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Method Article

Field based pilot-scale drinking water distribution system: Simulation of long hydraulic retention times and microbiological mediated monochloramine decay

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A B S T R A C T

Drinking water distribution systems with long hydraulic retention times (HRTs) commonly encounter rapid microbiological-mediated monochloramine decay that results in microbial regrowth and nitrification with reduction in alkalinity. In this paper, we report the design and operation of a field-based pilot-scale distribution system (PDS) operated at flows that simulate long HRTs (~10 days) to promote rapid microbiological monochloramine decay over long periods. The PDS is designed to enable the testing of chemical treatment for the control of nitrification and monochloramine decay. The PDS has two identical cylindrical polyethylene tanks (DS₁ & DS₂), each of 1 m diameter and 1.8 m height (~1 kL) holding 900 m of polyethylene (PE) tubing with sampling points every 300 m intervals. Microbial mediated decay (determined by the Fm test) of monochloramine occurred as treated (alum coagulated and flocculated) and chloraminated water passed through the DSs. In this manuscript we report:

- An inexpensive, flexible and compact system that can be readily set-up at a full-scale water treatment plant, requiring minimal supervision for operation.
- A 'draw & fill' system for achieving control on HRT's through the pipes.

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Specifications Table

Subject area	Engineering
More specific subject area	Water Engineering
Method name	Simulated pilot distribution system

Details of materials used for the pilot-scale drinking water distribution system

- 2 × PE tanks (1.8 m height, 1 m diameter, ~1 kL capacity) with lids and 2 × 1 m² fine wire mesh (as additional covering);
- PE tubing (900 m × 13 mm diameter/tank);
- Additional 13 mm and 19 mm PE pipes for external connections;
- 13 mm and 19 mm PE-connectors, taps, T-sections, pipe clips and 90° fittings;
- 19 mm to 13 mm PE reducers;
- 2 × float ball valves;
- 2 × mesh cartridge filter (300 μm);
- 2 × low strength peristaltic pumps (ProMinent, Models: gamma/L and Beta/4);
- 2 × 24-h power switch timers;
- Electrical cable and heavy-duty safety power board;
- 200 L tank (for biofilm assessment tank, BAT);
- 4 × ~100 cm PVC pipes (77 mm internal diameter, for draw and fill of water supplies);
- Nylon ropes;
- Covers (plastic containers) for the pumps and power board;
- 70-L chemical stock solution PE tank;
- Masterflex L/S (77800-50) Easy Load Pump for chemical dosing;
- L/S® tubing- 10 m spare tubing;
- Small and large cable ties

Method details
Pilot distribution system (PDS)
Installation phase

The pilot distribution system (PDS) was set up at the Tailem Bend Drinking Water Treatment Plant (TBWTP), Tailem Bend, South Australia (35.253 °S, 139.456 °E). The water treatment process (capacity of 28 ML/d) comprises coagulation & flocculation, tube settler clarification, dual media rapid gravity filters, and disinfection by UV (low pressure mercury lamps) and monochloramine [1]. Powdered activated carbon is periodically used and the treated water is fluoridated prior to distribution. The PDS was constructed to simulate a full-scale chloraminated drinking water distribution system and to enable control of water conditions that would allow the study of microbially-mediated and chemically-based monochloramine (NH₂Cl) decays. The PDS (Fig. 1) consists of two identical

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