UNIVERSITI TEKNOLOGI MARA

PHYSICOCHEMICAL AND BIOACTIVITY PROPERTIES OF HYDROXYAPATITE COATINGS ELECTRODEPOSITED ONTO TITANIUM SUBSTRATES

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AUTHOR'S DECLARATION

I declare that the work in this thesis was carried out in accordance with the regulations of Universiti Teknologi MARA. It is original and is the result of my own work, unless otherwise indicated or acknowledged as reference work. This thesis has not been submitted to any other academic institution or non-academic institution for any degree or qualification.

I, hereby, acknowledge that I have been supplied with the Academic Rules and Regulations for Post Graduate, Universiti Teknologi MARA, regulating the conduct of my study and research.

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ABSTRACT

Titanium and its alloys have widely been used as metallic implants because of their good biocompatibility and high corrosion resistance. However, they exhibit no bioactive properties and fail to bind to bone tissue. In order to make the titanium implants bioactive, hydroxyapatite (HAp) has been coated onto titanium surface. In this study, HAp coatings were successfully prepared on titanium substrates by electrodeposition technique using aqueous solution containing $CaCl_2$ + $NH_4H_2PO_4$ with Ca/P ratio equal to 1.67. The effects of varying deposition conditions and solutions such as applied potential, deposition time, deposition solution concentration and the addition of chitosan into deposition solution on the electrodeposition process as well as the formation of HAp coatings were investigated. The obtained deposited HAp samples were characterized using FESEM, EDAX, XRD, FTIR, immersion in SBF solution and Scotch® tape test. The deposition conditions and solutions have strongly affected the formation of HAp coatings. The best HAp coating was produced by applying a constant potential of – 1.5 V vs Ag/AgCl using 0.167 M $CaCl_2$ + 0.1 M $NH_4H_2PO_4$ solution at 80 ^oC for 30 min. The addition of 5 volume percent of chitosan into the deposition solution has improved the adhesion of HAp coatings on the Ti surface. It was found that the prepared HAp coatings are bioactive as shown by the change of surface morphology after immersion in SBF solution for a few days. The HAp material can also be deposited on different types of Ti substrates (i.e.: Ti mesh and NiTi alloy) using the electrodeposition technique. It was also proven that coated HAp onto Ti substrates gave better physicochemical properties of Ti implants.

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