An electrochemical competitive biosensor for fumonisin B1 (FB1) based on a DNA biotinylated aptamer

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Fumonisin B1 (FB1) is one of the most important mycotoxin contaminants of foods, particularly cereals and cereal products, with strict low regulatory levels (of mg/l) in many countries worldwide. An electrochemical competitive aptamer-based biosensor for FB1 is described.

The determination of FB1 is essential to minimize the consumption of contaminated foods. Many of the analytical methods for FB1 in foodstuffs have been validated in collaborative studies of the AOAC. These usually use liquid extraction, solid-phase extraction or immunoaffinity columns for the extraction and cleanup of the sample, and high-performance liquid chromatography with fluorescence detection (HPLC–FLD) for determination, obtaining limits of detection below 0.1g kg^{-1}. However, HPLC–FLD methods require sophisticated instrumentation and expertise.

Selected aptamers for FB1 were recently described for the first time [1], following characterization by fluorescence polarization and equilibrium dialysis, and were demonstrated to be useful for the determination of FB1 in wheat. The binding affinities of the selected FB1 aptamer, determined by equilibrium dialysis, are in the nanomolar range, comparable to or below the binding constants of antibodies to FB1, and they are very selective to FB1 target molecule, for which they can be used as useful biorecognition elements in biosensors for this mycotoxin.

Paramagnetic microparticle beads (MBs) modified with streptavidin were functionalized with an aptamer specific to FB1 and they were allowed to compete with a solution of the mycotoxin.

Voltammetric measurements were carried out, connected to three electrode screen-printed carbon electrodes (SPCEs). After separation and washing steps, the modified MBs were localized on disposable screen-printed carbon electrodes (SPCEs) under a magnetic field, and the product of the enzymatic reaction with the substrate was detected with differential-pulse voltammetry (DPV).

[1] Maureen McKeague, Charlotte R. Bradley, Annalisa De Girolamo, Angelo Visconti , J. David Miller and Maria C. DeRosa, Int. J. Mol. Sci, **11**, (2010), 4864-4881.

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