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Characterization of the electrochemical properties of carbon black modified screen printed electrodes and their application for food contaminant screening

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Carbon based nanomaterials such as graphene or carbon nanotubes, due to their great electrocatalytic activity, are often used to improve sensitivity and stability of sensors. Carbon screen-printed electrodes (SPEs) are recognized as an optimum platform for these nanomaterial modifications due to their low background currents, wide potential window and chemical inertness. Although in recent years screen printing technology has pushed the development of miniaturized sensors for cost-effective and customised use in multiple fields, several bottlenecks for mass production still exist e.g. complicated functionalization steps, high material cost and limited functioning of the sensor in complex matrix. Herein, a characterisation of home-made SPEs modified with carbon black (CB-SPEs) and its application for detection of domoic acid in naturally-contaminated scallops is reported. CB has similar electrocatalytic properties as graphene and carbon nanotubes but is at least 100 times more cost effective. Moreover, use of CB-SPEs in combination with magnetic beads can avoid individual SPE modifications with biological elements which simplifies storage and ensures better washing and preconcentration of the sample on the working electrode area. Different types of CB-SPEs were characterised, in terms of CB concentration and deposition steps, and an indirect competitive immunoassay was developed by using Enzyme-Linked-Immunomagnetic-Electrochemical (ELIME) format. The best performing CB-SPE was then successfully used as transducer for the ELIME assay to detect domoic acid both in buffer and naturally-contaminated scallops. Thus, the described system can be considered as a promising candidate to overcome the commercialization problems that are now affecting nanomaterial based electrochemical sensors.

Biography

Davide Migliorelli has completed his PhD in Analytical Chemistry at Tor Vergata University in Rome (IT) and two years of Postdoctoral studies working on development, verification and validation of systems and biosensors from CSEM SA (CH). He is a R&D Engineer at CSEM SA developing biochemical sensors, based on screen printed electrodes technology (SPEs), and integrating them in chips for their final use on field.

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