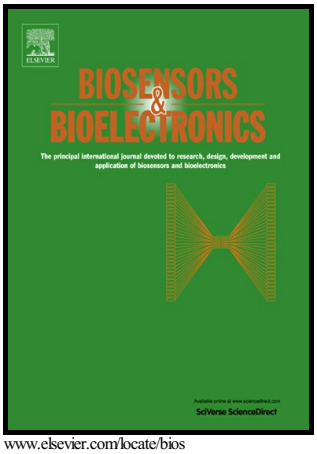

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Interferometric nanoimmunosensor for label-free and real-time monitoring of Irgarol 1051 in seawater

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Abstract

An interferometric nanobiosensor for the specific and label-free detection of the pollutant Irgarol 1051 directly in seawater has been settled. Due to the low molecular weight of Irgarol pollutant and its expected low concentration in seawater, the sensor is based on a competitive inhibition immunoassay. Parameters as surface biofunctionalization, concentration of the selective antibody and regeneration conditions have been carefully evaluated. The optimized immunosensor shows a limit of detection of only 3 ng/L, well below the 16 ng/L set by the EU as the maximum allowable concentration in seawater. It can properly operate during 30 assay-regeneration cycles using the same sensor biosurface and with a time-to-result of only 20 min for each cycle. Moreover, the interferometric nanosensor is able to directly detect low concentrations of Irgarol 1051 in seawater without requiring sample pre-treatments and without showing any background signal due to sea matrix effect.

Keywords

Bimodal waveguide biosensor; competitive immunoassay; Environmental monitoring; Irgarol 1051;

1. Introduction

Every year large quantities of waste and pollutants are dumped in the oceans, derived mainly from anthropogenic activities related to industrial, tourism and urban activities (Albaladejo et al., 2010). The discharges of these contaminants together with the intensive exploitation of the marine resources have caused the continuous degradation of our oceans. Most of the harmful contaminants are present in extremely low concentrations and, therefore, their monitoring is a crucial step towards sustainability of the ocean water quality and the use of the marine ecosystems (Bakker, 2012).

Conventional analytical methodologies are very sensitive and selective tools to control the sea quality but they only operate at laboratory settings, with the associate problems of samples transportation without degradation. Bringing the monitoring tools directly to the contaminated resource can result in cost and time savings, allowing tracing water pollutants evolution in real time and dramatically reducing the response time in case of pollution peaks episodes. Analytical tools which are portable, robust, low-cost and highly reliable are highly demanded. Biosensors emerged some years ago as devices capable to carry out fast,