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Title:

Gold nanostructured electrode for the electrochemical determination of mercury in canned tuna

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Abstract:

The presence of mercury even at trace and ultratrace level in food constitutes a risk for human health. Therefore, it is important to develop reliable and sensitive analytical methods for the determination of this metal to study how it affects the food chain. Since fish accumulates substantial amounts of mercury in its tissues and constitutes the first source of this element in humans diet, a widespread monitoring of mercury levels in seafood is needed. The applicability of the square wave anodic stripping voltammetry (SW-ASV) for mercury quantification was evaluated adopting a solid gold electrode (SGE) and a nanoparticle-modified glassy carbon electrode (AuNPs-GCE) in certified reference materials and in samples of canned tuna. The achieved results were compared with those obtained by conventional cold vapour atomic absorption spectroscopy (CV-AAS) and by a direct mercury analyser (DMA) based on AAS detection. The evaluation pointed out that SW-ASV is well suited for mercury detection, since a good agreement between spectroscopic and electrochemical approaches was observed. Therefore, SW-ASV can be used with both mentioned electrodes to monitor the mercury content in tuna fish, since the maximum admissible level has been set by European Legislation to 1 mg/kgfw. Furthermore, the SW-ASV coupled with AuNPs-GCE displayed a higher sensitivity than that recorded with SGE: accurate mercury determinations at concentrations lower than 0.1 mg/kg fresh weight (fw) were obtained, showing a limit of quantification comparable to that of DMA. Further advantages of the SW-ASV regard the instrumentation cost that is lower than that required for DMA or CV-AAS, and the presence of this instrumentation in the most of analytical laboratories. Thus, SW-ASV coupled with AuNPs-GCE can be considered suitable for mercury determination even at ultratrace level in tuna fish, and can be adopted as an alternative method by the designated laboratories for routine analysis.