Corrosion Behavior of AISI 1045 Carbon Steel in Metalworking Fluids Containing *Pseudomonas xiamenensis*

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Microbial contamination of aqueous metalworking fluids (MWFs) is of significant concern in metal process industries. In this study, a dominant *Pseudomonas* sp. strain (*P. xiamenensis*) was isolated from waste metalworking fluids (WMWFs) and the biodegradation of model MWF was studied under the influence of *P. xiamenensis*. Results showed that nitric additives in MWF were severely degraded by bacteria, leading to a significant increase in the turbidity of the MWF. The occurrence of microbially influenced corrosion of AISI 1045 carbon steel in MWF containing *P. xiamenensis*, was proven by morphological analysis and electrochemical characterization. The corrosion rate of the metal in MWF in the presence of bacteria was three-fold greater than in the absence of bacteria. Electrochemical results and surface analysis elucidated that the additive film was decomposed by *P. xaimenensis* adhered to the steel surface and a biofilm, which was controlled by diffusion replacing the additive film. The biofilm was reinforced by the reaction of metabolites and Ca^{2+} and seriously localized corrosion behavior was observed in carbon steel immersed in the bio-contaminated MWF due to the microbial influence.

Keywords: metalworking fluid; biodegradation; AISI 1045 carbon steel; microbially influenced corrosion; electrochemistry

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