Biodegradable polyester-based microcarriers with modified surface tailored for tissue engineering

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Abstract

Microcarriers offer attractive properties in tissue engineering, namely for bone, cartilage, skin, vascular, central nervous system. Although polyester-based microcarriers have been already proposed for this purpose, their surface properties are not specifically adapted to promote cell adhesion and growth.

The main purpose of this study was to prepare microcarriers based on poly(D,L-lactide) acid (PDLLA), poly(L-lactide) acid (PLLA), and to study fibroblast behavior (adhesion, spreading, growth and proliferation) in function of microbead topography and surface chemistry.
To improve L-929 fibroblast adhesion, surface of the microcarriers has been modified with polycations: chitosan, poly(2-dimethylamino ethylmethacrylate) (PDMAEMA) or chitosan-g-oligolactide copolymer (chit-g-OLA). These two first polyelectrolytes have been physically adsorbed on the preformed microbeads, while chit-g-OLA copolymer has been anchored to the surface during the manufacturing process of microbead formation. This simple approach 1) bypass the use of an emulsifier (polyvinyl alcohol, PVA); 2) avoid surface "contamination" with PVA molecules limiting a control of the surface characteristics.

In vitro study of the growth of mouse fibroblasts on the microbeads showed that both surface topography and chemistry affected cell attachment, spreading and proliferation. Cultivation of L-929 fibroblasts for 7 days resulted in the formation of a 3D cell-scaffold network.

Keywords: microcarriers, tissue engineering, surface modification, chitosan copolymer, polyester microbeads.