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INVESTIGATION OF THE PHOTOCATALYTIC ACTIVITY AND RADIOPACITY OF NANOPOWDERS PRODUCED BY PULSED ELECTRON BEAM EVAPORATION IN VACUUM*

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Nanopowders (NP) are promising substances for use in the medical and pharmaceutical field due to antimicrobial, antitumor and other properties of their shell and bioinert core. Various methods of obtaining nanopowders can significantly affect their properties. Thus, bismuth and zirconium oxide nanopowders produced by the pulsed electron beam evaporation (PEBE) method showed high biological and photocatalytic activity [1].

In this work, were investigated the photocatalytic properties and radiopacity of titanium TiO_2 and zinc Zn-ZnO oxide nanopowders produced by the PEBE method in vacuum [2]. These compounds can be used as photocatalytic thin coatings, whose nanoparticles have antimicrobial properties [3]. The high atomic number of metals and high density of atoms per nanoparticle in these oxides makes them prospective for implementation as a contrast agent for computed tomography (CT).

The photocatalytic activity of examined NP at the concentration of 300 mcg/ml was evaluated in comparison with the decomposition of methyl violet (MV) in the medium under ultraviolet light irradiation. The rate of decomposition of MV from the time of exposure to UV radiation can be described by the linear equation $y=kx+b$, where the coefficient k is the rate of photodestruction. The higher the coefficient k, the faster the solution discolors [4]. The measurement of k is exemplified below.

Table 1 – The k coefficient values for TiO_2 and Zn-ZnO NP

Sample	Absolute value	Relative to MV
MV	-0,0053	1
TiO_2	-0,0078	1,47
Zn-ZnO	-0,0085	1,60

Both NP showed significant photocatalytic activity. However, it was found that zinc oxide has better photocatalytic properties compared to TiO_2 samples.

The radiopacity of NP was evaluated relative to commercial iodine CT contrast agent Ultravist®, by analogy with the work [5]. For the study were prepared solutions of 0.75% Na-Carboxymethylcellulose containing nanopowders in various concentrations. X-ray images of the samples were processed in the "ImageJ" software package. During the analysis, were calculated linear X-ray attenuation coefficients.

The highest attenuation coefficient was found in a sample of titanium oxide at a concentration of 12.5% and amounted to 70% relative to Ultravist®. At the same time, the ZnO-Zn sample did not show high radiopaque ability.

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