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## Wireless, smartphone controlled electrochemical lab-on-a-disc platform for drug dissolution studies from containers

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*Publication date:*  
2018

*Document Version*  
Early version, also known as pre-print

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*Citation (APA):*  
Thoppe Rajendran, S., Bergkamp, . M. H., Scarano, E., Cheng, C-H., Wang, J-H., Capria, A. M., ... Boisen, A. (2018). Wireless, smartphone controlled electrochemical lab-on-a-disc platform for drug dissolution studies from containers. Abstract from Biosensors 2018, Miami, United States.

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**Title:**

**Wireless, smartphone controlled electrochemical lab-on-a-disc platform for drug dissolution studies from  $\mu$ containers**

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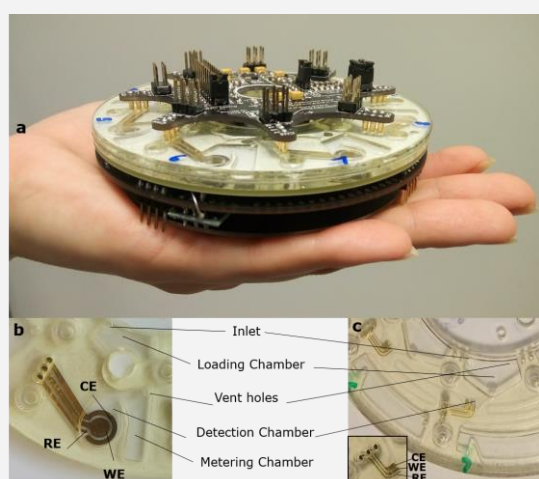
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Integration of electrochemical detection with microfluidics has several advantages<sup>1</sup>. Since both the electrode and the instrumentation can be miniaturized, multiplexed and automated without losing performance.<sup>1,2</sup> Lab-on-disc (LoD) platforms have gained significant interest in both academic research and industry.<sup>3</sup> They offer an alternative to traditional pressure driven microfluidic systems requiring minimal instrumentation for liquid handling, enabling the development of simple and compact detection systems. In this work we present a wireless, smartphone controlled potentiostat, custom made for LoD devices. As a case study we combined the electrochemical analyzer (Fig. 1a) with a fluidic device designed for real time drug dissolution studies from  $\mu$ containers<sup>4</sup>.

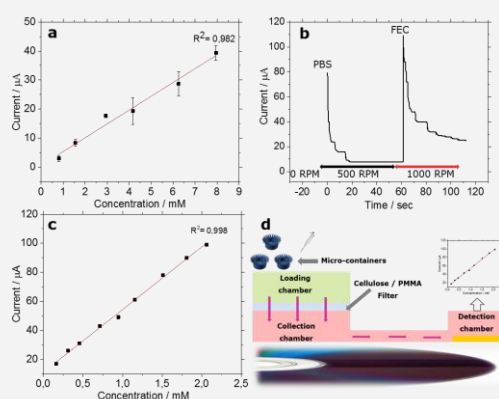
The main part of the potentiostat (Fig. 1a) is a printed circuit board (PCB) incorporating the vital components of the system, placed below the microfluidic unit, while a second PCB enables connection to the electrodes, integrated on the LoD system, via gold-coated spring loaded pins. To facilitate wireless data transfer, the analyzer is connected to a bluetooth transmission module and the data is recorded on a smartphone. By using wireless inductive powering technique, the analyzer is capable of measuring electrochemical signals while spinning.

The potentiostat connected to electrodes integrated in the LoD system enables real time detection of electrochemically active compounds released from carrier units. We evaluated two fluidic designs (Fig 1b,c) and characterized the system measuring the dissolution of a model electrochemical compound, ferrocyanide (FEC, Fig 2b). The quantification of the analyte is achieved using a calibration curve (Fig 2a). As a next step we are aiming for measuring the dissolution of paracetamol (Fig 2d) from  $\mu$ containers, coated with pH sensitive polymer and evaluate the effect of dissolution of various carrier designs and polymer coatings.

The developed multichannel electrochemical analyser is designed to be modular and to facilitate integration with other LoD devices, where electrochemical detection is applicable.



**Fig.1 a)** Photograph of the electrochemical analyzer prototype integrated with the LoD platform showing the main printed circuit board, Microfluidic disc integrated with **b)** cellulose filters and gold electrodes, **c)** PMMA filters and small surface area gold electrodes (details of electrodes in inset)



**Fig.2 a)** Calibration curve for model electrochemical analyte: ferrocyanide, **b)** Real-time detection of analytes using the disc shown in Fig. 1a: Initially PBS is loaded into the loading chamber and was spinned at 500 RPM to wet the electrodes and to get background current, followed by addition of 100  $\mu$ l of ferrocyanide in the loading chamber and spin at 1000 RPM hence moving the analyte from loading chamber to detection chamber, **c)** Calibration curve for paracetamol, **d)** cartoon depicting the cross section view of the microfluidic disc with cellulose filters

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