Biosensors for β 17-estradiol detection based on graphene quantum dots (GQDs)/conducting polymer and laccase modified platinum/gold electrodes

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A convenient electrochemical sensing pathway was investigated for β 17-estradiol determination based on graphene quantum dots (GQDs)/conducting polymer and laccase modified platinum (Pt)/gold (Au) electrodes. The miniature estradiol biosensors were created through the immobilization of laccase on the surface of an electroactive layer of an electrode coated with GQDs or with electroconducting polymer – poly(4-(5-hexylthiophen-2-yl)-2,6-bis(5-(selenophen-2-yl)thiophen-2-yl)pyridine). This sensing arrangement utilized the catalytic oxidation of β 17-estradiol to a reactive oxygen agent, and then to oligomeric structures. The process of hormone determination was based on the redox reaction using the presence of the laccase enzyme. Under optimized conditions, the constructed systems demonstrated a convenient degree of sensitivity – $0.25\text{--}0.75\text{ }\mu\text{A mM}^{-1}\text{cm}^{-2}$ - selectivity in a wide linear range ($0.1\text{--}120\times 10^{-6}\text{ M}$) with a detection limit of ca. $1\text{ }\mu\text{M}$. Moreover, the method was successfully applied for hormone determination in the presence of interfering compounds (ascorbic acid, L-cysteine, uric acid).

Keywords: biosensor, EDCs, hormones, GQDs, laccase, semiconductive polymer, voltammetry techniques

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