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Smart nano-dimensional dendritic aptasensor for real-time determination of Estrogenic 17β-estradiol

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An electrochemical dendritic DNA aptasensor for the determination of 17β-estradiol (E2), the most potent estrogeneous endocrine disrupting chemical (EDC), was constructed with a 76-mer biotinylated DNA aptamer conjugated to a nano-dimensional generation 2 poly(propylene thiophenoimine)-co-poly(3,4-ethylenedioxythiophene) dendritic star copolymer (G2PPT-co-PEDOT). The 76-mer biotinylated DNA aptamer was synthesised by Systematic Evolution of Ligands by Exponential Enrichment (SELEX). Bode impedimetric analysis indicated that the sensor platform (G2PPT-co-PEDOT) was a biocompatible polymeric semiconductor that enhanced the conductivity the electrochemical aptasensor. The response dynamics of the sensor involved the attenuation of square wave voltammetric current as E2 binds to the ssDNA aptamer component of the biosensor. The aptasensor was very selective and reproducible for E2. The dynamic linear range (DLR) of the biosensor was 8.17 – 307 pg/mL with a detection limit (DL) of 0.043 pg/mL. The response parameters of the sensor showed that it was more sensitive than most other techniques including dissociation enhanced lanthanide fluorescence immunoassay (DELFIA), enzyme-linked immunosorbent assay (ELISA), GC/MS method and bis(trimethylsilyl)trifluoroacetamide derivatisation method. The DL and DLR values show that the aptameric nanobiosensor is suitable for measuring deviation from acceptable daily intake (ADI) of E2 through all sources. The ADI limit for E2 is 0.05 μg/kg bw as determined by the Food and Agriculture Organisation of the United Nations (FAO).

Biography

Emmanuel Iwuoha obtained his PhD Chemistry degree from the University of Ibadan in 1986 and became a Fellow of the Royal Society of Chemistry of England in 1999. He has been a Professor of Chemistry at University of Western Cape, South Africa since 2001. He is the founder and leader of SensorLab, a nanoelectrochemistry, smart materials and sensor research laboratory. Prof Iwuoha was a Guest Editor for the Special Issue of Analytical Letters on Kinetics in Analytical Chemistry, and published more than 85 ISI-listed journal articles between 2005 and 2011.

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