

Electrochemical Aptasensor with Layer-by-layer Deposited Polyaniline for Aflatoxin M1 Voltammetric Determination

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Abstract

© 2019 Wiley-VCH Verlag GmbH & Co. KGaA, Weinheim Mycotoxins are highly toxic metabolites of some fungi that frequently contaminate water, food and feed and hence cause several human and animal diseases. In this work, a new approach to the fast and reliable determination of aflatoxin M1 (AFM1) in water and milk has been proposed with reagent free protocol of signal measurement. For this purpose, DNA aptamer selective to AFM1 was entrapped between two thin layers of polyaniline (PANI) electrodeposited on glassy carbon electrode. The incubation of the aptasensor in the AFM1 solution results in remarkable decrease of the PANI intrinsic activity monitored by direct current voltammetry or electrochemical impedance spectroscopy. Appropriate calibration curves were linear in the range from 3 to 90 ng/L with limit of detection (LOD) 1-5 ng/L depending on the measurement mode. Mechanism of signal generation involves shielding electrostatic interactions between the PANI and aptamer in the surface layer and variation of its redox activity attributed to the emeraldine form of PANI. Selectivity of the response was proved by similar experiments with aflatoxin B1 and ochratoxin A and by comparison of the results with those obtained with non-specific aptamer in the sensing layer. Simple protocol for milk pretreatment has been proposed for reliable detection of AFM1 on the level of its threshold limited values (20 ng/L).

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Keywords

Aflatoxin M1, DNA aptamer, Electrochemical impedance spectroscopy, Electropolymerization, Polyaniline

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