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Sonochemically Fabricated AuPs/HRP/PANI Microelectrode Arrays

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This article is the first report on the sonochemical fabrication of enzyme/gold particle microelectrode arrays. The study was aimed at incorporating the exceptional characteristics of both microelectrode arrays and gold particles (AuPs) for AuPs/horseradish peroxidase (HRP)/polyaniline (PANI) microelectrode array fabrication. A suitable sonication time of 17.30 min for microelectrode formation on a polydiaminobenzene (PDB)-modified glassy carbon electrode (GCE) was determined. The microelectrodes obtained were μm- and submicron-scale structures with population densities of approximately 7×10^4 and 17×10^4 pores cm^{-2}, respectively. HRP/PANI microelectrode arrays were investigated in comparison to AuPs/HRP/PANI microelectrode arrays in terms of surface characteristics and electrochemical evaluation for phenol detection. Spherical AuPs of around 1 μm were obtained by electrodeposition of AuP ions onto microelectrode surfaces. AuPs incorporated in the HRP/PANI matrix were postulated to enhance interfacial areas for HRP adsorption as well as function as electron conducting pathways between the redox HRP and electrode surfaces. As a consequence, a significantly improved 2.83-times-higher response current was obtained for the AuP-incorporated matrix in comparison to the ones without AuPs. Furthermore, the sensor response time of less than 20 s was achieved both with and without the incorporation of AuPs. Sonochemically fabricated enzyme/AuP microelectrode arrays showed good potential for biosensor applications.

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