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# A novel electrochemical enzyme biosensor for detection of 17 $\beta$ -estradiol by mediated electron-transfer system

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## Abstract

An extremely sensitive enzyme sensor for detection of 17 $\beta$ -estradiol based on electropolymerized L-lysine molecules on a glassy carbon electrode (GCE) modified with critic acid@graphene (CA-GR) and cross-linked with laccase enzyme has been developed in this work. As the laccase immobilization, glutaraldehyde was chosen as cross-linker through the groups reactions. The novel enzyme sensor could recognize and determinate 17 $\beta$ -estradiol effectively. The morphology of the enzyme modified electrode was characterized by transmission electron microscopy (TEM) and electron microscopy (SEM). The amino interaction between cross-linker and enzyme was characterized by Fourier transform infrared spectroscopy (FTIR). Under the optimal experimental conditions, good linear relationships were achieved in the range of  $4 \times 10^{-13}$ - $5.7 \times 10^{-11}$  M and a limit of detection as low as  $1.3 \times 10^{-13}$  M. Moreover, the enzyme sensor exhibited good reproducibility, stability and high selectivity to 17 $\beta$ -estradiol. Excellent performance was showed in the human urine samples analysis, thus confirming great prospect for further application in clinic diagnosis and biological research.

Graphical abstract

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