SURFACE MODIFIED AND DRUG RELEASING MACROPOROUS BIODEGRADABLE SCAFFOLDS FOR TISSUE ENGINEERING

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Aliphatic biodegradable polymers such as poly(L-lactic acid) and its copolymers with D-lactic acid and glycolic acid have been widely used for temporal scaffolds for tissue engineering. Macroporous structure with uniform pore sizes well over 100 (m is desirable for efficient cell seeding and culture. Sufficient supplies of nutrients and oxygen to seeded cells within the porous scaffolds are required for facile tissue formation. There have been a number of fabrication methods for biodegradable scaffolds. They are PGA non-woven mesh, solvent casting/salt leaching, phase separation, emulsion freeze drying, gas foaming with pressurized carbon dioxide, 3-D printing, and gas foaming/salt leaching. Very recently, we reported that macroporous biodegradable scaffolds could be successfully fabricated using ammonium bicarbonate salt as a gas foaming agent as well as a porogen additive. The gas foaming/salt leaching method is based on the idea that the salt particles of ammonium bicarbonate dispersed within polymer-solvent mixture generate ammonia and carbon dioxide gases within solidifying matrices upon contact with hot water, thereby producing highly porous structures. These scaffolds showed macro-pore structures over 200 (m with no visible surface skin layer, which permitted sufficient cell seeding within the scaffolds. Porosities could be controlled by the amount of ammonium bicarbonate incorporated to the polymer. Moreover, it was possible to make various scaffolds, geometries and sizes by hand-shaping or molding processes because the polymer-salt mixture became a gel paste after a partial evaporation of the solvent. The gas foaming/salt leaching method was further improved by immersing the semi-solidified polymer-salt mixture into an aqueous solution of citric

acid for gas foaming process at room temperature instead of using hot water. Furthermore, various PLGA polymers with molar lactic/glycolic ratios of 50/50, 65/35, and 75/25 were used to fabricate the scaffolds having different degradation rates. These PLGA scaffolds were also surface modified with cell recognizable ligands, such as galactose for hepatocytes, RGD for bone marrow stem cells, and hyaluronic acid for chondrocytes, to enhance cell attachment, proliferation, and functions.

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