Designing Trace Metal Sensors, Immunosensors, Genosensors, and Gas Sensors Using Screen-Printed Electrodes Modified with Various (Nano)Materials

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The proper selection, pretreatment, and modification of a supporting electrode are crucial steps for successfully fabricating an electrochemical sensor. In this context, screen-printed electrodes (SPEs) have been recognized as attractive substrates suitable for the deposition of various building blocks in the development of powerful electrochemical sensors, immunosensors, genosensors, gas sensors, etc. Particularly in environmental monitoring, clinical diagnostics, occupational health and food safety, cultural heritage preservation, homeland security, etc., there is an increasing need for low-cost, sensitive, and selective sensing devices for detecting numerous analytes of great importance. From this point of view, electrochemistry offers unsurpassed possibilities for the development of different sensing strategies in combination with advanced electrochemical techniques and countless modification (nano)materials that can be used as thin catalytic deposits, (bio)recognition elements, immobilization and anti-interference membranes, electrolytes, and analyte preconcentration and/or derivatization media. Different electrode configurations provide an excellent platform for developing simple and point-of-interest sensors, along with numerous miniaturization options [1].

We will summarize our recent research on developing SPE-based (bio)sensors for the detection of several important analytes in liquid and gaseous samples [2-4]. Since the reproducible response of the supporting electrode is a prerequisite in the fabrication of reliable electrochemical sensors, we will discuss selected strategies to improve the electrochemical properties of SPEs, along with a brief study of the effects of electrode surface pretreatments on protein binding kinetics and electrode surface stability. We will demonstrate the operation and performance of SPE-based sensors developed in our laboratory for the detection of trace metal ions, gaseous phenol and hydrogen peroxide, antibodies, antigens, and DNA/RNA.

Acknowledgments
The research received funding from the Slovenian Research Agency (Research Program P1-0034 and Research Project J1-3017).

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