

An amperometric biosensor for determination of heavy metal ions, based on a Thiolated DAB dendrimer to form self-assembled monolayers with Gold nanoparticles and HRP.

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Heavy metals such as lead, copper, cadmium and mercury have been implicated in soil, air and water contaminations. These heavy metals are non-degradable, cannot be detoxified biologically and can accumulate in the biosphere and transfer to the alimentary chain, thereby giving rise to potential serious health consequences for human beings, animals and plants [1]. The incorporation of AuNPs in biosensing devices has found to improve the electrode surface and the electronic conductivity, since the AuNPs enhance the transfer of the electrons generated by the enzyme-catalyzed redox reaction to the electrode surface [2]. Furthermore, the AuNPs present a high biocompatibility with the enzyme Horseradish peroxidase (HRP) maintaining their bioactivity [3]. Here we present a new amperometric hydrogen peroxide (H₂O₂) biosensor developed by immobilizing (HRP) onto colloidal gold nanoparticles (AuNPs), covalently bonded to a third generation thiolated DAB dendrimer linked in turn to a glassy carbon electrode (GCE) via electro-generated gold nanoparticles forming self-assembled monolayers (SAMs). The new biosensor show direct electrochemistry with the HRP and have been applied to the indirect determination of Pb²⁺ based on the inhibition of HRP. The inhibition measurements have used by other authors

to develop several heavy metals sensors [4]. The inhibition by Pb allow us to have a highly effective biosensor, with sensitivity 0.6709 $\mu\text{A } \mu\text{M}^{-1} \text{ cm}^{-2}$. In addition, the obtained apparent Michaelis-Menten constant, $K_{M,app}$, was 0.05 mM, significantly lower than the intrinsic K_M , revealing the very high enzymatic efficiency of the developed device. This work is being extended to other heavy metals as copper, cadmium and mercury.

References

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Figures

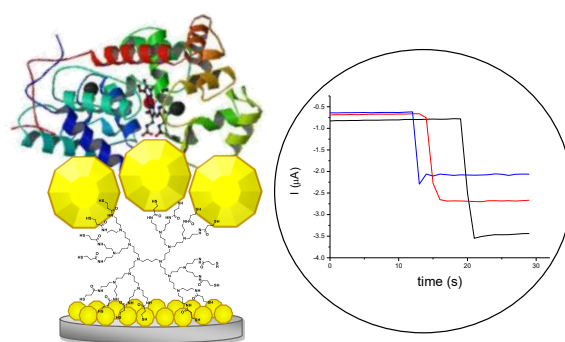


Figure 1: Scheme of biosensor and their response in absence (black) and presence of lead 0.05 mg L⁻¹ (red) and 0.1 mg L⁻¹ (blue).