TITLE: CHARACTERIZATION OF A SULPHATE REDUCING BACTERIA EXOPOLYMERS AND INVESTIGATION OF BIOCORROSION MARKERS IN A MILD STEEL SURFACE

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ABSTRACT:

Microbially Induced Corrosion (MIC) is becoming an emerging concern in many industrial fields, from oil and gas through naval industry to any production or transportation process that has to rely on metals, as more studies add proofs of its importance from the economic and ecological point of view. Although it is still difficult to separate the role of the microorganism from the abiotic variables, the literature agrees that microorganism attachment and consequent biofilm formation is one of the most important steps to speed up the corrosion evolution. Time of Flight-Secondary Ions Mass Spectrometry (ToF-SIMS), X-ray photoelectron spectroscopy (XPS) and Scanning Electron Microscopy-Electron Dispersive X-ray Spectroscopy (SEM-EDX) were used to characterize the exopolymeric susbtance composition and surface alteration of metal plates incubated with *Desulfovibrio desulfuricans* ATCC 27774, a typical sulphate reducing bacteria (SRB) using different respiratory substrate. Our results demonstrate that the respiratory substrate strongly influences the Extracellular Polymeric Substances composition (EPS), bacterial surface interaction and ultimately the biofilm configuration and corrosion process. The use of Principal Component Analysis (PCA) to treat ToF-SIMS data allowed us to differentiate between the two respiratory substrates and to identify the most important ion peaks for the variance observed. Sulphate reduction is one of the main factors responsible for the precipitation of inorganic salts like calcium and phosphates and could be related to the EPS iron uptake. Our study also demonstrates that nitrate-rich medium can increase the precipitation of chloride ions at the surface and ultimately increase the general corrosion rate when dealing with SRB. The use of state of the art technology for surface analysis as ToF-SIMS and SEM-EDX can give new insights into the (bio)corrosion mechanism and evolution, and some information of the interaction of the microorganisms with the metal surface.

Keywords: Biocorrosion, multivariate analysis, spectroscopy

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