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Biomimetic degradable porous scaffold for trabecular bone interlog

Biodegradable metals have been suggested for bone scaffold applications due to their mechanical properties that are better for load bearing applications. Among biodegradable metals, magnesium and its alloy are the most investigated materials due to their mechanical properties which are closer to the cancellous bone. The aim of this research is to analyse the degradation behaviour of porous magnesium under dynamic degradation test for bone scaffold applications. Interconnected holes of porous magnesium have been developed with various percentages of porosity (30%, 41% and 55%). Dynamic immersion test rigs are specifically designed to simulate environment of human cancellous bone. There are two types of tests that have been conducted in this study: (1) fluid flow with different flowrates and (2) fluid flow integrated cyclic loading. A dynamic immersion test has been conducted for 24, 48 and 72 hours. The results showed that the specimen with a higher percentage of porosity as well as the exposed surface area degrades faster compared to the others. The effects of different flow rates towards the mechanical integrity of porous magnesium have shown a huge drop of 95% from their original mechanical properties within 3 days, which have deteriorated in both functions; porosity and degradation time. The variation in flowrates used showed that degradation of the material is seven times higher compared to the static immersion test environment. Furthermore, the influenced of integrating fluid flow and cyclic loading have increased the relative weight loss and degradation rate as high as 61.56% and 93.67%, respectively. Additionally, the mechanical properties have improved and increased from 53% to 87% as compared to dynamic immersion test using the mechanical stimulus of fluid flow only. Therefore, the dynamic immersion test with integrated cyclic loading was more reliable compared to static immersion test for bone scaffold application.

Biography

Ardiyansyah Syahrom is Associate Professor at school of Mechanical Engineering, Faculty of Engineering, Universiti Teknologi Malaysia, UTM. Presently, he is the director of Medical Devices and Technology Centre (MEDiTEC), Institute Human Centred Engineeing (iHumEn). He is by profession a Mechanical Engineer with special interest in Biomechanics, Bone, Biomaterials and Sports Engineering. His previous administrative duties also include the Director of Sports Innovation and Technology Centre (SITC). He has published in reputed Journals and supervises many post-doctoral, doctoral and other post-graduate as well as undergraduate students. He sits in Innovation section in Malaysia Medical Devices Authority (MDA) committees, a member of many international societies, a reviewer to a number of academic journals and is the editor of the Jurnal Mekanikal.

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