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Fluorescence based explosives sensor: potential of plasmonic enhancement for the development of ultrasensitive portable technique

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The global problem associated with the growth of terrorism has significantly worsened in the conditions of war in Ukraine due to the large-scale contamination of soil and water resources with explosives and explosion products. This makes the development of a sensitive, fast, cheap, portable and mass-producible sensor for the detection of explosives an urgent issue.
A number of attempts have been made to solve the problem of developing such a sensor using various recognition elements and sensor principles, including optical, electrochemical, surface-acoustic and immunological methods. Also, plasmonic enhancement is a well-known method of improving the sensitivity of optical sensors [1].
We propose to implement the optical method of fluorescent detection of explosives in a portable version with sensitive sensor elements in the form of composite materials with plasmonic nanostructures. Previous experience in the development of nanochip technology with a molecularly imprinted polymer coating for the detection of chemical analogs and taggants of explosives based on localized surface plasmon resonance [2, 3] and a highly selective aflatoxin sensor based on plasmon-enhanced fluorescence [4] will be used.
Therefore, the development of a portable sensor based on plasmon-enhanced fluorescence using molecularly imprinted polymers to ensure the selective detection of explosive nitro compounds and/or their chemical analogues in the gas and liquid phase with a sensitivity that allows the registration of picomoles (nanograms) or less of the specified substances with a response time of several minutes looks promising.

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