In vitro biocompatibility evaluation of Polyhydroxybutirate (PHB) and poly(3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV) nanofiber meshes using human adipose derived stem cells

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Abstract- Polyhidroxibutyrate (PHB) and poly (3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV) are members of a family of polyesters synthesized by microorganisms the Polyhydroxyalkanoates (PHAs). PHAs are emerging as a class of biodegradable polymers for applications in tissue engineering. Nanofiber meshes for application as scaffolds was produced by blending 30% PHB 70% PHBHV using the technique eltrectrospinning (Fig. 1). Different cellular aspects were analyzed in order to know the cell viability of human adipose derived stem cells during cell culture on PHB/PHBHV nanofiber meshes. The results should that PHB/PHBHV nanofiber meshes is a suitable and biocompatible material as a scaffold for tissue engineering (Fig. 2).

Polyhydroxyalkanoates (PHAs) are a family of polyesters synthesized by microorganisms through the fermentation of carbon substrates. PHAs are emerging as a class of biodegradable polymers for applications in tissue engineering due to their reasonable biocompatibility, adjustable mechanical properties, and controllable biodegradability [1]. Polyhidroxibutyrate (PHB) and poly (3-hydroxybutyrate-co-3-hydroxyvalerate) (PHBV) can be produced by the fermentation of syrup sugar cane which reduce the cost of producing such biopolyesters. In this work nanofiber meshes with 250 nm a 2.5 µm was produced by blending 30% PHB 70% PHBHV using the technique eltrectrospinning for application as scaffold for tissue engineering.

Human adipose derived stem cells (ASC) were cultured, expanded and seeded on the PHB/PHBHV nanofiber meshes and different cellular aspects were analyzed using imunofluorescence, MTT assay, alkaline phosphatase activity and collagen production. The results provide evidences of good adhesion, proliferation, viability and morphology of ASC on PHB/PHBHV nanofiber meshes. Members of the PHA family have been used to develop devices including sutures, repair devices, repair patches, slings, cardiovascular patches, orthopedic pins, adhesion barriers, stents, guided tissue repair/regeneration devices, articular cartilage repair devices, nerve guides, tendon repair devices, bone marrow scaffolds, and wound dressings. Therefore, it can be concluded that PHB/PHBHV nanofiber meshes is a suitable and biocompatible material as a scaffold for tissue engineering.

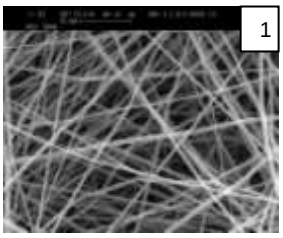
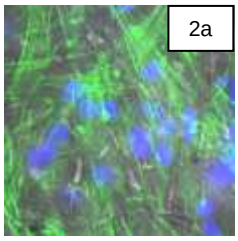


Figure 1: SEM micrographs illustrating PHB/PHBHV nanofiber meshes



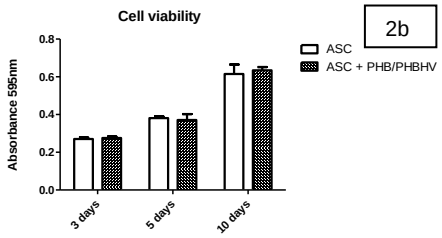
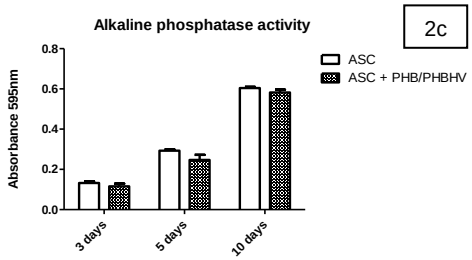


Figure 2: a) Morphology of human ASC cultured for 7 days on PHB/PHBHV nanofiber meshes **b)** Cell viability of human ASC grown on PHB/PHBHV nanofiber meshes



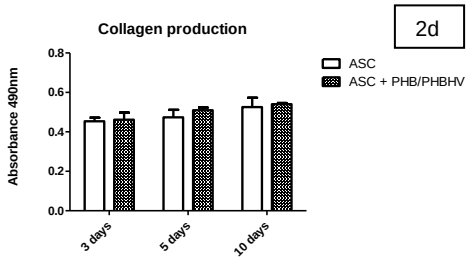


Figure 2: c) Alkaline phosphatase activity of human ASC grown on PHB/PHBHV nanofiber meshes **d)** Collagen production of human ASC grown on PHB/PHBHV nanofiber meshes

[1] Chen GQ, Wu Q. The application of polyhydroxyalkanoates as tissue engineering materials. Biomaterials. 2005 Nov;26(33):6565-78.