Nanocomposites and nanomaterials

Gold nanoparticles modified GC electrode for the voltammetric determination of melamine

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Melamine (MEL) is a toxic compound to both animals and human being. It is possible that melamine accumulates in the body and causes reproductive damage, or bladed kidney stones, cancer or the death. MEL can be found at ppm levels in food and beverages due to migration from melamine-containing plastic disposable tableware. It was intentionally adulterated to milk products to show a false increase in protein concentration. Considering these facts there is a need for establishing sensitive and reliable method of MEL determination.

The common methods for the determination of melamine are chromatography and mass spectrometry, sensitive but very expensive techniques. Voltammetry, much more cheap and express method, is not widely used because MEL does not show electrochemical activity in normal. The using of modified electrode is significantly better at detection and determination of important chemical compounds. Nanosized particles, in particularly, biocompatibility gold nanoparticles (nAu), when immobilized onto surface of carbon-based electrode can raise the electrode conductivity, wide electrochemical window and stable electrochemical and physical properties.

In the present work the GC electrode with nAu immobilized (nAu-GCE), was used for MEL determination by strip voltammetric method. It was found that MEL is not oxidized or reduced in available aria potential. As MEL is formed complex compound with electroactive Cu(II), peak of copper oxidizing was the basis of strip voltammetric method of MEL determination. The effect of variables such as percent and size of nAu, pH of solution, concentration of copper (II), accumulation potential and time, range and scan speed on peak current were optimized. The proposed electrode showed good oxidized response for copper in the presence of MEL in mixture of 0.1 $mmol \cdot L^{-1}$ Cu(II), 0.1 $mol \cdot L^{-1}$ KCl and 0.1 $mol \cdot L^{-1}$ HCl, the peak potential was about + 70 mV. The peak current increased linearly with the MEL concentration in the range of 9-100 $\mu mol \cdot L^{-1}$. The detection limit was found to be 7 $\mu mol \cdot L^{-1}$.