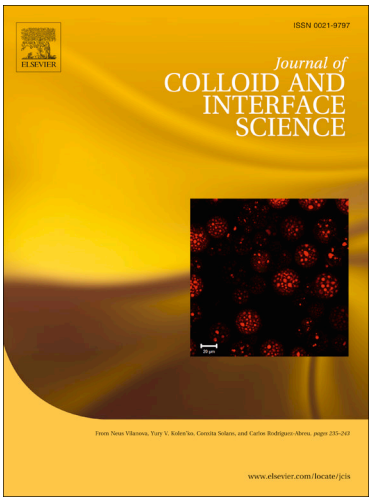
Accepted Manuscript



Regular Article

Bioelectrochromic hydrogel for fast antibiotic-susceptibility testing

Ferran Pujol-Vila, Jiri Dietvorst, Laura Gall-Mas, María Díaz-González, Núria Vigués, Jordi Mas, Xavier Muñoz-Berbel

PII: S0021-9797(17)31029-9
DOI: http://dx.doi.org/10.1016/j.jcis.2017.09.004
Reference: YJCIS 22755

To appear in: *Journal of Colloid and Interface Science*

Received Date: 17 July 2017
Revised Date: 1 September 2017
Accepted Date: 1 September 2017

Please cite this article as: F. Pujol-Vila, J. Dietvorst, L. Gall-Mas, M. Díaz-González, N. Vigués, J. Mas, X. Muñoz-Berbel, Bioelectrochromic hydrogel for fast antibiotic-susceptibility testing, *Journal of Colloid and Interface Science* (2017), doi: http://dx.doi.org/10.1016/j.jcis.2017.09.004

Bioelectrochromic hydrogel for fast antibiotic-susceptibility testing

Ferran Pujol-Vila[a]*, Jiri Dietvorst[b], Laura Gall-Mas[a], María Díaz-González[b], Núria Vigués[a], Jordi Mas[a], Xavier Muñoz-Berbel[b]

[a] Department of Genetics and Microbiology, Universitat Autònoma de Barcelona (UAB), Bellaterra, Barcelona, Spain
[b] Centre Nacional de Microelectrònica (IMB-CNM, CSIC), Bellaterra, Barcelona, Spain

Keywords: antibiotic-resistance determination, bioelectrochromic iron (III)/alginate hydrogel, electrodepositable material, Prussian Blue formation, metabolic chromatic response.

Materials science offers new perspectives in the clinical analysis of antimicrobial sensitivity. However, a biomaterial with the capacity to respond to living bacteria has not been developed to date. We present an electrochromic iron(III)-complexed alginate hydrogel sensitive to bacterial metabolism, here applied to fast antibiotic-susceptibility determination. Bacteria under evaluation are entrapped –and pre-concentrated- in the hydrogel matrix by oxidation of iron (II) ions to iron (III) and in situ formation of the alginate hydrogel in less than 2 minutes and in soft experimental conditions (i.e. room temperature, pH 7, aqueous solution). After incubation with the antibiotic (10 minutes), ferricyanide is added to the biomaterial. Bacteria resistant to the antibiotic dose remain alive and reduce ferricyanide to ferrocyanide, which reacts with the iron (III) ions in the hydrogel to produce Prussian Blue molecules. For a bacterial concentration above 10^7 colony forming units per mL colour development is detectable with the bare eye in less than 20 min. The simplicity, sensitivity, low-cost and short response time of the biomaterial and the assay envisages a high impact of these approaches on sensitive sectors such as public health system, food and beverage industries or environmental monitoring.