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Novel Coatings Based on Nanostructured Cefepime-Functionalized Magnetite for Implantable Devices †

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Abstract: The aim of this study was to obtain biocompatible coatings based on polylactic acid, hydroxyapatite and nanostructured Cefepime-functionalized magnetite for enhancing the activity of next-generation implants against antibiotic-resistant pathogens. Mixtures of various ratios of polylactic acid, hydroxyapatite and nanostructured Cefepime-functionalized magnetite (Fe_3O_4@CEF, HAP/Fe_3O_4@CEF and PLA/Fe_3O_4@CEF) were obtained and deposited on glass slides by Matrix Assisted Pulsed Laser Evaporation (MAPLE). The in vitro biological effects of these coated surfaces on murine normal osteoblasts (MC3T3-E1 Subclone 4 (ATCC cat. no. CRL-2593)) were investigated by observing their morphological features and measuring the cell viability and nitric oxide (NO) release as an indicator of inflammation and cell death. A good biocompatibility was noticed for all samples investigated within this study, according to a formazan-based assay. Additionally, no increase in NO level was induced after 24 h of cell growth on these coated glass slides. Moreover, the visible microscopy images showed a good cell attachment on these modified surfaces and proved that the proliferative capacity of ostelasts was not disturbed in the presence of tested samples. The coatings succeeded in reducing the microbial attachment as well as the subsequent Escherichia coli colonization and biofilm development on these surfaces. In conclusion, these novel coatings can become suitable surfaces for implantable devices with an enhanced biocompatibility and reduced bacterial colonization.

Keywords: coatings; polylactic acid; hydroxyapatite; cefepime; magnetite; osteoblasts

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