Electrochemical Aptasensors for Diagnostic Analysis

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There has been growing research interest in the development of rapid, reliable and ultrasensitive methods for clinical analysis. Among the available techniques, aptamer-based biosensing methods have shown great promise due to their high sensitivity and selectivity for the target biomolecules. Aptamers are synthetic nucleic acid ligands (single-standed DNA or RNA) that capable of binding to target molecules not only with high specifity but also high affinity. The single-stranded nature of the aptamer changes into a three-dimentional structure in the presence of the target molecule. To date, various aptamers have been developed for the detection of wide range of molecules including proteins, peptides, whole cells and drugs5. Our studies are aimed to carry out applications of these nanobiosensor systems in combination with certain bioreceptors (i.e. antibodies, aptamers) for detection of variable biomarkers in real biological samples for further possible development of point-of-care diagnostic tools.

Electrochemical aptasensors provide sensitive, fast response, low cost, miniaturized and easy to handle systems to obtain excellent point of care (POC) platforms. In recent years, a prompt development of nanotechnology and a better understanding of nanoparticle structures and properties have enabled their use in different areas of biosensors for diagnosis and monitoring of not only diseases but also drug discovery, food analysis and quality control. Among all nanomaterials, graphene oxide (GO) is one of the most attributed materials for opening new possibilities in the development of next generation biosensors due to its unique properties, such as high electron transfer rate, high affinity for specific biomolecules, thermal stability, water solubility, large specific surface area, exceptional elasticity and rigidity. On the other hand, transition metal oxide nanoparticles of iron, titanium, manganese, zirconium, cobalt, nickel and their composites offer promising features in the field of electrochemical and biosensing.Transition metal oxide nanoparticles of different shapes and structures have been synthesized using various techniques. These metal oxide nanoparticles possess good electrical and photocatalytic properties because of their size, shape, stability and larger surface area.

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