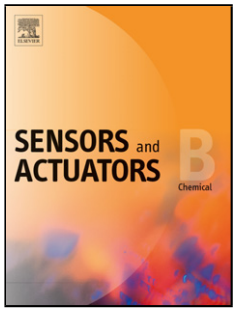

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Authors: Yunzeng Zhu, Yiqi Chen, Youchun Xu

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Interruptible siphon valving for centrifugal microfluidic platforms

Yunzeng Zhu [a], Yiqi Chen [a], and Youchun Xu [a,b,*]

[a] *Department of Biomedical Engineering, Tsinghua University School of Medicine, Beijing 100084, China.*

[b] *National Engineering Research Center for Beijing Biochip Technology, Beijing 102206, China*

Corresponding Author

*E-mail: xyc2012@tsinghua.edu.cn

Highlights

- Interruptible siphon valving is proposed for liquid manipulations.
- Interruptible transfer of liquid from one reservoir into the next is achieved.
- Analytical model of the interruptible siphon valving is reported and verified.
- Band-pass siphon valving, repeated washing, inward pumping, programmable flow control and flow sequencing are demonstrated.

ABSTRACT: Various types of valving techniques, especially passive valves, have been demonstrated on centrifugal microfluidic devices, which are simple to fabricate and easy to implement. In this study, a novel interruptible siphon valving technique is proposed to enhance the flexibility for the flow control on passive centrifugal microfluidic platforms. Differs from traditional siphon valves, the main feature of the interruptible valve is having an additional air vent at the crest of the siphon channel. Using this design, a primed siphon can discharge liquids in a proper range of spin speed, or be cut off by further increasing the rotation frequency. An analytical model of the interruptible siphon valving is proposed and verified to estimate the cut-off spin speed, which can be a guidance for the device design. To demonstrate the potential of this valve for flow control, five typical applications based on interruptible siphon valving were proposed and evaluated, including band-pass siphon valving, repeated washing, inward pumping, programmable flow control and flow sequencing. Our methods are well balanced in simplicity and flexibility, and have significant potential to be applied in multistep biochemical analysis, immunoassays and nucleic acid tests.