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Novel 3D porous biocomposite scaffolds fabricated by fused deposition modeling and gas foaming combined technology

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Abstract:

Porosity of scaffolds plays an indispensable role in tissue regeneration. In this paper, hierarchical scaffolds with tailored macro/micro-porosity architectures for bone tissue engineering applications were introduced. Poly(vinyl alcohol) (PVA) has been innovatively blended into poly(lactic acid) (PLA) to fabricate composite filaments for fused deposition modeling (FDM). Customized macropores (pore size > 100 μm) of scaffolds were designed and precisely fabricated by FDM process. Then the blended scaffolds were subjected to gas foaming process to create micropores (pore size < 10 μm), which are hardly created by using 3DP techniques. Subsequently, PVA phase in the scaffolds was extracted by solvent etching method to create open pores, which are hard to create in gas foaming. The results showed that the scaffolds with 100-800 μm macropores can be precisely fabricated by FDM technique. Meanwhile, 2-10 μm micropores were successfully created. These novel scaffolds have the potential to be used in bone tissue regeneration.

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