

Advanced Technologies for Water Resource Management

Next Generation Autonomous Analytical Platforms for Remote Environmental Monitoring

Generation of Fully Functioning Biomimetic Analytical Platforms for Water Quality

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Introduction

Nowadays, there is great interest in *in-situ* monitoring allowing fast data acquisition for environmental analysis. The challenge is to develop autonomous devices that could be used in remote locations, which would ultimately enable dynamic monitoring. Typical analysis methods are very costly and time consuming, therefore addressing the need for a simple and cost-effective sensor is crucial. Here we present the design and the development of a portable wireless centrifugal microfluidic analysis system (CMAS) for a lab-on-a-disc water quality monitoring. The micro-fluidic platform enables *in situ* nitrite detection of real water samples.

Centrifugal Microfluidics Analysis System (CMAS)

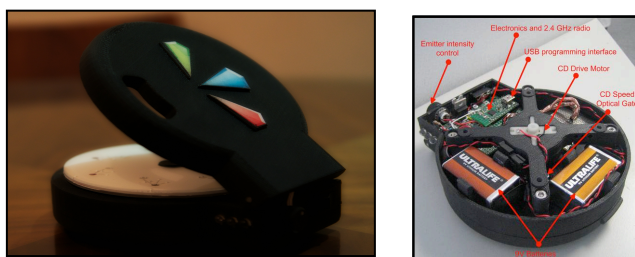


Fig. 1. Picture of the CMAS with a CD microfluidic in it (left), and the centrifugal microfluidic analysis system major components (right).

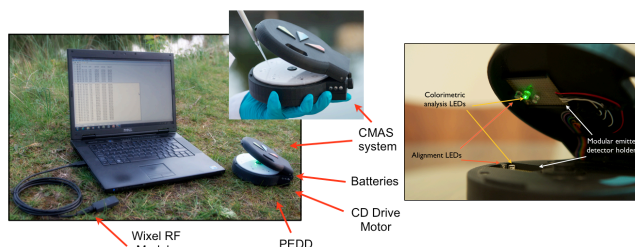


Fig. 2. Portable centrifugal microfluidic analysis system (left), and configuration of the paired LEDs for the alignment of the CD and the colorimetric analysis.

Career development

Conferences

- Lab-on-a-Chip European Congress, 28-29 March 2012, Edinburgh, Scotland (POSTER)
- 6th International Conference on Environmental Science and Technology 2012, June 25-29, 2012, Houston, USA (ORAL)
- Sino-European Symposium on Environment and Health, 20-25 Aug 2012, Galway, Ireland (ORAL)
- The 16th International Conference on Miniaturized Systems for Chemistry and Life Sciences, 28 Oct - 1 Nov, 2012, Okinawa

Short Courses

- Workshop: "Sensing: Changing the way we live our lives", 21 Nov 2011, DCU, Ireland
- "Stats and data processing course", 13-14 March 2012, DCU, Dublin, Ireland
- CMA Analytical Workshop 2012, 24-26 April, Trinity, Dublin, Ireland
- Cambridge Certificate in Advanced English English Course (CAE), 2012

CD platform

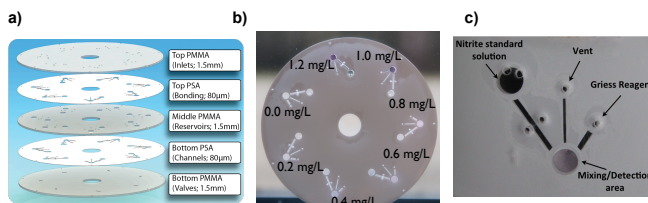


Fig. 3. a) Scheme showing the assembly of the micro-fluidic CD, b) picture of the Lab-on-a-Disc and channel consisting of three chambers and c) a zoom on a single chip consisting of three chambers.

Results

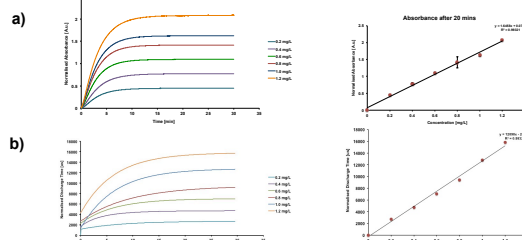


Fig. 4. Kinetic study of the colour formation monitored at a wavelength $\lambda_{max} = 540$ nm between NO_2^- and Griess reagent ($n = 3$) (left side) and absorbance versus nitrite Griess reagent complex concentration (right side) using a UV-Vis spectrometer (a) and the CMAS system (b).

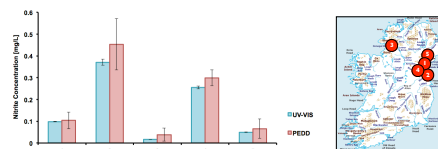


Fig. 5. Water nitrite analysis using a bench-top UV-VIS spectrometer and the CMAS device and a map of the sampling places ($n = 3$).

Conclusions

The autonomous capabilities of the CMAS unit, combined with the portability and wireless communication, provide the flexibility needed for on-site water analysis. Apart from the fact that acquisition parameters can be controlled remotely and adjusted according to individual needs, results can be downloaded in remote locations and displayed in real time. The system demonstrates the potential of a truly autonomous micro-fluidic platform for aquatic environmental analysis.

Acknowledgements

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