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Nano-Molar Level Hydrogen Peroxide Detection by Horseradish Peroxidase Adsorbed Cup-Stacked Carbon Nanotube Electrodes and Applications to L-Glutamate Detection

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We have developed a simple fabrication method of a highly sensitive direct electron transfer-type electrochemical biosensor for hydrogen peroxide by use of cup-stacked carbon nanotubes (CSCNTs). The CSCNTs, formed by stacking of cup-shaped carbon units, has larger internal space and more hydrophilic edges, thanks to the presence of functional groups containing oxygen (*e.g.*, –COOH, –OH), than multi-walled carbon nanotubes (MWCNTs). When the CSCNTs suspension was cast, the CSCNTs were dispersed homogeneously onto a glassy carbon (GC) electrode, and horseradish peroxidase (HRP) was immobilized firmly by physical adsorption without any chemical reactions. The flow injection analysis (FIA) system with the HRP/CSCNTs/GC electrode has superior sensitivity and stability to the HRP/MWCNTs/GC electrode. The detection limit was 0.75 nM (*S/N* = 3) and the activity was maintained over 85% for 21 days. Further, when the glutamate oxidase (GlOD)-immobilized reactor was set into the proposed FIA system, L-glutamate could be detected repeatedly with a detection limit of 1.2 nM (*S/N* = 3).

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