

Functionality and Viability of Rat Hepatocytes Cultured on 2D and 3D Self Assembled Monolayer (SAM) Modified Indium Tin Oxide (ITO) Substrates

Rajendra K. Aithal¹, Deepak P. Kumaraswamy^{1,2}, David K. Mills^{1,3}, Debasish Kuila¹

¹Institute for Micromanufacturing, 911 Hergot Avenue, Ruston, LA 71272.

²Department of Biomedical Engineering, Louisiana Tech University, Ruston, LA 71272.

³School of Biological Sciences, Louisiana Tech University, POB 3179, Ruston, LA 71272.

Abstract

Development of cell culture platforms for drug toxicity screening requires a suitable substrate facilitating efficient attachment of cells. Biocompatibility, maintenance of cell phenotype and long-term functionality of cell culture are parameters that govern the choice of a substrate. Self assembled monolayers (SAMs), ordered molecular assemblies formed by the adsorption of a surfactant onto a solid surface, can provide a means to regulate surface chemistry more precisely and enhance surface properties facilitating enhancement and inhibition of cell adhesion. Hepatocytes were seeded on both 2D and 3D patterned Indium Tin Oxide (ITO) substrates modified with SAMs of: 3-(aminopropyl)triethoxysilane [APTES, -NH₂ end group], 3-mercaptopropionic acid [MPA, -COOH end group], 1-octadecanethiol [ODT, -CH₃ end group] and 3-(mercaptopropyl)trimethoxysilane [MPS, -SH end group]. The changes in cell morphology were monitored over a period of 14 days. The cells exhibited normal rounded morphology on all the substrates with binuclei cells evident in some cases. Hepatocyte clustering was observed, which became prominent with increase in culture period. Overall, hepatocytes cultured on substrates coated with SAMs having different end groups showed normal morphology with no inferences of changes in cell structure, functionality and morphology. Further analyses of liver specific functions such as protein synthesis, lactate dehydrogenase (LDH) leakage, and urea and albumin synthesis will be reported along with cell viability and proliferation. These studies would provide valuable information for studying cell-substrate interactions and help us to choose the proper substrate for the development of stable SAM based cell culture platforms.

Keywords: Cell culture platforms, Self assembled monolayers, Hepatocytes, Morphological assessment, Biocompatibility, Functionality.