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Thermo-Responsive Non-Woven Scaffolds for ‘‘Smart’’3D Cell Culture

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ABSTRACT

The thermo-responsive polymer poly(Nisopropylacrylamide) has received widespread attention for its in vitro application in the non-invasive, nondestructive release of adherent cells on two dimensional surfaces. In this study, 3D non-woven scaffolds fabricated from poly(propylene) (PP), poly(ethylene terephthalate) (PET), and nylon that had been grafted with PNIPAAm were tested for their ability to support the proliferation and subsequent thermal release of HC04 and HepG2 hepatocytes. Hepatocyte viability and proliferation were estimated using the Alamar Blue assay and Hoechst 33258 total DNA quantification. The assays revealed that the pure and grafted non-woven scaffolds maintained the hepatocytes within the matrix and promoted 3D proliferation comparable to that of the commercially available AlgimatrixTM alginate scaffold. Albumin production and selected cytochrome P450 genes expression was found to be superior in cells growing on pure and grafted non-woven PP scaffolds as compared to cells grown as a 2D monolayer. Two scaffolds, namely, PP-g-PNIPAAm-A and PP-g-PNIPAAm-B were identified as having far superior thermal release capabilities; releasing the majority of the cells from the matrices within 2 h. This is the first report for the development of 3D non-woven, thermoresponsive scaffolds able to release cells from the matrix without the use of any enzymatic assistance or scaffold degradation.