DNA hybridization Detection by Charge Perturbation Through DNA at poly(thionine)-Modified Glassy Carbon And Gold Electrodes

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Simple and label-free electrochemical sensors for DNA hybridization detection were developed based on poly(thionine) [PTH] modified glassy carbon and gold electrodes. Probe ssDNA was immobilized on the PTH film via covalent linkage between pendant amine ($-NH_2$) group of the PTH and the phosphate (PO_4^-) group of the ssDNA. The hybridizations were examined with different target ssDNA sequences. DPV showed a significant decrease of Fe^{2+} oxidation peak current density (J_{peak}) when hybridized with complementary and 1-base miss match ssDNA sequences. 3-base miss match and non-complementary ssDNA sequences showed the negligible changes of Fe^{2+} oxidation J_{peak}. EIS demonstrated an increased charge transfer resistance (R_{ct}) and decreased charge transfer rate constant (K_a^o) after hybridization of complementary sequence. The PTH/GCE and PTH/GE sensors showed the excellent sensitivity of 1.44 and 50 $\mu A/cm^2/nM$ with the detection limit of 0.14 and 0.36 nM, respectively for sensing complementary ssDNA hybridization.