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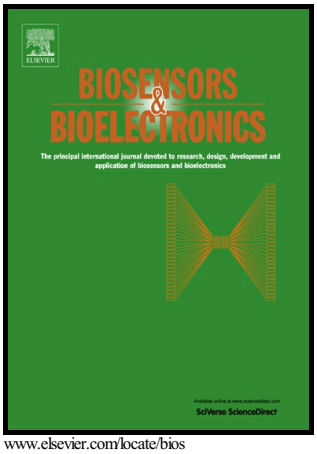

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Hybrid Molecularly Imprinted Polymer for Amoxicillin Detection

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Abstract

The potential adverse effects of the environmental presence of antibiotics on the ecosystem demands the development of new methods suitable for accurate detection of these micropollutants in various aquatic media. An analytical method exploiting the synergistic effect of a label-free sensing platform combined with a molecularly imprinted polymer (MIP) as robust recognition element could represent an efficient tool for the real-time monitoring of antibiotics. In this work, a hybrid organic-inorganic MIP film (AMO-MIP) selective towards amoxicillin (AMO) was synthesized and integrated with a surface plasmon resonance (SPR) sensor. The film was prepared by sol-gel using methacrylamide (MAAM) as organic functional monomer, tetraethoxysilane (TEOS) as inorganic precursor, and vinyltrimethoxysilane (VTMOS) as coupling agent. The AMO-MIP film characterized with the SPR system demonstrated about 16 times higher binding capacity to AMO than corresponding reference non-imprinted polymer (NIP). AMO-MIP-modified SPR sensors could detect AMO with LoD down to 73 pM and discriminate AMO among structurally similar molecules both in buffer and in tap water. Good reproducibility was achieved for several rebinding-regeneration cycles. The sensor could be stored at room temperature for up to 6 months without losing stability.

Keywords: Molecularly imprinted polymer; hybrid MIP; antibiotics; amoxicillin detection; SPR; environmental sensor.

1. Introduction

The increasing number of organic pollutants escaping into our surroundings gives rise to a growing global concern for environmental pollution. A large portion of these pollutants end up in water bodies, hence constituting a major potential threat to public health since water bodies usually serve as natural sources for the supply of potable water. Antibiotics represent a large group of pharmaceuticals being largely released into the water bodies due to their wide usage and possibility of escape from sewage treatment facilities (Xu et al. 2015). A growing concern with antibiotic pollution is the development and spread of virulent strains of bacterial that are resistant to antibiotics. Therefore, the monitoring and detection of these compounds in water deserves unrelenting research attention (Fair and Tor 2014). Existing detection techniques include mass spectrometry, chromatography or their combination. Biosensors are also emerging analytical techniques tailored towards environmental monitoring (Upadhyay and Verma 2015). Although these techniques have demonstrated beneficial importance, they suffer from limitations mainly relating to complex sample preparation and short-term stability (Nikolelis et al. 2013).