Towards integrated multi-microsensor platform using dual electrochemical and optical detection for on-sitepollutant detection in water

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1. SUMMARY:

The effective management of water requires regular and continuous monitoring of quality to detect pollutants (nutrients, pesticides, and heavy metals) in order to prevent a serious threat to human health. Traditional surveillance techniques are generally based on laboratory analyzes of representative field-collected samples leading to considerable expenses. Therefore, the sample has to be collected directly on-site and even if best available transportation practices are applied, e.g. freezing the samples, the composition could change during the drive to the lab producing false outcomes. In this context, portable lab-on-chip (LOC) monitoring systems seem well suited to offer an attractive alternative way to proceed among the analytical methods actually available [1]. Otherwise, they saves time, reduces reagent volume and costs.

2. MOTIVATION and RESULTS:

The present work is focused on a multisensing (electrochemical and optical) and fluidic platform based on a hybrid biosensor lab-on-chip. To evaluate performances of the whole tool, three green micro-algae strains are chosen as the biological sensing element: *Chlamydomonas reinhardtii* (CR) for the electrochemical part, plus *Pseudokirchneriella Subcapitata,* (PS) and *Chlorella Vulgaris* (CV) for the optical one. This paper demonstrates the utility of a standard multi-sensor platform using together the physical principles of electrochemistry and optic in a microfluidic system to allow fast and simple on-site measurements for environmental applications. The different elements (fluidic structure with multi-channel for measurement, emission/reception with the optical devices, autonomous electrochemical cells) are optimized, fabricated, tested and partially integrated on a unique platform. They allow the dual detection of chemical pollutants (pesticides) in fresh water thanks to the use of green micro- algae directly, with no added chemicals. This study is focalized on the effects of Diuron, considered as a model pollutant, on algae in order to compare the two aforementioned sensors characteristics. The advantages of each kind of detection (electrochemical vs. optical) are discussed in relation with the final application, which is the on-site detection of fresh water with no pretreatment.

Acknowledgement:

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References:

[1] Jang A., Zou Z., Kug Lee K., Ahn C.H. and Bishop P.L., 2011, Measurement Science and Technology, 22 1-18.

FIGURES :

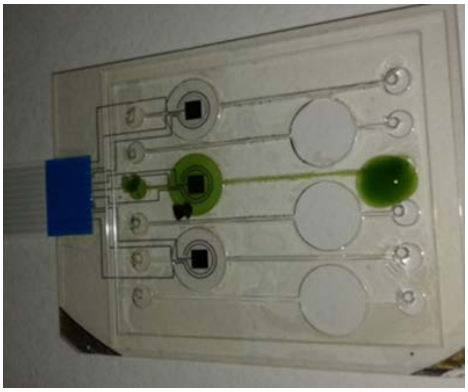

Figure 1: LOC platform with algae solution

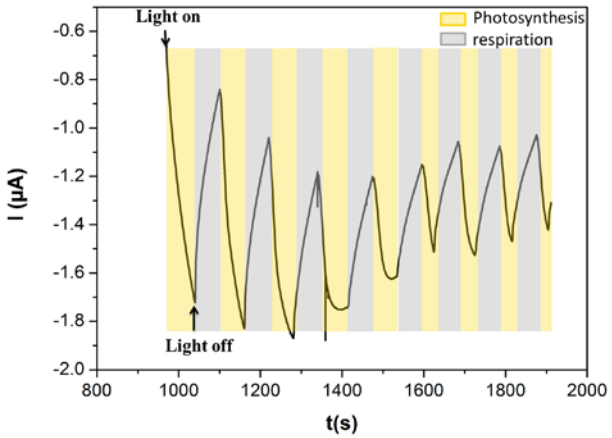

Figure 2: Algal photosynthesis and respiration monotoring

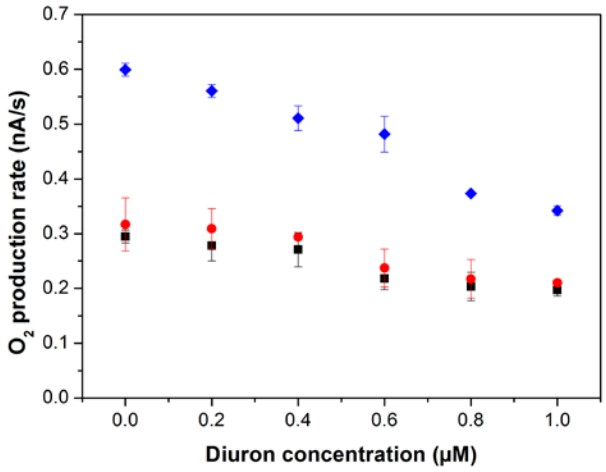

Figure 3: Diuron detection thanks to the LOC platform