Biofilm formation on Titanium and Titanium Oxide and its Characterization and Electrochemical Properties

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This work studied the surface characterisation and the electrochemical evaluation of titanium (Ti) and anodised titanium (A-Ti) electrodes modified with a bacterial biofilm of a novel consortium composed of *Enterobacter cloacae* complex, *Enterococcus gallinarum*, *Escherichia coli*, *Klebsiella pneumoniae*, and *Enterococcus faecium* – the biological support media consisted of peptone casein nutrient broth (PCNB), and acid whey (AW) – with the purpose of evaluating the electrochemical response of non-carbonaceous materials with low interferences. This is useful for bio-electrodes, mainly biocathodes intended to operate in bioelectrochemical systems of substrates at neutral pH and acid pH. For this, scanning electron microscopy (SEM) and electrochemical techniques of chronopotentiometry and voltammetry were used, following the biofilm growth after the inoculation of the bacterial consortium on the Ti and A-Ti materials, at times of 24 h and 168 h. The results showed that it was possible to obtain biofilms of bacteria with a high efficiency in a period of 24 hours, noting that the A-Ti material favours the biofilm growth in terms of quantity, chemical stability and a biocathodic response. The biofilms demonstrated specific behaviours depending on the inoculation time and the biological support medium, with evidence of bacterial bodies coated by extracellular polymeric substances (EPS) in the AW media. These results allow the possibility of using Ti and A-Ti materials in bioelectrochemical systems whose purpose is to treat whey solutions with an acidic pH.

Keywords: Bio-electrode, Titanium, Anodised, Media, pH, Biofilm.

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