Improved Cellular Response of Chemically Crosslinked Collagen Incorporated Hydroxyethyl Cellulose/Poly(Vinyl) Alcohol Nanofibers Scaffold

Farah Hanani Zulkifli[a], Fathima Shahitha Jahir Hussain[a], Mohammad Syaiful Bahari Abdull Rasad[b], Mashitah Mohd Yusoff[a]

[a]Faculty of Industrial Sciences & Technology, University Malaysia Pahang, Pahang, Malaysia
[b]Kulliyyah of Allied Health Sciences, International Islamic University Malaysia, Pahang, Malaysia

ABSTRACT

The aim of this research is to develop biocompatible nanofibrous mats using hydroxyethyl cellulose with improved cellular adhesion profiles and stability and use these fibrous mats as potential scaffold for skin tissue engineering. Glutaraldehyde was used to treat the scaffolds water insoluble as well as improve their biostability for possible use in biomedical applications. Electrospinning of hydroxyethyl cellulose (5 wt%) with poly(vinyl alcohol) (15 wt%) incorporated with and without collagen was blended at (1:1:1) and (1:1) ratios, respectively, and was evaluated for optimal criteria as tissue engineering scaffolds. The nanofibrous mats were crosslinked and characterized by scanning electron microscope, Fourier transform infrared spectroscopy, differential scanning calorimetry, and thermogravimetric analysis. Scanning electron microscope images showed that the mean diameters of blend nanofibers were gradually increased after chemically crosslinking with glutaraldehyde. Fourier transform infrared spectroscopy was carried out to understand chemical interactions in the presence of aldehyde groups. Thermal characterization results showed that the stability of hydroxyethyl cellulose/poly(vinyl alcohol) and hydroxyethyl cellulose/poly(vinyl alcohol)/collagen nanofibers was increased with glutaraldehyde treatment. Studies on cell–scaffolds interaction were carried out by culturing human fibroblast (hFOB) cells on the nanofibers by assessing the growth, proliferation, and morphologies of cells. The scanning electron microscope results show that better cell proliferation and attachment appeared on hydroxyethyl cellulose/poly(vinyl alcohol)/collagen substrates after 7 days of culturing, thus, promoting the potential of electrospun scaffolds as a promising candidate for tissue engineering applications.

DOI: 10.1177/0885328214549818