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Effect of Hazardous Bacteria Isolated From Copper Plumbing System on Microbiologically Influenced Corrosion of Copper

Carlos Galarce[1,*], *Fabiola Pineda*[2], *Diego A. Fischer*[1], *Marcos Flores*[3], *Ignacio T. Vargas*[1], *Mamie Sancy*[4] *and Gonzalo E. Pizarro*[1,*]

[1] Departamento de Ingeniería Hidráulica y Ambiental, Escuela de Ingeniería, Pontificia Universidad Católica de Chile. Vicuña Mackenna 4860, Santiago, Chile.
[2] Departamento de Ingeniería Mecánica y Metalúrgica, Escuela de Ingeniería, Pontificia Universidad Católica de Chile. Vicuña Mackenna 4860, Santiago, Chile.
[3] Departamento de Física, Facultad de Ciencias Físicas y Matemáticas, Universidad de Chile. Beauchef 850, Santiago, Chile
[4] Escuela de Construcción Civil, Pontificia Universidad Católica de Chile. Vicuña Mackenna 4860, Santiago, Chile.
[*]E-mail: gpizarro@ing.puc.cl

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Plumbing systems can be affected by Microbiologically Induced Corrosion (MIC). Through this process, microorganisms can modify water quality and jeopardize consumers' health by releasing metal from pipes' surface into the water. While it is known that microorganisms' interactions increase their electrochemical effect on the metal surface, the effect of mixed communities and their interactions remain poorly understood. In this work, we investigated two hazardous bacteria isolated from a copper plumbing system, *Variovorax sp,* and *Ralstonia pickettii*. Electrochemical impedance spectroscopy (EIS) showed a changing of oxide layer properties depending on immersion time. At short times, a capacitive behavior was observed at the low-frequency range, transiently including an additional inductive loop. At long times of exposure, the capacitive behavior disappears, and a Warburg behavior is present at the low-frequency. Interestingly, the corrosion was inhibited in pure culture tests, but this effect was reduced when the bacteria formed a consortium. In fact, EIS data show that the highest inhibitor activity was presented by *Variovorax sp* pure culture, with 3.5-fold reduction in the corrosion rate compared with abiotic condition, and around of 2-fold when copper was exposed to *Ralstonia pickettii* and the consortium. XPS showed the formation of a different by-product of corrosion in the samples exposed to bacterial action. Moreover, SEM images revealed different bacterial growth behavior at the end of the test period. This research highlights the relevance of understanding the interactions of drinking water microbial communities

Keywords: Microbial corrosion; biofilm; copper; impedance; pathogen bacteria

FULL TEXT