Electronic supplementary information

Assembly of the external actuator

An electrical cylinder "SMC LEY16DB-50BU" with dedicated controller "SMC LECP1-LEY16DB" is operated by a Siemens LOGO! programmable Logic Controller (PLC). The system contains the LOGO! 0BA6 basic device, the LOGO! Dm8 digital expansion module, the LOGO! TD Display including controls and the LOGO! Power 24 power supply. The PLC is programmed using the development environment "LOGO!Soft Comfort V7.0".

Electrochemical measurement procedure

The chambers of the reagent module were pre-filled with buffer, substrate ATCh, and the regeneration reagent 2-PAM (700 µl each). If applicable, 700 µl of the pesticide CPO in buffer or in homogenized apple sample were inserted into the sample chamber. The biosensor was plugged into the multipole connector attached to cylinder 2 and the cartridge was assembled as shown in figure 2. The external potentiostat (EmStat2, Palmsens, Netherlands) was used for amperometric measurements applying a potential of 300 mV. All experiments were carried out at room temperature. Initially, all sensors were equilibrated in buffer for 60 minutes. Before incubation in a reagent cavity, the sensor was dipped into the fluid 5 times by a medium actuation of the cartridge (no switching) to improve contact of the new reagent with the electrodes. Usually, one sensor was used for several consecutive experiments, taking into account some signal reduction over time.

For measurement of current peaks, the sensors were then incubated for 3 minutes (Fig. 4: 1 min) in ATCh with subsequent washing in buffer for 2 minutes. After 10 minutes of sensor incubation in sample, four washing steps of 5 minutes in buffer were performed. To reveal the influence of the sample matrix on the measurements, the same protocol was applied to homogenized apple samples without pesticide. If applicable, regeneration of the sensor was performed for 10 minutes in 2-PAM with two subsequent washing steps of 2 minutes and 5 minutes, respectively.

Data analysis

Each experiment was performed with at least three independent sensors. Data were plotted using Origin 9. Error bars or errors mentioned in the text represent standard deviations. If applicable, propagated errors were calculated using the Gaussian error propagation formula.