

## Fabrication and characterization of polypyrrole nanotube/gold nanoparticles with bienzyme composite film electrodes for glucose sensing

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Co-immobilization of glucose oxidase (GOx) and hydrogen peroxidase (HRP) were made on the polypyrrole nanotubes (PPy)-gold nanoparticles (Au NPs)-thionine (Th) by electrochemical method. The PPy nanotube size and the immobilization methods were optimized for the efficient glucose detection. Compared to other reports, we have used gold nanoparticles onto the PPy nanotubes in addition to bienzymes to enhance the electrocatalytic glucose detection. Both the Au nano particle and the cascade connections between the GOD and HRP in presence of thionine mediator provide a 3D network of high catalytic activity. The presence of a thin film of Nafion over the PPy-Au composite enhances the dynamic range to mM concentration and increases michalis-menton kinetic constant ( $K_M$ ) due to restricted diffusion of glucose through polymer pores. The hybrid nanocomposite provides a new class of electroactive polymer for designing new devices with high sensitivity and good stability for glucose sensing. The sensor behavior was characterized by scanning electron microscope (SEM), atomic force microscope (AFM), Fourier transform-infrared spectroscopy (FT-IR), impedance spectroscopy (IS) and cyclic voltammetry (CV) techniques. The developed sensor is useful for application in medical and food technology.

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