

ACTIVITY OF *Desulfovibrio desulfuricans* BIOFILMS IN RESPONSE TO THE SUBSTRATUM

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The understanding of the interactions between metallic surfaces such as stainless steel 304 and the bacteria implied in the phenomena of corrosion are primordial to fight biocorrosion (MIC – *Microbiologically Influenced Corrosion*). One of the main types of bacteria associated with corrosion failures of cast iron, mild steel and stainless steel structures are the sulfate-reducing bacteria (SRB). The goal of the present work was to study the influence of surface material on the development and activity of a sulphate-reducer biofilm. Therefore, *Desulfovibrio desulfuricans* biofilms were developed on 304 stainless steel (SS 304) and on a reference non-metallic material, polymethylmetacrylate (PMMA) in a flow cell system. The influence of chromium and nickel, elements included in the composition of stainless steel, on bacterial metabolism was also tested on a cell suspension of sulfate-reducing bacteria. Steady-state biofilms presented higher rates of nutrient consumption and metabolite production on SS 304 than on PMMA. This was probably due to a higher bacterial specific activity or to a higher number of bacteria in the biofilms developed under these conditions. Activity tests with bacterial suspensions from both steady-state biofilms also showed that the specific growth rates were higher for bacteria grown on stainless steel. These results led to the hypothesis of a positive influence of the metallic elements of steel on bacterial metabolism. The fragilisation of the passive layer of stainless steel, probably through the action of the sulphide produced by SRB, can make available metallic elements that otherwise would be in limiting concentrations. Considering the effect of alloying elements on SRB suspensions, chromium did not seem to have any effect on the growth of the bacteria while nickel increased the specific growth rate within the same molar concentration range. In fact, concentrations of nickel between 0.85 μM and 85.20 μM markedly increased the specific growth rate of *Desulfovibrio desulfuricans*. Additionally, an increase of iron in the culture medium did not lead to any significant effect on SRB growth. Therefore, the release of iron from the metallic surface was probably not the reason for higher consumption/production rates in biofilms developed on SS 304. As a conclusion, the present study allows to hypothesize the following mechanism: the presence of a *Desulfovibrio desulfuricans* biofilm on a 304 stainless steel surface in anaerobic conditions leads to the weakening of the metal passive layer and to the dissolution in the bulk phase of nickel ions that have a positive influence on the sulfate-reducing bacteria metabolism. This phenomenon may enhance the biocorrosion process contributing to a higher and/or faster degradation of the metallic surface.