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Multiwalled Carbon Nanotubes Decorated With Gold Or Silver Nanoparticles for Trace Electroanalysis

Luigi Falciola, Valentina Pifferi, Simone Olivieri, Laura Prati, Alberto Villa
Università degli Studi di Milano, Dipartimento di Chimica
Via Golgi 19, Milano, Italy
Luigi.Falciola@unimi.it; Valentina.Pifferi@unimi.it; Laura.Prati@unimi.it; Alberto.Villa@unimi.it

Extended Abstract

Albeit very challenging, in the last years trace analysis (Pierce and Zhao, 2010) (*i.e.* the analysis of analytes in concentration low enough to cause difficulty, generally under 1 ppm) has shown a tremendous growth, prompted by the urgent need of many International Organizations (US Environmental Protection Agency EPA, U.S. Food and Drug Administration FDA, European Food Safety Authority EFSA, World Health Organization WHO) looking for new analytical techniques for the detection of different molecules in different and increasingly more complex matrixes.

Trace analytes determination requires reliable and robust analytical methodologies characterized by high level of sensitivity, accuracy (in terms of precision and trueness), selectivity and specificity. In this context, electroanalytical techniques, particularly those based on pulsed voltammetry with modified electrodes, seem to be a promising independent alternative, combining the previously sought properties with other important characteristics: simplicity of use, low costs, portability, easy automation and possibility of on-line and on-site monitoring without tedious sample pre-treatments.

Among different possible modifying materials, nanosized and/or nanostructured materials are growing in importance and use, with the aim of increasing the affinity for the analyte and the sensitivity, lowering the limits of detection and minimizing or completely avoiding interferences, increasing the selectivity. In this field, unique peculiar properties dependent on metal nanoparticle size and shape are demonstrated by carbon nanomaterials coupled with metal nanoparticles (Rassaei et al., 2011 and Pifferi et al., 2013). For this reason, these materials are now extensively employed in electroanalysis for electrode modification.

In this framework, the electroanalytical application of modified electrodes based on carbon nanotubes decorated with gold or silver nanoparticles are here presented. The modified electrode were previously electrochemically characterized (by Cyclic Voltammetry and Electrochemical Impedance Spectroscopy). In particular, the synergic effect of both metal and carbon nanomaterials was investigated. Moreover, the use of PVA as protective polymer for metal NPs, has demonstrated its role in enhancing the electroanalytical performances due to the protection from oxidation, fouling products and interferences.

The optimized electrodes were finally tested for the determination of relevant or toxic analytical substances for environmental monitoring such as glycerol and chlorinated compounds, with interesting results (Pifferi et al., 2014).

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