**Occurrence and fate of nitrosamines and benzotriazoles in recycled water used for managed aquifer recharge**

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**ABSTRACT**

The use of recycled water sourced from wastewater can pose a risk for managed aquifer recharge (MAR) due to the potential for trace organic compounds contaminating aquifers. While advanced treatment processes, such as reverse osmosis, can remove many large hydrophobic compounds, some small, polar and uncharged compounds are poorly removed. The potential biodegradation of these poorly removed compounds within the aquifer were investigated in large-scale laboratory columns using field sediment and recycled water to mimic a MAR replenishment strategy of the Leederville aquifer in Western Australia.

The compounds investigated were (i) nitrosamines (*N*-nitrosodimethylamine - NDMA and *N*-nitrosomorpholine – NMOR) that can be formed during wastewater disinfection; and (ii) benzoltriazoles (benzotriazole – Btri and 5-methylbenzotriazole - 5-MeBT) that can contaminate wastewater from the use of dishwashing detergents.

All the compounds investigated showed high mobility in aquifer sediment with retardation coefficients of 1.1 (NDMA), 1.2 – 1.6 (NMOR), 2.0 (Btri) and 2.2 (5-MeBT). Degradation experiments with influent contaminant concentrations at 200 ng L-1 indicated first order biodegradation of contaminants, with biodegradation half-lives of 25-150 days (NDMA), 40 ± 2 days (NMOR), 29 ± 2 days (BTri) and 26 ± 1 days (5-MeBT). Further confirmation of biodegradation was the transient formation of degradation products, and limited removal of parent compounds in sterile control columns.

These results suggested that if NDMA, NMOR, BTri and 5-MeBT were present in recycled water that was recharged to the Leederville aquifer, biodegradation during aquifer passage is likely given sufficient aquifer residence times or travel distances between recycled water injection and groundwater extraction.

# Keywords: *N*-nitrosodimethylamine; *N*-nitrosomorpholine; benzotriazole; 5-methylbenzotriazole; degradation; recycled water; MAR