DEVELOPMENT OF AN ELECTROCHEMICAL SENSOR BASED ON SCREEN-PRINTED ELECTRODES FOR OCHRATOXIN A IN PORK MEAT SAMPLES

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Ochratoxin A (OTA) is a nephrotoxic, immunosuppressive and teratogenic mycotoxin produced by Aspergillus and Penicillium spp. fungi during food storage. OTA can be detected in cereal products, coffee, wine, beer, cheese and in poultry and pork meat. Many detection techniques, such as liquid chromatography coupled with immunoaffinity column or solid phase extraction cleanup, have been used for OTA determination in different samples (1). In recent years electrochemical techniques have been used for the rapid and accurate detection of OTA (2). The aim of the present study was to develop a new analytical method for OTA quantitative detection in pork meat based on electrochemical sensing, using graphite-based screen-printed electrodes and differential pulse voltammetry (DPV) as detection technique.

Experiments were performed with an electrochemical transducer Palmsens, monitored with a personal computer using PSTrace software (Palm Instrument BV, Houten, The Netherlands) for data acquisition and subsequent analysis. The electrochemical assays were performed with miniaturized disposable graphite based screen-printed electrodes (EcoBioServices & Researches s.r.l., Florence, Italy). The effect of pH (range 2-7) and of ionic strength (KCl concentration range 10-200 mM) of the supporting electrolyte solution (acetate buffer) on the DPV peak current and potentials was investigated to optimize the DPV method. The effect of the DPV parameters on OTA oxidation peak was studied. Potential pulse amplitude (Epulse) was evaluated in the range of 10-100 mV. Step height was evaluated in the range of 2-10 mV. The influence of the scan rate was examined in the range of 0.005-0.1V/s. Standard addition method was applied for quantitative analysis. The method was applied for OTA determination in spiked pork meat samples. Results were compared with those provided by a reference HPLC method.

The OTA peak current increased with increasing acetate buffer pH (from 2.0 to 7), thus pH of 7.0 for the supporting electrolyte solution was chosen. Concentrations of 75 mM KCl in the supporting electrolyte was selected. The optimization of DPV parameters indicated that best results for voltammograms were obtained from 0 to 1.1 V by using 5 mV potential step, 50 mV potential pulse, 0.01 V/sec scan rate and 0.07 sec time pulse; each scan was performed after an equilibrium time of 30 sec. Calibration graphs of peak height against concentration for OTA by DPV were plotted over the range 25-1000 μg/l in the supporting electrolyte with a LOQ of 25 μg/l. The findings obtained with voltammetric-based sensing were in good agreement with results obtained by HPLC analysis but matrix effects have been detected at lower OTA concentrations indicating the need of more selective extraction procedure. The proposed method is more rapid and inexpensive in comparison with the classical methods for OTA analysis, and can be considered a promising alternative for the evaluation of OTA in meat.

1) Turner et al, Anal Chim Acta, 2009, 632 ,168-180. 2) Prieto-Simón et al, TrAC, 2007, 26, 689-702.