Electrospinning of Bovine Split Hides Collagen and Collagen/Glycosaminoglycan for a Study of Stem Cell Adhesion and Proliferation on the mats: Influence of Composition and Structural Morphology

Todorka G. Vladkova, Dilyana N. Gospodinova, Peter D. Dineff, Milena Keremidarska-Marova, Kamelia Hristova-Panusheva, Natalia Krasteva
University of Chemical Technology and Metallurgy, 8 Blvd. Kliment Ohridski, Sofia, Bulgaria
tgv@uctm.edu

Abstract

Electrospun collagen-based fibrous mats are of increasing interest for cell culture, regenerative medicine, and tissue engineering. The focus of this investigation is on the assessing the electrospinning ability of bovine split hides collagen (BSHC) and the effect of glycosaminoglycans (GAGs) incorporation on the mats structural morphology, and impact on the adhesion and proliferation of human adipose-derived mesenchymal stem cells (hAD-MSCs). Electrospun mats were prepared using benign and fluoroalcohol solutions of BSHC and BSHC/GAGs under varied operation conditions. SEM observations and analysis were employed to characterise the structural morphology of the mats. Several parameters were used to evaluate the hAD-MSC behaviour: cytotoxicity, cell morphology, cell number and spreading area, cytoskeleton, focal adhesion contacts and cell proliferation. Electrospinning from benign solvents was impossible. However, fiber mats were successfully prepared from hexafluoropropanol (HFP) solutions. Different structural morphology and fibres diameter of the electrospun mats were observed depending on the composition and concentration of the electrospinning solutions. Both, BSHC and BSHC/GAGs mats supported the in vitro adhesion, growth and differentiation of hAD-MSCs with some variations based on their composition and structural morphology. The absence of cytotoxicity and the good hAD-MSCs adhesiveness make them promising substrates for cell adhesion, proliferation and further stem cell differentiation.

Figures

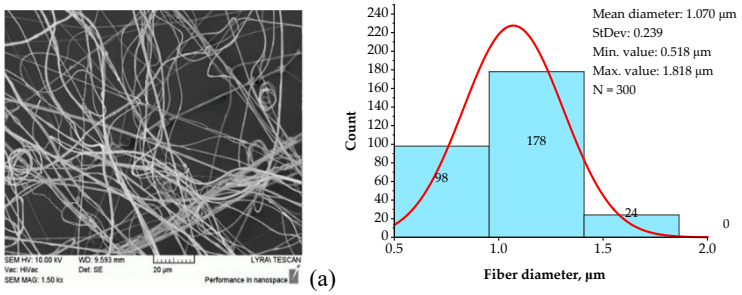

Figure 1: SEM picture and histogram of a fibrous BSHC/HA5, electrospun from 6 wt. % HFP solution of BSHC in presence of 5 wt. % HA

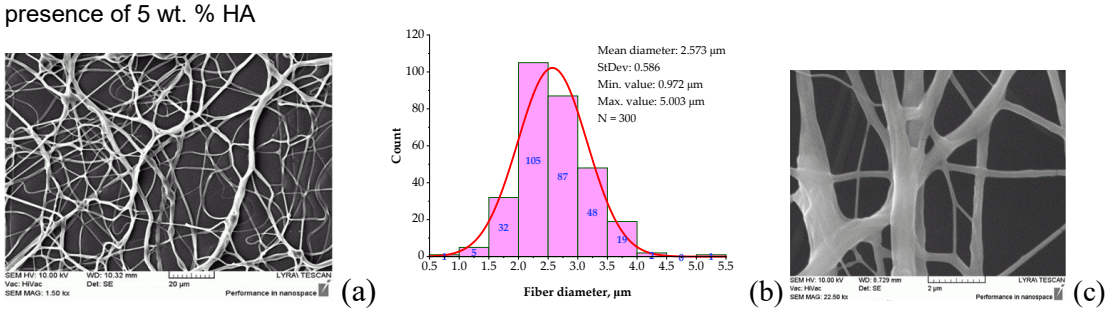

Figure 2: Morphology of fibrous BSHC/CS5 mat, electrospun from 6 % HFP solution of BSHC in presence of 5 wt. % CS

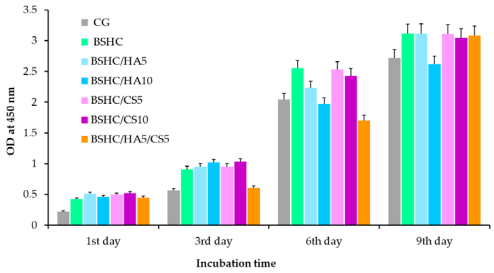

Figure 3: Proliferation hAD-MSCs cultured for 9 days on: control glass (CG), BSHC mat without GAGs and BSHC mats containing HA (BSHC/HA5 and BSHC/HA10), CS (BSHC/CS5 and BSHC/CS10) or both HA and CS (BSHC/HA5/CS5)