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

Thoppe Rajendran, Sriram; Bergkamp, Max H.; Scarano, Ermes; Cheng, Chung-Hsiang; Wang, Jen-Hung; Capria, Alessandro M.; Ferrari, Giorgio; Zor, Kinga; Hwu, En Te; Huang, Kuang-Yuh

Publication date:
2018

Document Version
Early version, also known as pre-print

Citation (APA):
Important notes:

Do NOT write outside the grey boxes. Any text or images outside the boxes will be deleted.

Do NOT alter the structure of this form. Simply enter your information into the boxes. The form will be automatically processed – if you alter its structure your submission will not be processed correctly.

Do not include keywords – you can add them when you submit the abstract online.

Title:

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

Authors & affiliations:

Sriram Thoppe Ranjendran\(^a\), Max H. Bergkamp \(^1\,2\), Ermes Scarano\(^1\,3\), Chung-Hsiang Cheng\(^4\), Jen-Hung Wang\(^5\), Alessandro M. Capria\(^1\,3\), Giorgio Ferrari\(^1\), Kinga Żör\(^1\), En-Te Hwu\(^1\), Kuang-Yuh Huang\(^4\) and Anja Boisen\(^1\)

\(^1\) Center for Intelligent Drug Delivery and Sensing Using Microcontainers and Nanomechanics (IDUN), Department of Micro- and Nanotechnology, Technical University of Denmark, Kgs. Lyngby, Denmark

\(^2\) Department of Applied Physics and Biomedical Engineering, Molecular Biosensors for Medical Diagnostics, Eindhoven University of Technology, Eindhoven, The Netherlands

\(^3\) Department of Electrical Engineering and Information Technology, University of Naples Federico II, Naples, Italy

\(^4\) Department of Mechanical Engineering, National Taiwan University, Taipei, Taiwan

\(^5\) Department of Electronics Engineering, Polytechnic University of Milan, Milan, Italy

stran@nanotech.dtu.dk

Abstract: (Your abstract must use Normal style and must fit in this box. Your abstract should be no longer than 300 words. The box will ‘expand’ over 2 pages as you add text/diagrams into it.)

Preparation of Your Abstract

1. The title should be as brief as possible but long enough to indicate clearly the nature of the study. Capitalise the first letter of the first word ONLY (place names excluded). No full stop at the end.
2. Abstracts should state briefly and clearly the purpose, methods, results and conclusions of the work.

Methods: Describe your selection of observations or experimental subjects clearly

Results: Present your results in a logical sequence in text, tables and illustrations

Discussion: Emphasize new and important aspects of the study and conclusions that are drawn from them
Integration of electrochemical detection with microfluidics has several advantages\textsuperscript{1}. Since both the electrode and the instrumentation can be miniaturized, multiplexed and automated without losing performance\textsuperscript{1,2}. Lab-on-disc (LoD) platforms have gained significant interest in both academic research and industry\textsuperscript{3}. 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 µcontainers\textsuperscript{4}.

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 µcontainers, 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.
Important notes:

Do NOT write outside the grey boxes. Any text or images outside the boxes will be deleted.

Do NOT alter the structure of this form. Simply enter your information into the boxes. The form will be automatically processed – if you alter its structure your submission will not be processed correctly.

Do not include keywords – you can add them when you submit the abstract online.

References: