NEW APPROACHES TO LARGE SCALE MONITORING OF VARIOUS BIOLOGICALLY ACTIVE ORGANIC COMPOUNDS USING BARE AND MODIFIED ELECTRODES BASED ON NON-TRADITIONAL ELECTRODE MATERIALS

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The aim of this contribution is to demonstrate that in many cases modern voltammetric and amperometric methods can successfully compete with fascinating possibilities of modern spectrometric and separation methods. The main problem with the practical application of voltammetric and/or amperometric methods for the determination of submicromolar concentrations of electrochemically active organic compounds in complex biological and/or environmental matrices is connected with the passivation of the working electrode. It will be shown that this problem can be in many cases eliminated by using non-traditional electrode materials, the surface of which can be successfully renewed mechanically, chemically, or electrochemically. Moreover, their chemical and or biological modification can further increase both selectivity and sensitivity of appropriate electroanalytical methods. This approach will be demonstrated on methods recently developed in our UNESCO Laboratory of Environmental Electrochemistry for the determination of various chemical carcinogens, pesticides, phenols, and nitro phenols and other biologically active organic compounds in various environmental matrices, and of various biomarkers (of illness, exposition, or treatment) in biological fluids.

In the first part, attention will be paid to the use of novel electrodes based on non-toxic solid or paste mercury amalgams [1], bismuth electrodes [2], and antimony electrodes [3] suitable for voltammetric and/or amperometric determination of electrochemically reducible organic compounds (e.g. carcinogenic nitrated polycyclic aromatic hydrocarbons, electrochemically reducible pesticides, anticancer drugs derived from anthraquinone, some cancer biomarkers, and food dyes).

Second part will be devoted to the use of novel versions of carbon paste electrodes [4], boron doped diamond film electrodes [5], carbon film electrodes [6], and nanostructured sputtered electrodes [7] on either conductive or non-nonconductive substrate, and their application for the determination of electrochemically oxidisable organic compounds (e.g. carcinogenic amino derivatives of polycyclic aromatic hydrocarbons, hydroxyl derivatives of polycyclic aromatic hydrocarbons as markers of exposure to parent hydrocarbons, various pesticides, cancer biomarkers, etc.).

Third part will be focused on electrode miniaturization [8–12] and on their application both in batch analysis and in flowing systems [13–15] and their combination with a preliminary separation and preconcentration (solid phase extraction, membrane separation, hollow fibre micro extraction, etc.).

Fourth part will be devoted to the possibilities and limitations of 3D printing in this filed together with the use of smart sensors based on DNA modified electrodes [16], electrodes modified with molecularly imprinted polymers and electrodes modified with various nanoparticles.

Some practical applications of the above mentioned methods for monitoring of tumour biomarkers [17], saccharides [18], derivatized DNA [19] and cholesterol [20, 21] will be given

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