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Nano-fibers of poly (vinyl alcohol co-vinyl acetate) as novel scaffold for mammalian cell culture and controlled drug delivery

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The development of novel materials as scaffolds for cell culture has gained attention. The current challenge is to provide a scaffold that mimics natural tissues. We have synthetized at physiological temperature a pH-responsive and biocompatible nanostructured hydrogel with three different crosslinking degrees by varying the content of Glutaraldehyde (GA). According to our data of Scanning Electron Microscopy (SEM) and FTIR, we observed that the hydrogel is conformed highly ordered nano-fibers of poly (vinyl alcohol co-vinyl acetate) (nsPAcVA). By Atomic Force Microscopy (AFM), we showed that nsPAcVA has nano-pores homogeneously distributed on its surface. We have characterized the relative amount of remaining hydroxyl groups and of formed acetal bridges by FTIR and by mechanical tests; we have measured the Young's modulus, strain stress, elastic deformation and tensile strength. nsPAcVA had swelling dynamics dependent on pH and crosslinking. By cyclic voltammetry, we showed that nsPAcVA has ionic conductivity properties inversely proportional to its crosslinking degree. Based on this, we evaluated its capability to controllably release a model molecule. Diffusion analysis through the Peppas equation showed that at lower crosslinking degrees (5 and 10% of GA content), diffusion from nsPAcVA was Fickian. Moreover, we demonstrated for the very first time that nsPAcVA is an efficient scaffold for growth of mammalian cells (embryonic mouse hypothalamic mHypoE-N1 and human lung carcinoma A-549 cells). mHypoE- grown on nsPAcVA had lower proliferation than the control, but after 108 hours of adaptation, cells proliferated at comparable growth levels than the control. No significant difference in A-549 cell growth over nsPAcVA and the control was observed. We present a very easy synthesizable, cheap, biocompatible and nanostructured scaffold for controlled drug release with promising physicochemical characteristics to be applied as a tissue engineering material that integrates abiotic and biotic components towards a new generation of smart implants which ultimately could mimic natural tissues.

Biography

Francisca Villanueva Flores is currently pursuing her PhD in Biochemistry from Instituto de Biotecnología in the Universidad Nacional Autónoma de México. Her main research focuses in the development of medical nano devices for neuronal tissue engineering. In her PhD, she has synthetized a nano-implant for restoring cellular function. Her research interests also include the understanding of cell-nanomaterial interactions to develop novel, efficient and safe therapeutic nanobiomaterials.

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