**Simple and Sensitive Electrochemical Sensor-Based Three-Dimensional Porous Ni-Hemoglobin Composite Electrode**

The development of sensing systems that can detect ultra-trace amounts of hydrogen peroxide (H2O2) remains a key challenge in biological and biomedical fields. In the present study, we introduce a simple and highly sensitive enzymeless H2O2 biosensor based on a three-dimensional open pore nickel (Ni) foam electrode functionalized with hemoglobin (Hb). Our findings revealed that the Hb maintained its biological functions and effective electronic connection even after immobilization process. The exceptional physical and intrinsic catalytic properties of the Ni foam combined with the bio-functionality and electron transport facility of the Hb robustly construct a H2O2 biosensor. The enzymeless H2O2 biosensor showed high selectivity, a quick response time, high sensitivity, a wide linear range and a low limit of detection (0.83 μM at a signal-to-noise ratio of three). Such an electrode composition with safe immobilization processes offers viability for engineering new biosensors.