

Disposable World-to-Chip Interface for Digital Microfluidics

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SUMMARY

Researchers at UCLA have designed a disposable system that allows the automated delivery and retrieval of micro-liter sized liquid sample reagents to and from a digital microfluidic chip.

BACKGROUND

Current systems used to perform sample preparations that integrate with digital microfluidics use liquid valves, rotary valves, or small volume injection loops that are expensive and often require a large apparatus to operate. Other digital microfluidic systems require operators to directly pipette sample reagents into the platform which can incorporate human error and the potential exposure to hazardous chemicals. In order for automated and consistent benchtop chemical synthesis using digital microfluidics to exist, a compact and inexpensive system must be able to interface with the external environment to allow efficient chemical delivery and retrieval.

INNOVATION

Researchers from UCLA's Department of Molecular and Medical Pharmacology have developed a system for interfacing digital microfluidic chips with external vials for the delivery and retrieval of liquid reagents. The system is capable of preparing and delivering multiple reagents of specific volumes less than 20 μ L to the digital microfluidic chip. The digital microfluidic chip can manipulate the discrete droplets of reagents using electric fields to initiate various chemical reactions. The novel interface system can then retrieve and purify the samples, all in a software-controlled automated fashion that eliminates human-induced error. The automated external vial system prevents cross-contamination of reagents and removes the need for manual interfacing (e.g. pipetting) for sample preparation, loading, and collection. Finally, this interface design conveniently allows for disposable cassettes comprised of inexpensive materials.

APPLICATIONS

- ▶ Automated synthesis for organic chemistry and radiochemistry
- ▶ Chemical synthesis
- ▶ Nano- and micro-particle synthesis
- ▶ Biochemical synthesis
- ▶ Chemical, biochemical, and biological assays
- ▶ HPLC purification
- ▶ PET probe synthesis

ADVANTAGES

- ▶ Uses inexpensive materials designed to be disposable
- ▶ Compact and available for benchtop testing
- ▶ Automation makes the system easy-to-use, more accurate, more consistent, and safer by preventing human interaction and contact with potentially hazardous chemicals

STATE OF DEVELOPMENT

A working prototype has been developed and is currently being used for experiments in radiochemistry for PET probe synthesis.

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INVENTORS

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OTHER INFORMATION

KEYWORDS

Digital microfluidics, EWOD, pumps, valves, valve-free, assay, disposable, automated, radiochemistry, chemical, biochemical, biological, synthesis, nanoparticle, microparticle, organic chemistry, benchtop, PET, HPLC

CATEGORIZED AS

- ▶ **Biotechnology**
 - ▶ Other
 - ▶ Proteomics
- ▶ **Medical**
 - ▶ Research Tools
- ▶ **Research Tools**
 - ▶ Other
 - ▶ Reagents
 - ▶ Screening Assays
- ▶ **Sensors & Instrumentation**
 - ▶ Analytical
 - ▶ Process Control
 - ▶ Scientific/Research

RELATED CASES

2012-816-0

PATENT STATUS

Country	Type	Number	Dated	Case
United States Of America	Issued Patent	9,649,632	05/16/2017	2012-816

RELATED MATERIALS

- ▶ GJ Shah, P-Y Keng, S Chen, MR Javed, H Ding, S Sadeghi, C-J Kim, RM van Dam, "Integrated microchemistry platform: Automation of multi-reagent loading, on-chip high temperature reactions, and product extraction." Proceedings of the 4th International Symposium on Microchemistry and Microsystems, 2012.
- ▶ Shah, Gaurav, Javed, Mohammed, Yang, Anqiz, Keng, Pei Yuin, van Dam, R. Michael, "Integration of [F-18]fluoride pre-concentration into a digital microfluidics-based radiosynthesizer for the benchtop." International Society of Nuclear Medicine Annual Meeting, 2013.
- ▶ GJ Shah, S Chen, P-Y Keng, S Sadeghi, C-J Kim, RM van Dam, "Automation of a digital microfluidic system for repeatable radiosynthesis of 2-[18F]fluoro-2-deoxy-D-glucose ([18F]FDG) and other tracers." The Sixth Annual World Imaging Conference, 2013.
- ▶ GJ Shah, J Lei, S Chen, C-J Kim, P-Y Keng, RM van Dam, "Automated injection from EWOD digital microfluidic chip into HPLC purification system." 16th International Conference on Miniaturized Systems for Chemistry and Life Sciences, 2012.

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- ▶ Device and Method for Microscale Chemical Reactions
- ▶ Microscale Device and Method for Purification of Radiopharmaceuticals
- ▶ Novel Method of Radiofluorination
- ▶ Digital Microfluidic Platform for Radiochemistry
- ▶ Method for Concentration and Formulation of Radiopharmaceuticals

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