

Determination of two cyclosiloxanes in waste activated sludge and removal by advanced oxidation.

Harshad Vijay Kulkarni, Dr. Pinar Omur-Ozbek

Department of Civil and Environmental Engineering, Colorado State University

Abstract. Siloxanes are persistent, bio-accumulative and toxic emerging contaminants introduced to wastewater from common healthcare and biomedical products, and various industrial processes. They remain unchanged through wastewater treatment and a considerable portion ends up in surface waters through effluent discharge. 30-60 ng/L decamethylcyclopentasiloxane (D5) was detected in two UK rivers, while ~400 ng/L of D5 may be found in wastewater effluents. Hence, siloxanes are under consideration by Canadian Environmental Assessment Agency and UK Environment Agency for drinking water regulations. Siloxanes are hydrophobic and accumulate in sludge and biogas, causing mechanical problems due to scaling. This research aims: to quantify the siloxanes in sludge samples obtained from Loveland, CO wastewater treatment plant (WWTP); and to study their removal using advanced oxidation techniques. A method was developed to effectively extract siloxanes from sludge and gas chromatography/mass spectrometry was used for quantification. Results for Loveland WWTP samples indicated that octamethylcyclotetrasiloxane (D4) and D5 are present up to 9ug/g dried-sludge. To study siloxane removal hydrogen peroxide (H₂O₂), UV, ozone and their combinations will be used. Currently effectiveness of H₂O₂ is being investigated. Sludge samples were spiked with D4 and D5 at 12 mg/g and treated with 3ml, 5ml, 7ml of 30% H₂O₂ for 1hr, 2hr, and 3hr reaction time each. Results indicated a 72% reduction in D4 and D5 levels after 3 hrs. Other treatment methods will be investigated next. The results will shed a light whether these methods can be used to remove siloxanes from the wastewater effluents to protect the source waters.