Abstract

The main matter of the doctoral thesis was the elaboration of the methodology for the functionalization leading to attach organic functional groups, alkyl chains, aromatics groups and drugs molecule to the nanodiamonds surface.

The first stage of the research was particularly characteristic of physicochemical properties and definition (qualification) of the shape and structure purchased material. Material characterization of detonation diamond nanoparticles allowed for the selection of a suitable purification treatment of the nanodiamond surface. The purification process was divided into two stages so that the first of these was the purification of the surface of detonation diamond nanoparticles with solvents, including the selected ethanol, 2–ethoxyethanol and acetone. Applied method of the Soxhlet extraction allows the removal of the all chemical impurities adsorbed on the nanodiamond surface. The second step of the purification process relies on the use of strong acids, (trifluoromethanesulfonic acid and fuming nitric acid). The method of chemical purification of the surface in superacids allows to obtain a diamond material with no other impurities in the form of allotropic varieties of carbon.

Thereafter, such prepared diamond nanopowders was functionalized by selected chemical reactions. Carried out the modification relies on the attached the hydroxyl and amino groups to the nanodiamond surface. It was found that the best effect is obtained by the treatment of Fenton's reaction and the nitration reaction. It was carried out also the modifications using a Friedel–Crafts reaction, by which it was possible to implement the alkyl chains and aromatic compounds on the nanodiamonds surface. Presented in this work method of chemical functionalization with the obtain reagents was also carried out in higher temperature under microwave irradiation.

Further stage of this research was attached drug – ampicillin to the nanodiamond surface. It has been proved that the positive effect of the functionalization, however, microbiological tests on the selected bacterial strains have shown that antibiotic which were attached to nanodiamond had no effect on inhibition of growth, however only on induce the fluorescence by the strong bacterial stress. This additional characteristic observed during the study of biological properties of nanodiamonds, may be used in the future for microbiological diagnostics, as a great test for determining the presence of such microorganisms in the test samples using the fluorescent effect. In this work were presented the research results on chemical functionalization of the detonation nanodiamond particles and the effect of this modification on its biological properties.

Kinga Adach
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