NANOPHOTONIC METHOD AND SENSOR FOR POLYCYCLIC AROMATIC HYDROCARBONS DETECTION

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Anthropogenic pollution of environmental water is a huge problem for humanity today as it leads to an increase of incurable diseases. For example, the penetration into the organism of organic carcinogens such as polycyclic aromatic hydrocarbons (PAHs) can lead to the development of cancer tumors. Among PAHs the most dangerous is 3,4-benzopyrene (BP).

There are a number of analytical methods for BP detection such as chromatographic, immuno-chemical, spectroscopic, luminescent and biological methods. But these methods beside their advantages have a number of significant shortcomings such as high detection limit (immuno-chemical and biological method), insufficient selectivity of PAHs detection, complexity and duration of sample preparation and analysis, high cost of device. Therefore development of new methods and tools for PAHs detecting using modern nanotechnology and nanomaterials remains urgent. So this work is devoted to the development of nanophotonic method and sensor device construction for the PAH in particular BP detection in water environment objects.

Nanomaterials such as spherical quantum dots (QDs) are perspective object of nanophotonics can be used for development of optical sensors as sensor's detector elements. They have a high luminescence quantum yield, possibility of optical and non-optical excitation, narrow luminescence spectrum and its wavelength dependence on the QDs diameter, high selectivity. This defined the perspective of their use instead of the well known organic luminophores.

Proposed nanophotonic analytical method is based upon traditional electrochemiluminescent process with QDs transfer to ionic forms in an electrochemical process and their subsequent interactions with oppositely charged ionic forms of the analyte – PAHs (BP) inside the sensor, resulting in the formation of emitter and emission of an analytical luminescent 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. Increase of the selectivity by the proposed method is caused by the following reasons – electrochemical, that consists in formation of charge reactants while using one of known methods of electrochemical analysis; 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 and mechanical, that include filtration with the use of high-quality systems for segregation of the sample components by size.

As the main result of this work the nanophotonic sensor for PAHs detection in water objects was developed [1]. The working electrode is specially prepared optically transparent semiconductor ITO plate modified by thin-layer ordered film of QD's plotted by the spin-coating method.

Nanophotonic method and sensor for polycyclic aromatic hydrocarbons detection can be used in various applications such as medicine, biology, ecology, bionanophysics, pharmacy, etc.

References

[1] O. A. Sushko, M. M. Rozhitskii *J. of Nano- and Electronic Phys*. **6**, 01, 01009(7).