

快速检测大肠杆菌O157:H7的电化学阻抗免疫生物传感器

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摘要:

建立了一种采用电化学阻抗谱技术快速检测大肠杆菌O157:H7的生物传感器,它是通过石英晶体金电极表面附着一层蛋白A膜来固定抗体的。该生物传感器采用了三电极系统—工作电极石英晶体金电极、Ag/AgCl/Cl⁻参考电极和铂对电极。和以往普通金电极不同,第一次采用了石英晶体金电极。试验结果说明抗体的固定以及大肠杆菌O157:H7与抗体的结合都增加了石英晶体金电极表面的电子传递阻抗,在[Fe(CN)₆]^{3-/4-}氧化还原对存在的情况下,用电化学阻抗谱测量该阻抗。该免疫生物传感器的检测限是10³ cfu/ml,石英晶体金电极的电子传递阻抗变化值和大肠杆菌O157:H7的浓度在一定范围内呈线性关系,检测时间少于10分钟。

关键词: 食品安全检测; 免疫生物传感器; 电化学阻抗谱; 石英晶体金电极; 大肠杆菌O157:H7

Rapid Detection of Escherichia coli O157:H7 Using Electrochemical Impedance Immunosensor

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Abstract:

A biosensor based on electrochemical impedance spectroscopy (EIS) was developed for rapid detection of Escherichia coli O157:H7. It was based on the immobilization of antibodies onto a monolayer of protein A on an Quartz Crystal Au electrode surface. In the structure of the biosensor, a three electrode system was utilized—quartz crystal Au working electrode, Ag/AgCl/Cl⁻ Reference electrode and Pt counter electrode. The results indicate that the immobilization of antibodies and the binding of E.coli cells to the Au electrode surface increased the impedance, which was directly measured with electrochemical impedance spectroscopy in the presence of [Fe(CN)₆]^{3-/4-} as a redox probe. The Δ impedance, $Z_{\text{cells}} - Z_{\text{antibody}}$, is correlated with the concentration of E. coli cells. The detection limit of the immunosensor can reach 10³ cfu/mL and the detection time is less than ten minutes.

Keywords: key words: foodsafety detection, immunosensor, Electrochemical Impedance Spectroscopy (EIS), Quartz Crystal Au electrode, Escherichia coli O157:H7

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