Digital Droplet Infusion System for High-Precision, Low-Volume, Delivery of Drugs or Nutritional Supplements

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ABSTRACT

Researchers at the University of California, Davis have developed the first, digital, droplet infusion system capable of high-precision delivery of very low-volume therapeutics or nutraceuticals.

FULL DESCRIPTION

Infusions to deliver medications intravenously are a common clinical practice. They are especially effective in treating patients who are not responsive to other drug delivery routes. Infusion applications include chemotherapy, outpatient surgery, pain management, and the delivery of medications and supplements such as antibiotics, analgesia, anesthesia, and alimentation. Microinfusion pumps provide relatively accurate delivery of some fluids at rates lower than 10mL/h – a volume commonly associated with pediatric patients, neonates, or for administrating short-acting or highly concentrated drugs. However, even automated infusion systems – which improve delivery control, precision, and safety compared to manual systems - have several inherent limitations. These limitations include volume inaccuracies at very low volumes, as well as other functional properties with various disadvantages. An emerging technology attracting increased interest is digital droplet infusion (DDI) systems. These systems have demonstrated their potential as a lower-cost, higher precision, alternative to existing infusion dispensing solutions. Researchers at the University of California Davis have

developed a microfluidics-based infusion system that delivers very low volumes with extremely high precision. It employs digital droplet flowmetry, utilizing interfacial instability to convert continuous flow into uniform, discrete, droplets. The device's governing parameters also help increase the consistency of droplet volume. This technology can achieve micro-infusion rates ranging from 0.1mL/h to 10mL/h - with a precision resolution of 57nL for a single droplet. Its low-cost, modular design and simple architecture allow for fast assembly using only off-the-shelf and 3D- printed components - making it suitable for both disposable applications and remote settings. Thus DDI technology has the potential to become the next-generation clinical standard.

APPLICATIONS

- Low volume, high-precision delivery of therapeutics and nutraceuticals
- Safe for small children and neonatals – for whom precise delivery of very small infusion volumes is essential
- Allows controlled dosing of short-acting or highly concentrated drugs

FEATURES/BENEFITS

- Simple device architecture and modular design promotes lower production costs
- Small dimensions and footprint allows for portability and use in non-traditional settings
- High accuracy at infusion rates ranging from 0.1mL/h to 10mL/h

PATENT STATUS

Patent Pending

ADDITIONAL TECHNOLOGIES BY THESE INVENTORS

- Micropatterned Superhydrophobic Textile for Enhanced Biofluid Transport
- Microfluidic Dispenser for Automated, High-Precision, Liquids Handling
- Digital Droplet Microflowmetry Enabled by Interfacial Instability
- Digital Meter-On-Chip with Microfluidic Flowmetry

CONTACT

Andrew M. Van Court
amvancourt@ucdavis.edu
tel: .



INVENTORS

- Fang, Zecong
- Li, Andrew
- Liu, Hong
- Pan, Tingrui

OTHER INFORMATION

KEYWORDS

Microinfusion

CATEGORIZED AS

- **Medical**
  - Delivery Systems
  - Devices
  - Therapeutics
- **Engineering**
  - Other

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University of California, Davis
Technology Transfer Office
1 Shields Avenue, Mrak Hall 4th Floor,
Davis,CA 95616

Tel: 530.754.8649
techtransfer@ucdavis.edu
https://research.ucdavis.edu/technology-transfer/
Fax: 530.754.7620

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