

电化学石英晶体微天平实时表征和定量检测短序列DNA

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摘要 利用电化学石英晶体微天平(EQCM)

这一灵敏的质量和电化学传感器测定特定序列DNA。应用自组装膜技术在压电石英晶振表面自组装一带羧基的 α -硫辛酸单层膜,通过盐酸1-乙基-3-(3-二甲氨基丙基)碳二亚胺(EDC)及N-羟基琥珀酰亚胺(NHS)共价固定寡聚核苷酸为探针,

用于测定与其碱基序列互补的DNA。实验中EQCM实时监测了 α -硫辛酸的自组装过程、

探针固定过程及其与cDNA杂交过程。定量得出了探针固定量及cDNA杂交量。在酸性、中性和碱性条件下,

分别对固定和杂交过程进行表征,实验发现探针固定及DNA杂交都受pH影响,本文对此现象进行了解释。同时,

利用染料Hoechst33258的电化学活性,使其与双链DNA嵌合,通过测量Hoechst33258的电化学信息进一步验证了DNA杂交关键步骤。

关键词 [电化学](#) [石英](#) [晶体](#) [特点序列DNA](#) [自组装膜](#) [杂交](#)

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Real-time characterization and determination of short DNA sequences with electrochemical quartz crystal microbalance

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Abstract Electrochemical quartz crystal microbalance (EQCM), which is capable of sensitive measurement for mass and electrochemical signals, was employed to analyze specific-sequence DNA. Self-assembled monolayers with carboxy groups were first coated on the gold electrode of a quartz crystal resonator by adsorption of α -thioctic acid, ssDNA of 20-mer oligonucleotides was then covalently attached to the surface via N-ethyl-N'-(3-(dimethyl)aminopropyl) carbodiimide hydrochloride (EDC), N-hydroxysuccinimide (NHS) as probe molecules. The processes for self-assembly of α -thioctic acid, immobilization of the probe and hybridization of the target DNA were real-time characterized, and the amounts of immobilized ssDNA and hybridized cDNA in acidic, basic and neutral solution were determined. It is found that both of the amounts of immobilized ssDNA and hybridized cDNA are depended on solution pH, and this phenomenon is explained reasonably in this paper. After hybridization, the gold electrode of the quartz crystal resonator was reacted with Hoechst 33258, which is a DNA minor groove binder and can bind to dsDNA hybrids. Electrochemical signals of Hoechst 33258 were measured to characterize the processes of DNA hybridization. Qualitative and quantitative analysis of specific sequence of DNA can be performed in this way without a label.

Key words [ELECTROCHEMISTRY](#) [QUARTZ](#) [CRYSTALS](#) [HYBRIDIZATION](#)

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