Sodium Silicate Impacts on Copper Release in a potable water comprised of Ground, surface and desalted sea water supplies

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\textbf{ABSTRACT}

The effects of sodium silicate corrosion inhibitor dosages, ranging from 3 to 12 mg/L-SiO\textsubscript{2} on total and dissolved copper release was studied using coiled copper pipes that were exposed to differing blends of groundwater, surface water, and reverse osmosis treated groundwater that was intended to simulate desalinated seawater. The evaluation was conducted within a pre-existing, demonstration-scale drinking water distribution pilot system where samples were drawn from tapped copper coils 30 feet in length and 5/8 inch diameter. One set of loops contained water treated with sodium silicate and two loops contained water not treated with inhibitor and were designated as pH\textsubscript{4} and pH\textsubscript{4}+0.3. Testing was segmented into four different phases (I:II:III:IV), where water quality was varied in each phase by blending differing proportions of three source waters; groundwater (62:27:62:40), surface water (27:62:27:40), and simulated desalinated seawater (11:11:11:20), respectively. Total copper release decreased by approximately \([34\%:41\%:54\%:50\%] \) when dosed with 3 mg/L—SiO\textsubscript{2} of sodium silicate, \([32\%:49\%:56\%:59\%] \) at 6 mg/L—SiO\textsubscript{2} and \([48\%:63\%:66\%:70\%] \) at 12 mg/L—SiO\textsubscript{2} for the conditions experienced in the study. An observed light green scale developed on loop-inserted copper coupon surfaces; elemental analyses of inserted coupon surfaces depicted evidence of a silicate-copper based surface film. Linear regression correlated total copper release in terms of dosage and water quality \((R^2 = 0.68)\). The model suggested that dosage, alkalinity, chlorides, and pH were statistically associated with copper release.

\textbf{Keywords:} Sodium silicate; Silica; Internal corrosion control; Inhibitor; Copper release; Blended water supplies

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