Fate of iodinated X-ray contrast media compounds under aerobic and anaerobic groundwater conditions

B. M. PATTERSON¹², M. SHACKLETON¹, A. J. FURNESS¹ & F. BUSETTI³

¹ CSIRO Land and Water, Private Bag no. 5, Wembley, Western Australia 6913, Australia
bradley.patterson@csiro.au

² School of Biomedical, Biomolecular and Chemical Sciences, University of Western Australia, Crawley, Western Australia 6009, Australia

³ Curtin Water Quality Research Centre (CWQRC), Department of Applied Chemistry, Curtin University, GPO Box U1987 Perth, Western Australia 6845, Australia

Abstract  Iodinated X-ray contrast media (ICM) compounds have been detected in the effluent of wastewater treatment plants (WWTP) in Perth, Western Australia, as well as in other locations around the world. With the increased use of treated wastewater for managed aquifer recharge (MAR), potential groundwater contamination from these compounds has become a concern, and there is little data available on the fate of these compounds under different aquifer geochemical conditions. The fate of two ICM compounds, iohexol (IOX) and iodipamide (IDP) were investigated under both aerobic and anaerobic aquifer conditions during 12-month large-scale column experiments. Under natural aerobic conditions, IOX was observed to biodegrade with a half life of <1 day. However, IDP was persistent throughout the experiment (half life >100 days). Under natural anaerobic conditions, no degradation of IOX was observed (half life >100 days), while IDP degraded rapidly with a half life of 2 days. Based on this data, a sequential remediation strategy was investigated that involved establishing an anaerobic reductive zone half way along a 200 cm-long aerobic column to provide a 100 cm-long aerobic zone followed by a 100 cm-long anaerobic zone. Results from this experiment confirmed that a sequential natural aerobic/enhanced anaerobic remediation strategy was viable, with rapid IOX degradation (half life <1 day) in the aerobic zone, followed by rapid IDP degradation (half life <1 day), along with denitrification and sulphate reduction, in the anaerobic zone of the column.

Key words  X-ray contrast media; iohexol; iodipamide; biodegradation; groundwater; managed aquifer recharge