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參展科別 醫學與健康科學

作品名稱 **THE DESIGN OF MICROFLUIDIC
PUMP (MFP) FOR MEDICAL FIELD**

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關鍵詞 **Micro Fluid Pump、PDMS、3D Printer**

作者照片



ABSTRACT

The ability of microfluidic (MF) device technologies to provide a lot of information with a small amount of sample, the opportunities it offers 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 intricate designs.

In our project, it is aimed to design microfluidic pumps (MFP) to be used in the 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 a 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. The resistance to the applied pressure is observed, and the appropriate membrane thickness is determined as $\sim 235\mu\text{m}$. 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 60°C . 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 $\sim 50\ \mu\text{L}/\text{min}$ at a maximum of 15 Hz, and the backpressure is $\sim 0.085\ \text{Pa}$ under a maximum pressure of 3 bar. Also, values such as size, membrane thickness, and applied pressure for the possible models of MFP were supported by theoretical calculations.

As a result, MFP, which is biocompatible, drug adaptable, portable, wearable technology application potential, and has suitable flow characteristics as a pharmaceutical pump, has been developed. MFP introduced a microfluidic pump system that can make life easier for the patient and contribute to the national economy through domestic production and can be used as a drug pump in the treatment of diseases such as diabetes and cancer.

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The authors demonstrate a new way to manufacture a MFP, which greatly reduces the cost and is beneficial for commercialization. It would be good if the author could really demonstrate its application on biological experiments.