USING CARBON AND HYDROGEN STABLE ISOTOPE ANALYSIS TO QUANTIFY MTBE BIODEGRADATION DURING AIR SPARGING

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2-D compound specific isotope analysis was conducted to verify and quantify the biodegradation of MTBE and TBA from high flow pulsed air sparging. Rapid groundwater MTBE and TBA concentration reductions have been observed during a high flow pulsed air sparging pilot test. While both MTBE and TBA were detected in the vapor monitoring points as a result of volatilization, it's believed that their aerobic biodegradation also materially contributed to the total mass removal since both compounds can be readily biodegraded with the presence of oxygen. Groundwater samples were collected from the air sparging monitoring wells for MTBE carbon and hydrogen stable isotope ratio analysis at different points of time during the tests. The field data proved that MTBE hydrogen isotopic fractionation is more significant than its carbon isotopic fractionation in the process of aerobic biodegradation. The ratio of MTBE hydrogen and carbon enrichment factors derived from this field test is 21, matching the results of laboratory studies. Since MTBE is first degraded to TBA which is further metabolized, the conventional stoichiometric mass balance using daughter product appears to underestimate the biodegradation extent. The Raleigh's equation, however, can be used to correlate the stable isotopic ratio to the MTBE remaining fraction solely as a result of biodegradation. The stable isotopic mass balance indicated that MTBE biodegradation contributes to 50-60% of total MTBE mass removal. Moreover, TBA carbon isotopic analysis was conducted and the results showed that more than 64% of groundwater TBA removal is from aerobic degradation.

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