CIHEAM

Mediterranean Agronomic Institute of Zaragoza

Advanced Course

USE OF BIOSENSORS FOR FOOD SAFETY AND QUALITY

Zaragoza (Spain), 16-20 January 2017

1. Objective of the course

Quality and safety of food products is a major concern of consumers and thus is one of the main challenges for a producer. Foodstuff comprises a great diversity of different products, each of which may have different hazards affecting its quality and safety. Biosensors play a crucial role in food control and analysis, providing relevant information on food-borne pathogens and contaminants and facilitating quality assessment. They also provide instrumental control necessary to comply with food European regulations.

As compared with classical analytical methods, biosensors need smaller sample volumes, can be used for in-site on-line control and offer fast results allowing almost real-time decisions. Although most people can see the benefits of using the information provided by biosensors, this technology has not yet moved into the mainstream food processing industry. A better knowledge on the possibilities of these sensors and on their complementarity to other traditional analytical methods to achieve faster and more accurate results can enhance their adoption.

This course provides comprehensive information about modern biosensors, their parameters, possibilities and limitations, along with the emerging technologies of their fabrication. The programme shows a wide range of possible applications developed for food safety and quality control.

At the end of the course participants will have gained:

- An overview of the role played by biosensors in food analysis.
- Knowledge of the large range of different biosensors and their possibilities and limitations.
- Better understanding of biosensor principles and technical implement requirements.
- Criteria to choose the appropriate technology and strategy for monitoring safety and quality parameters under different conditions.
- An overview of emerging sensor technologies and future advances.

2. Organization

The course will take place at the **Mediterranean Agronomic Institute of Zaragoza (IAMZ)** of the **International Centre for Advanced Mediterranean Agronomic Studies (CIHEAM)**, and will be given by well qualified lecturers from research centres, universities and private companies in different countries.

The course will be held over a period of 1 week, from 16 to 20 January 2017, in morning and afternoon sessions.

3. Admission

The course is designed for 25 participants with a university degree and is aimed at professionals from the industry and public institutions involved in food safety and quality, such as decision makers, food and food-risk managers, competent authorities for food inspection, technical advisors and experts from R&D institutions. The course is also open to sensor experts interested in applications in the food sector.

Given the diverse nationalities of the lecturers, knowledge of English, French or Spanish will be valued in the selection of candidates, since they will be the working languages of the course. IAMZ will provide simultaneous interpretation of the lectures in these three languages.

4. Registration

Application forms may be obtained from:

Instituto Agronómico Mediterráneo de Zaragoza
Avenida de Montañana 1005, 50059 Zaragoza (Spain)
Tel.: +34 976 716000 - Fax: +34 976 716001
e-mail: iamz@iamz.ciheam.org
Web: www.iamz.ciheam.org

Candidates should send the completed application form to the above address, accompanied by a detailed *curriculum vitae*, stating degree, diplomas, experience, professional activities, language knowledge and reasons for applying to the course. Copies of certificates should be enclosed with the application.

The deadline for the submission of applications is **21 November 2016.**

Applications from those candidates who cannot present their complete records when applying, or those requiring authorization to attend the course, may be accepted provisionally.

Registration fees for the course amount to 500 euro. This sum covers tuition fees only.

5. Scholarships

Candidates from CIHEAM member countries (Albania, Algeria, Egypt, France, Greece, Italy, Lebanon, Malta, Morocco, Portugal, Spain, Tunisia and Turkey) may apply for scholarships covering registration fees, and for scholarships covering the cost of travel and full board accommodation in the Hall of Residence on the Aula Dei Campus.

Candidates from other countries who require financial support should apply directly to other national or international institutions.

Please display on a notice board if possible

Instituto Agronómico Mediterráneo de Zaragoza
Avenida de Montañana 1005, 50059 Zaragoza, Spain
Tel.: +34 976 716000, Fax: +34 976 716001
E-mail: iamz@iamz.ciheam.org

CIHEAM

See updated information at

www.iamz.ciheam.org

INFORMATION CONTINUES OVERLEAF

6. Insurance

It is compulsory for participants to have medical insurance valid for Spain. Proof of insurance cover must be given at the beginning of the course. Those who so wish may participate in a collective insurance policy taken out by the IAMZ upon payment of the stipulated sum.

7. Teaching organization

The course requires personal work and interaction among participants and with lecturers. The international characteristics of the course favour the exchange of experiences and points of view. The programme has an applied approach. Lectures are complemented by examples of current biosensor applications and a final round table discussion.

