Corrosion performance and electrochemical stability of 316L in body fluid

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Abstract : Metal implants are the best choice for the long-term replacement of hard tissue, such as hip and knee joints, because of their excellent mechanical properties. 316L stainless steel is widely accepted as biocompatible metal implants. The aim of this work is to study the biocompatibility of 316L stainless steel, for the manufacture of screw plates having high chromium and low carbon contents; in a simulated blood medium (Ringer's solution). The specimen having a cylindrical shape, has been characterized by a spectral analysis for the identification of the chemical composition, a mechanical characterization (hardness Rockwell), physicochemical (X-ray diffraction), and finally electrochemical measurements (monitoring the free potential evolution, plots of polarization curves and electrochemical impedance spectroscopy (EIS) measurements were conducted after 4h, 6h, 24h, 48h, 168h, 215h, 10 days and 15 days of immersion in Ringer's solution. The influence of parameters such as electrolytic medium, pH, agitation of the medical device (screw plates used in orthopedics) has studied. Very low current densities were obtained, indicating the formation of a passive layer. Impedance spectra, represented in the Nyquist plan, exhibited a single constant system suggesting the formation of one layer.

Keywords : Implants, stainless steel, biocompatibility, Ringer's solution, X-ray diffraction