Titanium electrolytic plasma treatment targeting applications in implants with controlled drug release

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Pores with uniform size and distribution are of fundamental importance in drug delivery systems. If used in dermal or intraosseous implants, for example, they need to have, in addition, functionally adequate wettability, chemical composition and biocompatibility. In the present work, titanium was treated by pulsed plasma electrolytic (PEO) oxidation using, as the electrolyte, 0.025 M sodium dihydrogen phosphate and 0.25 M calcium acetate, for use in drug delivery systems. The current intensities used were 0.4 A, 0.5 A, or 0.6 A. Pulse widths (Ton) of 50 µs and 100 µs were used, repeated (Toff) in time of 100 µs and 50 µs respectively, resulting in a frequency of 5 kHz, which is a higher frequency than those used in the literature. After treatment, Ca/P ratio, wettability, pore size, and distribution were determined. For this purpose, X-ray diffraction and fluorescence techniques (XRD, XRF), energy dispersive spectroscopy, sessile droplet assays, and analysis of electron micrograph images were used, using ImageJ software. The average pore size ranged from 1.5 µm to 2.3 µm, according to the increase in energy supplied to the system. The pore distributions with lower dispersion were verified for the condition Ton/Toff of 50 µs /100 µs, using current of 0.4 A. On the other hand, the conditions 100 µs/50 µs produce larger pores, but with greater dispersion. In general, conditions with lower currents (0.4 A and 0.5 A) and Ton/Toff ratio = 50/100 were the most appropriate for use in drug delivery systems, due to their size and distribution of uniform pores, greater hydrophilicity and Ca/P ratio close to the desirable (1.67). For current 0.6 A, super stoichiometry Ca/P was obtained.

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Reference

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