Immediate drop on demand technology – a new platform for cell applications in low-volume range

L. Schober, C. Laske, T. Brode, A.F. Traube, A. Traube

[1]Fraunhofer Institute for Manufacturing Engineering and Automation, Stuttgart, Germany

The handling and dosing of cells is the most critical step in the microfabrication of 3D cell-based assay systems for screening and toxicity testing applications. The use of robotic workstations for liquid handling has increased enormously over the last decades, in order to meet the requirements for high accuracy and high throughput of current bioanalytics. The immediate drop on demand technology (I-DOT) overcomes the challenge of dispensing cells in a small volume precisely and with low shear stress.

The I-DOT provides a fast and flexible non-contact liquid handling system enabling dispensing cells and liquid without the risk of cross-contamination to a precise volume even in nanoliter range. Liquid is dispensed from a special source plate with a nozzle (Ø 100 µm) at the bottom. To release a defined amount of liquid a short compressed air pulse is given through a quick release valve into the well, exceeding the capillary pressure in the nozzle. Droplets with a defined volume can be spotted directly onto SBS-plates or other cell culture devices.

In this study MCF-7, human skin fibroblasts (phSD) and human mesenchymal stem cells (hMSCs) were tested for viability, adherence capability, apoptosis induction, proliferative and differentiation capacity after printing. As a control, cells were dispensed using commercially available pipette systems. The viabilities of all cell types after the printing process were comparable to the control, all cells had a viability > 80%.

Printed as well as manual pipetted cells showed similar proliferation rates, with the strongest rate for MCF-7, followed by primary skin cells and hMSCs. After printing no apoptotic cells were detected as confirmed by TUNEL staining. Furthermore, the I-DOT application did not affect hMSCs in undergoing adipogenic and osteogenic differentiation, as demonstrated histologically.

This new technology enables the user to apply accurate cells without detrimental fluorochrome tagging and shows promising potential for single cell and non-invasive stem cell application, 3D-bioprinting and biomarker screening.

Contact:
Dr. Andrea Traube
Email: andrea.traube@ipa.fraunhofer.de
Phone: +49 711 970 1241
www.ipa.fraunhofer.de