ELECTROCHEMICAL BIOSENSING IN FOOD FOR PATHOGENIC BACTERIA BASED ON NANOSTRUCTURED TRANSDUCERS

***Susana Liébana,* Anabel Lermo, Salvador Alegret, Isabel Pividori**
Grup de Sensors & Biosensors, Unitat de Química Analítica, Universitat Autònoma de Barcelona Edifici Cn. Campus UAB, 08193, Bellaterra, Barcelona, SPAIN
Susana.Liebana@uab.cat

The control of food quality has become of growing interest for both consumer and food industry since the increasing incidence of food poisoning is a significant public health concern for customers worldwide [1]. While additives were at one time a major concern, nowadays microbiological issues are the greatest. Among food pathogens, *Salmonella enteritidis* has been the source –in the last decade– of many outbreaks, while *Salmonella typhimurium* and other antibiotic-resistant salmonellae have also recently become a concern [2].

Many factors have contributed to recent food emergencies, such as the increasingly complexity of the food production chain because of mass production. Food regulatory agencies have thus established control programs in order to avoid food pathogens from entering the food supply. One of the most effective ways for the food sector to protect public health is to base their food management programs on Hazard Analysis and Critical Control Point (HACCP). Biosensing devices can be considered as ideal tools to be implemented in HACCP programs, for being used as an 'alarm' to rapidly detect the risk of contamination by food pathogens in a rapid, inexpensive and sensitive manner and in a wide variety of food matrixes [3,4]. An ideal biosensing device for the rapid detection of microorganisms should be fully automated, inexpensive and routinely used both 'in field' and the laboratory.

Electrochemically based transduction devices are robust, user-friendly, portable, sensitive, and cost-effective analytical systems which can operate in turbid media such as food matrixes. Electrochemical biosensors devices thus, offer considerable promise to obtain the risk of contamination by food pathogens in a faster, simpler and cheaper manner compared to traditional methods.

Rigid conducting composites represent a simple method for the immobilization of nanostructure materials for biosensing proposes, ranged from high molecular weight biological molecules, metal nanoparticles, or carbon nanotubes.

Carbon composites result from the combination of carbon with one or more dissimilar materials. Each individual component maintains its original characteristics while giving the composite distinctive chemical, mechanical and physical properties. The capability of integrating various materials (such as metal nanoparticles as well as CNT), is one of their main advantages. Some components incorporated within the composite result in enhanced sensitivity, such as bamboo-structured CNT. The best composite compounds to be used as electrochemical transducer for biosensors will give the resulting material improved chemical, physical and mechanical properties. As such, it is possible to choose between different binders and polymeric matrices in order to obtain a better signal-to-noise ratio, a lower nonspecific adsorption, and improved electrochemical properties (electron transfer rate and electrocatalytic behavior). These materials can just be prepared through 'dry chemistry' using procedures that can be easily transferred to mass fabrication of thick film devices.

The development of magnetic beads based separations has also brought unique opportunities for biological detection strategies. DNA, cells, antibodies, and enzymes, can be selectively bound to the magnetic beads and then separated from its matrix by using a magnetic field.

Magnetic beads have been recently used in new strategies for electrochemical biosensing [5,6].

In this work, a novel strategy for electrochemical biosensing of food pathogenic bacteria using nanostructured electrochemical magneto electrode is reported.

In this approach, the bacteria are attached to magnetic nanoestructured beads by immunological reaction with specific antibody for *Salmonella*. Further reaction with a second enzyme-conjugated antibody is performed. The magnetic nanobeads are then attached to improved nanostructured magnetic transducer for the electrochemical detection, based on bamboo structured CNT.

The features of this new approach are compared with classical cultured methods as well as PCR strategies and other electrochemical detection methods based on classical micro-sized magnetic beads and conventional non-nanostructured transducers.

References:

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