The relationship between the mechanism of zinc oxide crystallization and its antimicrobial properties for the surface modification of surgical meshes.

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Streszczenie

Surgical meshes were modified with zinc oxide (ZnO) using a chemical bath deposition method (CBD) at 50 °C, 70 °C, or 90 °C, in order to biologically activate them. Scanning electron microscopy (SEM), mass changes, and X-ray diffraction measurements revealed that at low temperatures Zn(OH)2 was formed, and that this was converted into ZnO with a temperature increase. The antimicrobial activity without light stimulation of the ZnO modified Mersilene™ meshes was related to the species of microorganism, the incubation time, and the conditions of the experiment. Generally, cocci (S. aureus, S. epidermidis) and yeast (C. albicans) were more sensitive than Gram-negative rods (E. coli). The differences in sensitivity of the studied microorganisms to ZnO were discussed. The most active sample was that obtained at 90 °C. The mechanism of antimicrobial action of ZnO was determined by various techniques, such as zeta potential analysis, electron paramagnetic resonance (EPR) spectroscopy, SEM studies, and measurements of Zn(II) and reactive oxygen species (ROS) concentration. Our results confirmed that the generation of free radicals was crucial, which occurs on the surface of crystalline ZnO.

Słowa kluczowe

zinc oxide, crystallization, antimicrobial properties, free radicals, surgical mesh

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