The Design of Microfluidic Pump (MFP) for Medical Field

Yucebas, Lara (School: Cakabey Schools)
Karakusoglu, Sila (School: Cakabey Schools)

The ability of microfluidic (MF) device technologies to provide a lot of information with a small amount of sample, the opportunities it provides increases their use in the medical field in the bedside monitoring in drug delivery systems. Three-dimensional (3D) printer technologies provide advantages such as cost-effectiveness in the production of MF devices and quick and easy production in complex designs. In our project, it is aimed to design microfluidic pumps (MFP) to be used in medical field and conduct its production with 3D printer technologies. The developed MFP is intended to be at low cost, bio-compatible, adaptable and portable to the drug, suitable flow properties as a pharmaceutical pump. First of all, MFP air channel, flow channel etc. parts were designed and printed with the help of 3D printer and on AutoCAD, one of the professional drawing programs. The poly(dimethylsiloxane) (PDMS) membrane that will enable MFP activation is produced in different thicknesses and glued to the air channel of MFP, and the resistance to the applied pressure is observed and the appropriate membrane thickness is determined as ~ 236μm. Liquid PDMS was applied to the inner surfaces of MFP's air and flow channel, PDMS membrane was placed between them and the parts were assembled in the oven at 60ºC. MFP has been connected to the pneumatic valve system, where operation codes have been prepared with Arduino Uno, and flow properties have been examined. The flow rate of MFP is ~ 50 μL/min at a maximum of 15 Hz and the backpressure is ~ 0.085 Pa under a maximum pressure of 3 bar. In addition, values such as size, membrane thickness and applied pressure for the possible models of MFP were supported by theoretical calculations.

Awards Won: