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Conducting distribution system corrosivity evaluations using an innovative jar test procedure

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ABSTRACT

There have been several attempts in enhancing corrosion jar testing methods to better mimic real-world conditions found in drinking water distribution systems. A key feature that is generally omitted in such studies is zero headspace and the lack of interaction with the atmosphere within the jars as well as the flow interactions which affect total metal release. This work proposes a modified method to typical corrosion jar testing protocols to better simulate distribution system conditions. Modified separatory funnels with the addition of a rubber stopper and coupon holder were set-up to allow an in-flow and out-flow for water replacement every three to 4 d. The results demonstrated the effectiveness and reproducibility of the modified method, specifically with the analysis of variance conducted. A synthetic water test using both the modified and original methods showed a statistical difference between the two, and decreased variability in the metal release with the new procedure. Enhanced dissolved oxygen depletion was also observed with the modified method. The results of another study conducted, using actual waters, was used to create an empirical model with the water quality parameters measured, and the total metal release. This model was a good fit, with a 0.81 R-squared value and a 0.71 linear slope between the predicted and measured copper concentrations. In addition, first-order rate law models were created for fitting the metal release observed. The resultant equations were not good fits the batch testing conducted, however, the first-rate models created for the direct-connection study resulted in up to a 0.98 R-squared value with slopes close to unity when plotting the calculated vs. measured metal release.

Keywords: Jar test; Immersion; Corrosion; Drinking water; Copper; Flow-through; Metal release

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