Mechanism of degradation of AgCl coating on biopotential sensors

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摘要

Abstract

AgCl coated Ag foil has been widely used as the biopotential sensor to diagnose problems of the human heart. Evidence shows that quality of AgCl on the electrode could experience degradation during the process of long-term monitoring for irregular activities of the heart. To study the degradation of AgCl/Ag electrode, new and used electrodes were collected. Electrochemical tests such as open-circuit potential (OCP), cathodic stripping, electrochemical impedance spectroscopy (EIS), scanning electron microscopy (SEM), and X-ray mapping of elemental distribution were applied to understand the electrochemical properties of the sensors during the progress of degradation. Results revealed that OCP values shift from positive potential of new sensor to negative potential of used sensor (OCPnew: +30 mV; OCPused: -300 mV, $p < 0.05$) and a significant difference in impedance (Impedancenew: 3000 Ω; Impedanceused: 1 MΩ, $p < 0.05$). Ratio of the average AgCl thickness on good and bad eletrocardiographic (ECG or EKG) electrodes is 4.83 ($p < 0.05$). Simulated degradation by exposing the biosensor to deaerated sweat solution and by cathodic stripping of AgCl proposed that the degradation occurs by cathodic reduction of AgCl due to the presence of hydrogen ions in the low pH value of human sweat under deaerated condition

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