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Electrochemical composite bioceramic coatings based on hydroxyapatite, chitosan and polyvinyl alcohol loaded with gentamicin

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Composite bioceramic coatings have been attracting increasing attention of the scientific public in recent decades due to the good potential of their use for medical purposes. The main goal of this scientific research is to show the characterization of the obtained hydroxyapatite (HAP), chitosan (CS) and polyvinyl alcohol (PVA) bioceramic composite coatings loaded with gentamicin (Gent), on titanium (Ti) substrate using the single-step electrophoretic deposition process. Titanium, traditionally used for the purpose of replacing parts of damaged bone tissue, has shown good mechanical properties and biocompatibility through many years of orthopedic practice. Hydroxyapatite provided the HAP/CS/PVA/Gent composite coating with osteoinductivity, while the presence of chitosan and polyvinyl alcohol contributed to its adhesive and mild analgesic properties. The antibacterial agent gentamicin was added to the HAP/CS/PVA composite, which ensured its direct antibacterial effect at the implantation site. The coatings were deposited using the cathodic electrophoretic deposition process, with the Ti plate as the cathode, at a constant voltage of 7V, in the range of the deposition time from 5 to 12 min. To demonstrate the presumed bioactivity, HAP/CS/PVA/Gent coatings were immersed in simulated body fluid (SBF) at 37□C for periods of 7 and 14 days. Characterization of HAP/CS/PVA/Gent coatings after immersion was performed through employment of Fourier transform infrared spectroscopy (FTIR), X-ray diffraction (XRD), and field emission scanning electron microscopy (SEM) techniques. Antibacterial activity was tested by agar diffusion method on two bacterial strains, *Echerichia coli* and *Staphylococcus aureus* with a positive response to both bacterial strains. The final conclusions of this research suggest a good potential for utilization of HAP/CS/PVA/Gent bioceramic composite coating, applied through electrophoretic deposition process on Ti substrate, for medical purposes in the replacement and healing of damaged bone tissue.