Poster

NANODIAMOND COMPOSITES AS AN ACTIVE BIOPROTECTOR

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In resent years a great progress of nanobiotechnologies is displayed. Different types of polymers, ceramics are used as drug-delivery systems, membranes, adsorbents. In this respect an application of carbon materials is more perspective because of their high biocompatibility in contrast to other types of materials.

Carbon composite materials based on nanodiamonds have been developed by us for such applications. The composite (NDC - Nano Diamond Composites) has a structure comprising carbon nanofragments of two types: nanodiamond particles (medium size 4-6 nm) and nano-sized graphite-like matrix connecting them to a three- dimension composite. By varying of preparation conditions it is possible to prepare materials with different effective thickness of the graphite-like matrix on the surface of nanodiamond particles (from 0.2 to more then 1 nm). Thus, it provides a nanostructure which has two carbon phases of different crystalline types (Fig.1). One of the features of NDC as carbon composite materials is that they can be prepared as bodies of desirable shape.

The NDC materials are high-porous carbon composite bodies: a pore volume is ranging from 30 to 60 vol%, and an effective pore size of 7 ± 2 nm. The narrow pore-size distribution and, hence, an uniformity of pores properties throughout material volume makes it possible to consider nanopores as a third nanophase of the composite. Thus, NDC have three types of volume distributed nanofragments: diamond nanoparticles, a graphite-like carbon matrix and pores. The possibility to vary the contents of different components in materials in a wide range makes NDC a suitable model material for biological tests.

We studied a biocompatibility and a bioprotector property of nanodiamond composites on reduction of the toxic action to cadmium. The experimental animal intravitelline received cadmium solution, activated carbon and nanodiamond composite, reduced in powdery mass in the manner of water dispersion during 9 days. The produced meal was dissolved in distilled water in the 1:1 ration and it was injected intravitelline with the help of a probe to female rats in 0.5 ml amount. Nanodiamond composite and activated carbon dispersions for separation form the base sheet were performed in distilled water by the ultrasonic frequency of about 48 kHz.

We tested the lipid peroxidation in liver, adrenal and thyroid glands tissues homogenates and relative weight of adrenal and thyroid glands. The intensity of peroxidation of lipids was evaluated against the level of malonic dialdehyde. We traced the autonomic and ascorbate dependent peroxidation rate of lipids (POL) and the initial rate of malonic dialdehyde (MDA) in liver tissue, thyroid and adrenal gland.

Thereby, cadmium injection led to significant increasing of the processes of the lipid peroxidation in liver and an adrenal and thyroid gland relative weight. Nanodiamond composite injection either as activated carbon did not differ from the similar factors of the control animals. Cadmium simultaneously injection with activated carbon and nanodiamond composite led to decrease toxic cadmium action. The bioprotector nanodiamond composite property was more impressive than at activated carbon.