8. Programme

1. **Introduction (1 hour)**
   - 1.1. Food quality and safety control
   - 1.2. Regulatory issues
2. **Biosensors: general overview (2 hours)**
   - 2.1. Biosensors and sensor systems in food analysis
   - 2.2. Comparison with other analytical methods
   - 2.3. Transducers
   - 2.4. Bioreceptors
     - 2.4.1. Biomolecules: DNA/RNA, proteins, enzymes, antibodies, cells, phages
     - 2.4.2. Biological derived materials: aptamers and recombinant antibodies
     - 2.4.3. Biomimic: molecular imprinted polymers
   - 2.5. Labelled and label-free analysis
   - 2.6. Importance of sampling and sample preparation
3. **Electrochemical biosensors (5 hours)**
   - 3.1. Amperometric
     - 3.1.1. Characteristics and functioning. Advantages and limits
     - 3.1.2. Direct and indirect measurements
     - 3.1.3. Molecular imprinted polymer sensors for ochratoxin in beer and wine
     - 3.1.4. Immunosensors for peanut allergens
   - 3.2. Potentiometric
     - 3.2.1. Characteristics and functioning. Advantages and limits
     - 3.2.2. Types of ion sensors (ISE, ISFETs, solid-state electrodes, sensor arrays)
     - 3.2.3. Examples of ion analysis in food
     - 3.2.4. Potentiometric enzymatic sensors
       - 3.2.4.1. Sucrose, glucose and urea determination
       - 3.2.4.2. Determination of pesticides in food
   - 3.3. Impedimetric
     - 3.3.1. Characteristics and functioning. Advantages and limits
     - 3.3.2. Modification of sensors with DNA, aptamers and antibodies. Label-free biosensing
     - 3.3.3. Impedimetric sensors for bacteria detection
       - 3.3.3.1. Analysis *of Listeria innocua, E. coli* O157:H7, *Salmonella typhimurium* and *Staphylococcus aureus* in food samples
       - 3.3.3.2. Determination of *E. coli* in milk
4. **Optical biosensors (4 hours)**
   - 4.1. Optical fibre and planar waveguide biosensors
     - 4.1.1. Characteristics and functioning. Advantages and limits
     - 4.1.2. Examples of application in food analysis
   - 4.2. Surface plasmon resonance (SPR)
     - 4.2.1. Characteristics and functioning. Advantages and limits
     - 4.2.2. Examples of application in food analysis
5. **Mass-based biosensors**
   - 5.1. Quartz crystal microbalance (QCM) and Surface acoustic wave (SAW)
   - 5.2. Characteristics and functioning. Advantages and limits
   - 5.3. Detection of pesticides in food and water
6. **Electronic tongues and noses**
   - 6.1. Basic principles of artificial sensory systems
   - 6.2. Measuring platforms for multisensor systems
   - 6.3. Chemometric data processing
   - 6.4. Examples of application in food analysis
     - 6.4.1. Analysis of wines, beers, fruits and vegetables
     - 6.4.2. Fish and meat analysis
     - 6.4.3. Differentiation of foods of various origins
     - 6.4.4. Process control – monitoring of fermentation
7. **Biosensors for product control in packaging and storage (2 hours)**
8. **Microelectromechanical systems (MEM) (4 hours)**
   - 8.1. Miniaturization of sensing
   - 8.2. Microfluidics and lab-on-a-chip
   - 8.3. Biofilm monitoring
   - 8.4. Rapid methods for pathogen detection
   - 8.5. Cost-effective methods
9. **Nanotechnologies in biosensing (3 hours)**
   - 9.1. Nanofabrication technologies and nanomaterials for biosensors
   - 9.2. Advantages and limits
   - 9.3. Examples of application in food analysis
10. **From research to development: case studies (1 hour)**
    - 10.1. IK4CIDETEC: a technology centre generating and transferring biosensor technology to the industry
    - 10.2. Biolan: a biotechnological company for the development and marketing of food biosensors
11. **Round table discussion – Research applications and their implementation at industrial level: perspectives and challenges (2 hours)**

GUEST LECTURERS

A. ALFONSO, Univ. Santiago de Compostela, Lugo (Spain)
L. AÑORGA, IK4CIDETEC, San Sebastián (Spain)
A. ARNAU, Univ. Politécnica de Valencia (Spain)
A. BRATOV, CSIC, Instituto de Microelectrónica de Barcelona (Spain)
K. CAMPBELL, Queen's Univ. Belfast (UK)
C. DELERUE-MATOS, Instituto Superior de Engenharia do Porto (Portugal)
A. JAUREGUIBEITIA, Biolan, Zamudio (Spain)
D. KIRSANOV, Saint Petersburg State Univ. (Russia)
M.C. MORENO-BONDI, Univ. Complutense de Madrid (Spain)
F.X. MUÑOZ PASCUAL, CSIC, Instituto de Microelectrónica de Barcelona (Spain)
C. NERIN, Univ. Zaragoza (Spain)
V. SANCHIS, Agrotecnio Center, Univ. Lleida (Spain)

CIHEAM
International Centre for Advanced Mediterranean Agronomic Studies
Mediterranean Agronomic Institute of Zaragoza