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3-Mercapto propionic acid self-assembled on gold nano-particles applied for modification of screen-printed electrode as a new digoxin electrochemical aptasensor using graphene oxide-based signal-on strategy

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Abstract

In this study a new electrochemical aptasensor has been represented for digoxin determination using signal-on strategy to improve limit of detection. To construct the sensor, gold screen printed electrode (GSPE) was modified with electrodeposited gold nanoparticles (GNPs) followed by self-assembling a layer of 3-mercaptopropionic acid (MPA) on the GNPs. Amino-labeled digoxin specific aptamer was covalently attached to the surface via carbodiimide bond formation. Graphene oxide (GO) was accumulated on the electrode surface through interaction with aromatic nucleobases in aptamer structure and the monitored reduction signal of potassium ferriciyanide as a redox probe was decreased. In the presence of digoxin, the immobilized GO left the surface and the current was increased and recorded as analytical signal. The proposed sensor was delivered a linear dynamic response over the range of 0.1 pM to 1.0 µM with a detection limit of 0.050 pM. The ability of the aptasensor in real sample analysis was successfully evaluated by determination of digoxin in human blood plasma samples with no serious matrix interferences.

Keywords: digoxin; electrochemical aptasensor; graphene oxide; gold nanoparticles; 3-mercaptopropionic acid; self-assemble

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