

MODELLING FATE OF TRACE ORGANIC CHEMICALS THROUGH ACTIVATED SLUDGE PLANTS

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MODELLING FATE OF TRACE ORGANIC CHEMICALS THROUGH ACTIVATED SLUDGE PLANTS USING CHEM-R

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BACKGROUND AND RELEVANCE

Trace organic compounds (TOCs) occur in recycled water as a result of domestic chemical usage and trade waste discharges to sewer. Water industry professionals, regulators and the community have long been concerned about the presence of TOCs in recycled water and their fate through Activated Sludge Plants (ASPs). Due to the large number of compounds used in industry testing can only cover a tiny fraction of the compounds that could be present. Consequently, a model - CHEM-R - was developed for ASPs to describe the rates of chemical biodegradation, volatilisation, partitioning to biosolids, and persistence in treated recycled water. Separate versions of CHEM-R were developed for Melbourne Water's Eastern and Western Treatment Plants. The models were subject to a validation study and used to screen the fate of several hundred priority TOCs through the plants.

RESEARCH APPROACH

CHEM-R uses the chemical thermodynamics concept of fugacity - a convenient approach for describing mathematically the rates at which chemicals diffuse, or are transported, between phases (i.e. soil, water, air).

Key model variables are the substance biodegradation rate and Log K_{ow} (octanol-water partition coefficient). Quantitative Structure Activity Relationships (QSAR) were used to provide much of this data which introduces some additional uncertainty.

Microsoft Excel® was used as the modelling platform for CHEM-R. Excel allows the use of high quality graphing and plotting tools for data visualisation, database lookup tools to assist the user to assess large batches of substances simultaneously, and the potential to incorporate sensitivity analyses to account for operational and parameter uncertainty.

AFFILIATIONS

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