

A sensor to monitor the growth of bacterial biofilms

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Abstract

Health care systems in Western countries are requiring increasing resources and this creates concerns about sustainability of a universal health care. The present pandemic once again highlights an unmet need for technologies providing prompt measurements of physical, chemical and biological parameters. In this view, sensors and wearable sensors are expected to be the core of point of care devices and telemedicine systems that will play a key role in the near future.

Here, we describe the use of a potentiometric sensor based on functionalized reduced graphene oxide for monitoring the formation and growth of biofilms from three bacterial species (*Escherichia coli*, *Pseudomonas aeruginosa* and *Staphylococcus aureus*) in liquid and semisolid culture media [1]. The Open Circuit Potential (OCP) between an Ag/AgCl pseudo reference electrode and a working electrode, both screen-printed on a flexible polyethylene terephthalate film, was measured during the growth of biofilm-forming bacteria. The OCP decreased over time as bacteria grew on the sensor surface, exhibiting a negative correlation between the optical density of the liquid broth and number of bacteria. Since we have used a similar device in previous studies for the monitoring of pH in chronic wounds [2], the possible application of this technology and its limitations for this specific purpose will also be discussed.

References

- [1] N. Poma, F. Vivaldi, A. Bonini, A. Kirchhain, P. Salvo, B. Melai, D. Bottai, A. Tavanti and F. Di Francesco, A graphenic and potentiometric sensor for monitoring the growth of bacterial biofilms, submitted to Sensors & Actuators B
- [2] P. Salvo, N. Calisi, B. Melai, C. Paoletti, T. Lomonaco, R. Fuoco, A. Paolicchi, B. Cortigiani, M. Mannini, A. Caneschi, V. Dini, M. Romanelli, F. Di Francesco, Temperature and pH sensors based on graphenic materials, Biosensors & Bioelectronics 91 (2017) 870-877. DOI: 10.1016/j.bios.2017.01.062.

Figure

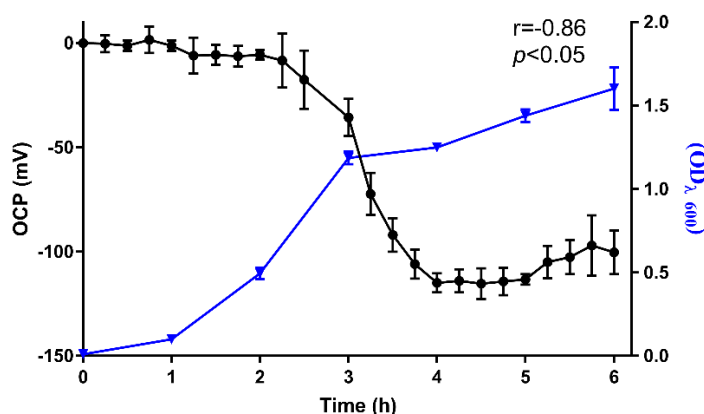


Figure 1. OCP and optical density values during bacterial growth in Luria Bertani liquid culture for *E. coli* ATCC 25922.