_rC from wastewater influences decisions regarding capital upgrades at water resource recovery facilities (WRRFs) because the same technologies can potentially allow utilities to meet strict nutrient limits while remediating TO_rC. Possession of unbiased performance data that characterizes TO_rC removal would enable engineers and utility managers to assess strategies to facilitate enhanced biological TO_rC removal.

In this study, three WRRFs participated in full-scale studies to confirm consistent removal of four TO_rCs which were:

- Salicylic acid (antiseptic, anti-inflammatory drug).
- 17 α -ethinylestradiol (estrogen).
- Trimethoprim (antibiotic).
- Nonylphenol (surfactant).

Findings and Conclusions

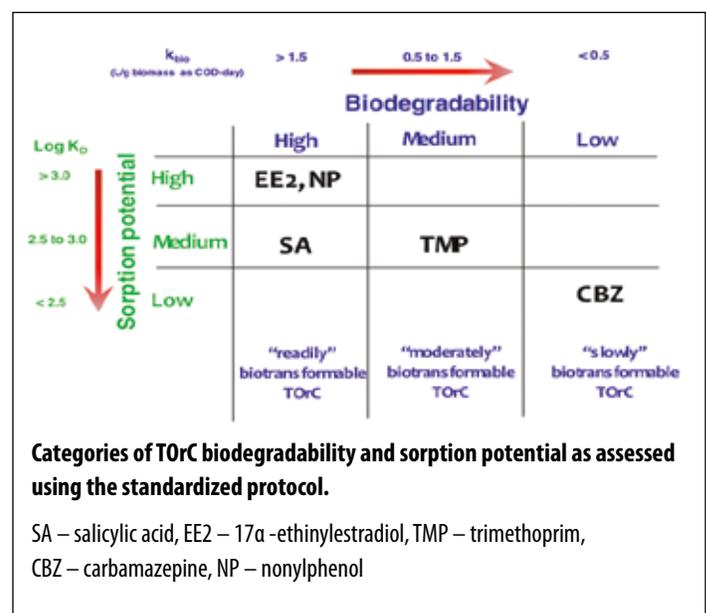
The research demonstrates that the TO_rCs studied are biodegradable under aerobic and anoxic conditions and that batch testing methods are sufficiently sensitive to allow quantification of the removal. The report includes a detailed standardized protocol for predicting TO_rC concentrations in the effluent of WRRFs.



Full-scale studies were conducted to confirm consistent removal of TO_rCs at water resource recovery facilities.

Management and Policy Implications

The results of this research provide an analytical technique that minimizes the number of sample injections required for TO_rC monitoring. It also provides a consistent guideline for performing TO_rC biotransformation batch tests.



Developing a Standardized Protocol for Assessing the Biodegradability of Trace Organic Compounds

Related WERF Research	
Project Title	Research Focus
Trace Organic Compound Indicator Removal during Conventional Wastewater Treatment (CEC4R08)	Defines and quantifies synergies between specific operational process changes and process upgrades that may be considered for improving nutrient removal and benefit trace organic removal.
Demonstrating Advanced Oxidation Coupled with Biodegradation for Removal of Carbamazepine (INFR6SG09)	Demonstrates that carbamazepine and its breakdown products can be removed in the wastewater treatment process.
Demonstrating Advanced Oxidation/ Biofiltration for Pharmaceutical Removal in Wastewater (U2R11)	Develops and demonstrates design criteria for removal of biologically recalcitrant pharmaceuticals from wastewater effluents.
Pharmaceutical Fate Under Varying Redox Biological Treatment Environments (U1R09)	Evaluates the fate of pharmaceuticals at trace concentrations through bioreactors that either achieve nitrogen removal (anoxic/aerobic, microaerobic with nitrate limitation, microaerobic with nitrate sufficient) or achieve ammonia oxidation, but not nitrogen removal (aerobic).

Principal Investigators:

Wendell O. Khunjar, Ph.D.
Hazen and Sawyer, P.C. and Columbia University

Kartik Chandran, Ph.D.
Columbia University

Benjamin Stanford, Ph.D.
Hazen and Sawyer, P.C.

Research Team:

Diana Aga, Ph.D.
State University of New York, Buffalo

Charles Bott, Ph.D., P.E.
Hampton Roads Sanitation District

Kimberly Jones, Ph.D.
Howard University

Sudhir Murthy, Ph.D., P.E.
DC Water

Technical Reviewers:

Carolyn Acheson, Ph.D.
U.S. Environmental Protection Agency

Robert G. Arnold, Ph.D.
University of Arizona

Eric R. Velázquez Dickenson, Ph.D.
Southern Nevada Water Authority

Uzi Daniel, M.S., REM
West Basin Municipal Water District

Christopher Impellitteri, Ph.D.
U.S. Environmental Protection Agency



To Order

Contact WERF at 571-384-2100 or visit www.werf.org and click on Search Research Publications & Tools.
 WERF Subscribers: Download unlimited free PDFs. Non-Subscribers: Charges apply to some products.

Refer to Stock No. **U3R10**
 For more information, contact
 Lola Olabode at lolabode@werf.org