

Accepted Manuscript

OMIS: The Open Millifluidic Inquiry System for small scale chemical synthesis and analysis

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PII: S2468-0672(18)30052-X
DOI: <https://doi.org/10.1016/j.ohx.2018.e00038>
Article Number: e00038
Reference: OHX 38

To appear in: *HardwareX*

Received Date: 21 June 2018
Revised Date: 23 July 2018
Accepted Date: 23 July 2018

Please cite this article as: R.J. LeSuer, K.L. Osgood, K.E. Stelnicki, J.L. Mendez, OMIS: The Open Millifluidic Inquiry System for small scale chemical synthesis and analysis, *HardwareX* (2018), doi: <https://doi.org/10.1016/j.ohx.2018.e00038>

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Title: OMIS: The Open Millifluidic Inquiry System for small scale chemical synthesis and analysis

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Abstract: With the continued establishment of hacker-spaces and fab-labs hosted in academic libraries, there is an increase in the availability of resources for designing scientific instrumentation in the undergraduate curriculum. Many available designs, however, may be too complex to fabricate in teaching environments. Presented here is OMIS, the Open Millifluidic Inquiry System, which is a platform for performing small-scale chemical synthesis and analysis. OMIS consists of a 3D printed syringe pump, control hardware based upon the Arduino microcontroller and 3D printed reaction vessels. The OMIS syringe pump utilizes a low-power stepper motor which simplifies the instrument construction and allows for power to be supplied from batteries or the USB port of a computer. The simple design of OMIS allows for the instrument to be fabricated in one day, including the time to 3D print components. The OMIS syringe pump is able to deliver fluids at rates between 60 and 300 $\mu\text{L}/\text{min}$, depending on syringe size, with a reproducibility of 3%. Several applications of OMIS are presented, including a demonstration of laminar flow in a 3D printed millifluidic chip, implementation of a low-volume flow-cell cuvette insert and the synthesis of magnetite nanoparticles.

Keywords: 3D printed syringe pump; Arduino microcontroller; lab on a chip

Specifications table

Hardware name	OMIS: The Open Millifluidic Inquiry System, consisting of a 3D printed syringe pump Arduino Shield and millifluidic devices for chemical synthesis and analysis
Subject area	<ul style="list-style-type: none"> • Chemistry and Biochemistry • Educational Tools and Open Source Alternatives to Existing Infrastructure
Hardware type	<ul style="list-style-type: none"> • Chemical sample handling and synthesis • Liquid handling • Syringe manipulation
Open Source License	CERN OHL v1.2
Cost of Hardware	\$50
Source File Repository	doi:10.17632/h6t5g6m57t.1

1. Hardware in context

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