Biosensors for food safety applications

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Abstract

Foodborne diseases, caused by foods contaminated by pathogens, can have relevant socioeconomic impacts. In 2022 *Listeria monocytogenes* showed an increase in the number of reported cases, and *Campylobacter* spp. is cause of the most reported zoonoses (127,840 cases), thus it is important to develop rapid, sensitive and specific methods for their finding in foods.

Various approaches for the detection of pathogens in food have been studied, but they often require long time (classical plate count based methods) and trained personnel (molecular methods). Innovations in nanotechnology has allowed the development of new strategies in the field of biosensors using DNA probes bioreceptors.

An organic electrochemical transistor (OECT) has been utilized for the detection of *L. monocytogenes* in samples of smoked salmon, fresh ham, and cured ham, while for the detection of *Campylobacter* spp. (*C. jejuni*, *C. coli*, *C. lari,* and *C. upsaliensis*) in poultry meat samples an electrochemical biosensor based on the utilization of screen-printed electrodes was proposed. *Listeria* Precis™ *method* for *L. monocytogenes* and standard ISO 10272:2017 for *Campylobacter* spp. were used as control methods. Data from the *Listeria* Precis™ method corresponded to results from our textile OECT biosensor. The DNA probe specific for *L. monocytogenes* reached the limit of detection 1.05 ng/µL (corresponding to 0.56 pM of *L. monocytogenes* also in the presence of other contaminating bacteria. The genomic DNA of *Campylobacter jejuni* diluted at 1000 pg/µL,100 pg/µL, 10 pg/µL, and 1 pg/µL was used as target for the CampyP3 probe (patent SIB BI803/RVP/rmc Italy 102020000012496). The Limit of Detection (LOD) corresponded to a DNA concentration of of 2 pg/µL.

The proposed biosensors showed high specificity and good sensitivity, moreover the results performed with the biosensors were confirmed with the standard methods used as controls suggesting the possibility to use bio0sensors for food analyses.