World Academy of Science, Engineering and Technology
International Journal of Materials and Metallurgical Engineering
Vol:14, No:10, 2020

3D Printing of Cold Atmospheric Plasma Treated Poly(ε-Caprolactone) for Bone Tissue Engineering

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Abstract : Three-dimensional (3D) technology is a promising method for bone tissue engineering. In order to enhance bone tissue regeneration, it is important to have ideal 3D constructs with biomimetic mechanical strength, structure interconnectivity, roughened surface, and the presence of chemical functionality. In this respect, a 3D printing system combined with cold atmospheric plasma (CAP) was developed to fabricate a 3D construct that has a rough surface with polar functional chemical groups. The CAP-etching process leads to oxidation of chemical groups existing on the polycaprolactone (PCL) surface without conformational change. The surface morphology, chemical composition, mean roughness of the CAP-treated PCL surfaces were evaluated. 3D printed constructs composed of CAP-treated PCL showed an effective increment in the hydrophilicity and roughness of the PCL surface. Also, an in vitro study revealed that CAP-treated 3D PCL constructs had higher cellular behaviors such as cell adhesion, cell proliferation, and osteogenic differentiation. Therefore, a 3D printing system with CAP can be a highly useful fabrication method for bone tissue regeneration.

Keywords : bone tissue engineering, cold atmospheric plasma, PCL, 3D printing
Conference Title : ICASS 2020 : International Conference on Applied Surface Science
Conference Location : London, United Kingdom
Conference Dates : October 22-23, 2020