Comparison of Geometries for Diffusion-Based Extraction of Dimethyl Sulphoxide From a Cell Suspension

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Microfluidics can be used in a variety of medical applications. In this study, a microfluidic device is being developed to remove cryoprotective agents from cells post thaw (1–150 ml). Hematopoietic stem cells are typically cryopreserved with Dimethyl sulphoxide (DMSO), which is toxic upon infusion. Conventional methods of removing DMSO results in cells losses of 25–30%. The overall objective of this study is to characterize the influence of flow geometry on extraction of DMSO from a cell stream. For all the flow geometries analyzed, flow rate fraction, Peclet Number, and channel geometry had the greatest influence on extraction of DMSO from the cell stream. The range of flow rate fractions that can achieve the desired removal ranges between 0.10 and 0.30. Similarly, the range of Peclet numbers is 250–2500. Distinct differences in channel length could be observed between the different flow configurations studied. The flow rates and channel geometries studied suggest that clinical volumes of cell suspensions (1–100 ml) can be processed using a multi-stage microfluidic device in short periods of time (<1 hr).