

SF-P006

Bio-Inspired Surface Modification of 3-Dimensional Polycaprolactone Scaffold for Enhanced Cellular Behaviors

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The research of 3-dimensional (3-D) scaffold for tissue engineering has been widely investigated as the importance of the 3-D scaffold increased. 3-D scaffold is needed to support for cells to proliferate and maintain their biological functions. Furthermore, its architecture defines the shape of the new bone and cartilage growth. Polycaprolactone (PCL) has been one of the most promising materials for fabricating 3-D scaffold owing to its excellent mechanical property and biocompatibility. However, there are practical problems for using it, in vitro and in vivo; extracellular matrix components and nutrients cannot penetrate into the inner space of scaffold, due to its hydrophobic property, and thus cell seeding and attachment onto the inner surface remain as a challenge. Thus, the surface modification strategy of 3-D PCL scaffold is prerequisite for successful tissue engineering.

Herein, we utilized a mussel-inspired approach for surface modification of 3-D PCL scaffold. Modification of 3-D PCL scaffolds was carried out by simple immersion of scaffolds into the dopamine solution and simulated body fluid, and as a result, hydroxyapatite-immobilized 3-D PCL scaffolds were obtained. After surface modification, the wettability of 3-D PCL scaffold was considerably changed, and infiltration of the pre-osteoblastic cells into the 3-D scaffold followed by the attachment onto the surface was successfully achieved.

Keywords: surface modification, 3D scaffold, bio-inspired method