

Occurrence of Cyclic Volatile Methylsiloxanes in Surface Waters

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Abstract. Cyclic volatile methylsiloxanes (cVMS) are commonly present in cosmetic and personal care products, healthcare products and many industrial applications. Because cVMS are persistent, they end up in the wastewater and go untreated through the wastewater treatment units, which lead to contamination of the surface waters through effluent discharge. The three most common cVMS are: octamethylcyclotetrasiloxane (D4), decamethylcyclopentasiloxane (D5) and dodecamethylcyclohexasiloxane (D6). It was determined that D4 is very toxic to some aquatic organisms at very low concentrations of 6.3 ug/L, which meets the toxicity criterion of the European Commission. D4 was classified as Category 3 for reproductive toxicity by the European Commission. It was determined by Dow Corning Corporation that D5 showed a potential carcinogenic effect in a 2-year chronic toxicity and carcinogenicity study. cVMS are often measured by gas chromatography/mass spectrometry for precise measurement. In two UK rivers D5 was detected at <0.01-0.03 ug/L. A study from Canada reported <0.01-0.02 ug/L of D4, <0.03-1.45 ug/L of D5 and <0.02-0.15 ug/L of D6 in a river studied. Because these cVMSs were detected at considerable levels, they are under consideration by the UK Environment Agency and Canadian Environmental Assessment Agency for drinking water regulations and are declared as harmful to the environment by Environment Canada and Health Canada. This study focused on refining the available detection methods for cVMSs and to monitor the occurrence of them in local wastewater treatment plants. After refining a headspace chromatography/mass spectrometry method, 0.69 ug/L of D4 and 2.14 ug/L of D5, in the effluent from Drake Wastewater Treatment Facility (WWTF), Fort Collins, CO and 0.97 ug/L of D4 and 2.61 ug/L of D5 in the effluent from Loveland Wastewater Treatment Plant, Loveland, CO were detected. These results indicate that the surface waters receiving the effluents from these two WWTFs are likely to contain considerable amounts of D4 and D5.