Programmable Biosensor Development for the Electrochemical Detection of Metal Ions

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ABSTRACT:

A label free programmable biosensor for electrochemical detection of metal ions using on-chip synthesized probe was developed. The developed system is expected to be detecting different metal ions by synthesizing the specific peptide probes on the chip. In this work, we focused on the detection of copper ion, using a new peptide probe, Gly-Gly-Gly (GGG) instead of reported probes Gly-Gly-His (GGH) [1]. A new design of electrochemical chip was purposed, integrated with the three patterned gold (Au) electrodes on glass, and a PDMS microfluidic chip. Before Probe synthesis, working electrode was chemically modified with 2-aminoethanethio (AET)/ethanethiol (ET)[6:4] for 4 hours at room temperature to form the self-assembled monolayers (SAMs) of amino terminal thiol molecule. The peptide probe, GGG was synthesized over chemically modified working electrode using solid phase peptide synthesis (SPPS)[2] on microchip[3]. After probe synthesis, copper ion solution was added to chip to pre-concentrate the electrode by forming ternary coordination complex between copper ion (Cu²⁺) and GGG Peptide probe. The captured metal ion was further reduced and then oxidized to detect using Differential pulse voltammetry (DPV) technique. A step by step modification of Au surface was also analyzed using electrochemical impedance spectroscopy (EIS) and cyclic voltammetry (CV) measurement. On-chip synthesized peptide probe was found to be able to detect the copper ion in concentration range of 1×10⁻⁷ M.

REFERENCES:

