

Evaluation of Dibutyltin and Monobutyltin Leaching from PVC pipe: A Bench and Pilot Scale Approach

by

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University of Toronto

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Abstract

Bench scale pipe-section reactors (PSRs) along with pilot scale pipe-loops were used to examine the leaching of toxic dibutyltin (DBT) and monobutyltin (MBT) heat stabilizers which are commonly used in drinking water distribution systems across North America from C900 and C909 PVC pipe. PSR trials were conducted using artificial freshwater containing up to 4 mg/L free chlorine, as typically employed for drinking water distribution. Pipe-loops located onsite at a water treatment facility continuously received chloraminated water. MBT was observed above the detection limit only during the first 24 hours of the PSR trial, with the presence of chlorine showing a positive impact on leaching. Pipe-loop and PSR results did not show DBT above the detection limits during the trials. These findings suggest that DBT leaching from C909 and C900 PVC pipes within a typical drinking water distribution system should not pose a concern to consumers.

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PREVIEW

NOMENCLATURE

| | |
|--------------------------------|--|
| " | Inch |
| % | Percent |
| > | Greater than |
| < | Less than |
| ≥ | Greater than or equal to |
| ± | Plus/minus |
| A | Area |
| AFW | Artificial Freshwater |
| ASTM | American Society for Testing and Materials |
| AWWA | American Water Works Association |
| C | Degrees Celsius |
| °C/min | Degrees Celsius per min |
| cm | Centimetre |
| CPVC | Chlorinated Polyvinyl Chloride |
| DBT | Dibutyltin |
| DI | De-ionized |
| DMT | Dimethyltin |
| DO | Dissolved Oxygen |
| DOT | Diocetyl tin |
| EI | Electron Ionization |
| EPA | Environmental Protection Agency |
| eV | Electron Volt |
| g | Gram |
| GCMS | Gas Chromatography - Mass Spectrometry |
| h | Hour |
| HRT | Hydraulic Retention Time |
| L | Litre |
| m | Metre |
| M | Molarity |
| m(t) | Organotin leaching rate at time t |
| m/s | Metre per second |
| m/z | Mass to charge ratio |
| m ² | Metre squared |
| m ² /m ³ | Metre squared per metre cubed |
| m ³ | Metre cubed |