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Engineering Ligand-Free Biodegradable-Based Nanoparticles for Cell Attachment and Growth

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Abstract : Tissue engineering aims to develop alternatives to treat damaged tissues by promoting their regeneration. Its basic principle is to place cells on a scaffold capable of promoting cell functions, and for this purpose, polymeric nanoparticles have been successfully used due to the ability of some macro chains to mimic the extracellular matrix and influence cell functions. In general, nanoparticles require surface chemical modification to achieve cell adhesion, and recent advances in their synthesis include methods for modifying the ligand density and distribution onto nanoparticles surface. However, this work reports the development of biodegradable polymeric nanoparticles capable of promoting cellular adhesion without any surface chemical modification by ligands. Biocompatible and biodegradable nanoparticles based on poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBHV) were synthesized by solvent evaporation method. The produced nanoparticles were small in size (85 and 125 nm) and colloidally stable against time in aqueous solution. Morphology evaluation showed their spherical shape with small polydispersity. Human osteoblast-like cells (MG63) were cultured in the presence of PHBHV nanoparticles, and growth kinetics were compared to those grown on tissue culture polystyrene (TCPS). Cell attachment on non-tissue culture polystyrene (non-TCPS) pre-coated with nanoparticles was assessed and compared to attachment on TCPS. These findings reveal the potential of PHBHV nanoparticles for cell adhesion and growth, without requiring a matrix ligand to support cells, to be used as scaffolds, in tissue engineering applications.

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