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Fabrication of Nanoporous Hemi-Spherical Micro-Shell Array for 3D Cell Culture

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Extended Abstract

Many studies on co-culture with non-parenchymal cells to improve the function expression and activity of cancer cells have been reported.[1] In co-culture, a microwell array for 3D cell culture and a nanoporous membrane for exchange of biomolecules between cells while separating two kinds of cells.[2] Using nanoporous membranes, two types of cells were separated and their effects on the exchange of biomolecules between cells were identified. Previous studies have carried out co-culture with commercial polymer nanoporous membranes, with limitations of low porosity(less than 4%) and high thickness(more than 10μm). To overcome this, a thin nanoporous anodic alumina membrane(NAAM) was proposed using high purity aluminum sheet (99.999%) for cell co-culture. When NAAM was used to co-culture NIH3T3 cells and HepG2 cells, albumin was about 1.7 times higher than that of commercial membranes. Through this, it was confirmed that co-culture using NAAM is effective in increasing functional expression and activity of cancer cells.[3] Nanoporous hemi-spherical micro-shell array(NHMA) were made for 3D cell culture in order to apply the advantages of NAAM instead of the microwell array used in previous studies. Aluminum was etched because it had to be hemispherical in order to be used instead of microwell array. The SU-8 photoresist was used to perform a lithography process on a 200μm circular pattern on high purity aluminum. Circular partial etching was performed using EP solution mixed with ethanol and perchloric acid. Hemispherical high purity aluminum was fabricated and anodized with phosphoric acid. In real time monitoring, 0.3M phosphoric acid was maintained at an electrolyte temperature of 0℃ and a bias voltage of 160V. After anodization, the aluminum layer under the nanoporous alumina layer was removed using a $CuCl_2$-based etchant.

The fabricated NHMA is expected to have a porosity of 60% and a thickness of 10μm. The manufactured NHMA is expected to have an effect of improving the function expression and activity of HepG2 cells when co-culture is performed compared to commercial microwell array.

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