Fabrication and characterization of P3HB scaffold as a MS cell delivery vehicle in tissue regeneration

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Background and Aims: Scaffolds have been used extensively in a variety of tissue engineering applications, to provide extracellular matrix (ECM) analog and cell delivery vehicle. In this study, structural properties of Poly(3-hydroxybutyrate) (P3HB) scaffold and proliferation of mouse mesenchymal stem (mMS) cells on it, was evaluated.

Methods: P3HB porous scaffold was fabricated by a solvent-casting/particulate leaching (SC/PL) technique with 212-250µm NaCl particles as a porogen. To evaluate the structure of scaffolds, scanning electron microscopy (SEM) was used for morphology assessment and determination of pore size; In addition, water replacement method was applied to measure the scaffold porosity. To evaluate cell proliferation on the scaffold, mMS cells were cultured on 15mm discs; After 2, 4 and 6 days of cell seeding, MTS [3-(4,5-dimethylthiazol-2-yl)-5-(3-carboxy-methoxyphenyl)-2-(4-sulfophenyl)-2H-tetrazolium] assay was applied to determinate mMS cells proliferation, in 24-well tissue culture plates (TCPs).

Results: Structural evaluation results revealed that scaffolds porosity range, was 80-90% and relative uniform pore distribution was observed in the surface and cross-section of the scaffolds; Pore size was in the range of 212-250µm, that match to the size of porogen, and these pores were relatively interconnected. MTS assay results showed that MTS absorbance of mMS cells from 2nd to 6th day of culture was gradually increased, while this absorbance was significantly less than the results of cell proliferation at the bottom of 24-well TCP as a control.

Conclusions: To regenerate tissue, as a cell delivery vehicle and ECM analog, P3HB porous scaffold, has relatively acceptable structural properties; However, its characteristics should be modified and optimized for better cell proliferation and structural properties.

Keywords: Poly (3-hydroxybutyrate); Mouse mesenchymal stem cell; Scaffold; Tissue engineering