

Nanophotonic method for polycyclic aromatic hydrocarbons detection in water solutions

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Polycyclic aromatic hydrocarbons (PAHs) are ubiquitous environmental agents commonly believed to contribute significantly to human cancer pathologies. One of the most dangerous organic PAHs carcinogens is benzo[a]pyrene (BP). Like many other carcinogens, PAHs are metabolized enzymatically to various metabolites, some of which are highly reaction active.

Proposed nanophotonic analytical method is based on the process of QDs transfer to ionic forms in an EC process and their subsequent reactions with oppositely charged ionic forms of the analyte – PAHs (BP) inside ECL cell, resulting in the formation of emitter and emission of an analytical optical signal. The number of quanta emitted at the given period of time is a measure of PAHs (BP) content thus characterizing the essence of nanophotonic method of quantified PAHs (BP) detection in water. The problem of increasing selectivity of the proposed method is solved by the following ways – electrochemical, that consists in formation of charge reactants while using one of known methods of EC analysis and mechanical, that include filtration with the use of high-quality systems for segregation of the sample components by size; physical based on the selection of specific QDs for the analyte detection by finding and calculation the optimal physical parameters (nature, content and size) of QDs.

Reactants are electrochemically oxidized and reduced, correspondingly, in nanophotonic sensor fabricated from at least two parallel electrodes situated in a thin-layer cell. During electric current flow through sensor's electrodes electron-transfer reactions between electrode and corresponding particles – analyte (PAHs) or QD are taking place. The working electrode constitutes specially prepared optically transparent semiconductor ITO plate modified by thin-layer ordered film of QD's plotted by Langmuir-Blodgett or spin-coating methods. This improves sensor's response for detection of a very low, trace including analyte amounts. Data of experiment testing of the proposed method and sensor's instrument for BP detection are being provided and discussed.