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The Effect of Nanocomposite on the Release of Imipenem on Bacteria Causing Infections with Implants

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Abstract : —Results The prudent administration of antibiotics aims to avoid the side effects and the microbes' resistance to antibiotics. An approach developing methods of local administration of antibiotics is especially required for localized infections caused by bacterial colonization of medical devices or implant materials. Among the wide variety of materials used as drug delivery systems, bioactive glasses (BG) have large utilization in regenerative medicine . firstly, the production of bioactive glass/nickel oxide/tin dioxide nanocomposite using sol-gel method, and then, the controlled release of imipenem from the double metal oxide/bioactive glass nanocomposite, and finally, the investigation of the antibacterial property of the nanocomposite. against a number of implant-related infectious agents. In this study, BG/SnO2 and BG/NiO single systema with different metal oxide present and BG/NiO/SnO2 nanocomposites were synthesized by sol-gel as drug carriers for tetracycline and imepinem. These two antibiotics were widely used for osteomyelitis because of its favorable penetration and bactericidal effect on all the probable osteomyelitis pathogens. The antibacterial activity of synthesized samples were evaluated against Staphylococcus aureus, Escherichia coli, Pseudomonas aeruginosa as bacteria model using disk diffusion method. The BG modification using metal oxides results to antibacterial property of samples containing metal oxide with highest efficiency for nancomposite. bioactivity of all samples was assessed by determining the surface morphology, structural and composition changes using scanning electron microscopy (SEM), FTIR and X-ray diffraction (XRD) spectroscopy, respectively, after soaking in simulated body fluid (SBF) for 28 days. The hydroxyapatite formation was clearly observed as a bioactivity measurement. Then, BG nanocomposite sample was loaded using two antibiotics, separately and their release profiles were studied. The BG nancomposite sample was shown the slow and continuous drug releasing for a period of 72 hours which is desirable for a drug delivery system. The loaded antibiotic nanocomposite sample retaining antibacterial property and showing inactivation effect against bacteria under test. The modified bioactive glass forming hydroxyapatite with controlled release drug and effective against bacterial infections can be introduced as scaffolds for bone implants after clinical trials for biomedical applications . Considering the formation of biofilm by infectious bacteria after sticking on the surfaces of implants, medical devices, etc. Also, considering the complications of traditional methods, solving the problems caused by the above-mentioned microorganisms in technical and biomedical industries was one of the necessities of this research.

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