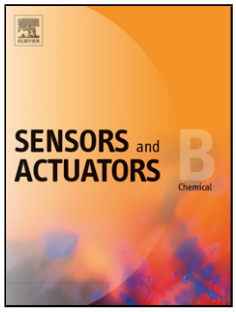

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Molecularly imprinted poly(meta-phenylenediamine) based QCM sensor for detecting Amoxicillin

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Highlights

- Molecularly imprinted poly(meta-phenylenediamine) film designed to recognize amoxicillin was synthesized electrochemically.
- The film modified QCM sensor could detect amoxicillin with LOD of 0.2 nM and discriminate between the antibiotics of different classes.
- The study demonstrates promise towards the fabrication of MIP-based sensor for environmental monitoring.

Abstract

A chemical sensor based on molecularly imprinted polymer (MIP) and quartz crystal microbalance (QCM) to detect amoxicillin (AMO) antibiotics in aqueous samples was developed. The thin film of AMO-MIP was generated electrochemically from meta-phenylenediamine (mPD) directly on the QCM transducer. Pre-polymerization complex formation between the template (AMO) and the monomer molecules (mPD) was confirmed by a combination of computational modeling and spectroscopic studies. The electrodeposition process was carefully studied to allow for the selection of the optimal parameters for stable AMO-MIP film deposition. The AMO-MIP QCM sensor showed a significantly better sensitivity and affinity than the reference film displaying more than seven times relative adsorption capacity and a limit of detection down to 0.2 nM. Likewise, the sensor demonstrates good selectivity to the target analyte (AMO) than the other non-templated molecules and remain sensitive to the target even after a prior exposure to other interferents that may be present within the same environment. This remarkable result in the analysis of amoxicillin on QCM sensor without employing any signal amplification methodology demonstrates an important step towards the fabrication of MIP-based environmental sensor.

Keywords: Molecularly Imprinted Polymers; antibiotic; amoxicillin; QCM; sensor; electrochemical polymerization

1. Introduction

The environmental impacts of antibiotics pollution cannot be over-emphasized due to their potential of increasing bacterial resistance [1, 2]. Their urgent detection, especially in aqueous environment and food has therefore continued to attract enormous research interests. As a result, analytical devices which combine the selectivity of biological systems with the chemical stability of chemical systems are increasingly becoming a focus of attention in environmental and clinical research [3]. Molecularly imprinted polymers (MIPs)