

# CARBADETECT

Financing source: UEFISCDI;

Project code: PN-II-PT-PCCA-2013-4-0128 No: 147 / 2014;

Project manager: Ph.D. eng. Gabriela Hristea;

## **Main contractor: INCDIE ICPE CA:**

**Phase 1** – term: december 2014; budget phase 1 - 58.000 lei;

**Phase 2** – term: december 2015; budget phase 2 - 835.720 lei;

**Phase 3** – term: june 2016; budget phase 3 - 356.280 lei.

## **Abstract:**

### **IMMUNOBIOSENSORS FOR RAPID DETECTION OF SOME CARBAMATE PESTICIDE RESIDUES (CARBARYL, CARBENDAZIM) IN HORTICULTURAL PRODUCTS**

Pesticides play a major role in improving agricultural production through control of pest populations such as insects, weeds, and plant diseases. The toxicological properties of pesticides that allow them the ability to control pests also provide potential risks to humans, to the environment, and to non-target organisms that might be inadvertently exposed to pesticides. Despite their merits, pesticides are considered to be some of the most dangerous environmental contaminants because of their ability to accumulate and their long-term effects on living organisms.

The concern about the presence of pesticide residues in water, soil, and food has prompted the search for alternative methods able to detect low levels of these compounds in a simple way. Biosensors offer great advantages over conventional analytical techniques, including high specificity for real-time analysis in complex mixtures, high sensitivity, simple operation without the need for extensive sample pre-treatment, and low cost. Immunobiosensors which can provide concentration-dependent signals, appear to be appropriate for identification of a single pesticide or, in some cases, small groups of similar pesticides in environmental monitoring, as they are rapid, specific, sensitive and cost-effective analytical devices.

The major challenge for immunobiosensors is the development of appropriate antibodies with desired specificity and high binding ability, as these critical biological reagents are usually requiring bio-medical labs with experience in immunoassays research and development. In most cases, antibody affinity and specificity are the limiting factors of these assays. In this context, biosensing based on nanomaterials is one of the hottest topics in nanotechnology and nanoscience. Thus, in agreement with the 5.1.10 priority theme call, through this project is intended to develop and validate high affinity antibodies against carbaryl and carbendazim / related molecules (carbaryl and carbendazim are among the most frequently detected pesticide residues in food analyses worldwide), synthesize nanoparticles/nanomaterials for biosensing application, and then to combine these compounds in order to set up at least one highly sensitive and reliable immunobiosensor for rapid detection of such compounds in horticultural products (e.g. fresh and dried fruits and vegetables, horticultural processed products, wine and other beverages).

This project will exploit the unique properties of nanomaterials (carbon based and magnetic) which could offer excellent platforms as electronic and optical signal transduction to design a new

generation of biosensing devices. The research result of this project will allow to industrial partner to tackle other markets, inside and outside Romania. The end-product of this project will come under international/national economical and food safety regulation providing compact analytical devices designed for biomolecular recognition. The introduction of sensitive, easy-to-use, and fast immunodetection tools and reagents for potential harmful pesticides detection in horticultural products will really enrich the available tools for monitoring food pollutants, improve the efficiency of the early warning systems related to the quality of food and feed, and leading to an evident positive impact on the quality of life and health, on a medium and long term basis.

## **Project Objectives**

Realization of experimental model demonstrative of imunobiosensor, based on carbon nanomaterials / magnetic and antibodies for detection of carbamate pesticides (carbaryl and / or carbendazim or related molecules) in horticultural products.

Estimated results:

1. Monoclonal antibodies and / or high affinity polyclonal, directed against carbamate pesticides mentioned / similar molecules.
2. Experimental variants of nanomaterials / nanoparticles of carbon and / or magnetic, bio-functionalized for use in immunoassays.
3. Experimental demonstrative model of imunobiosensor / immunoassay for the detection of carbamate pesticides in horticultural products.
4. Scientific publications, scientific communications and publicity; documentation relating to property rights (intellectual / industrial).

## **Project phases**

### **Phase I**

#### **Experiments on obtaining nanoparticles / nanomaterials for use in biosensors**

Phase deadline: 30.12.2014

#### **Expected results from Phase I:**

- Experimental variants of carbon and/or magnetic nanoparticles/nanomaterials;
- Immunogenic complexes with molecules of pesticides;
- Website associated project;

### **Phase II**

#### **Anti-pesticides antibodies: development for use in biosensors**

Phase deadline: 30.12.2015

#### **Expected results from Phase II:**

- Monoclonal/polyclonal anti-pesticide antibodies ;
- Nanoparticles / nanomaterials carbon /magnetic functionalized;
- Synthesis methods of nanogranular material, magnetic composite encapsulated in biocompatible polymers;
- Publications / Scientific communications.

### **Phase III**

#### **Experimental model of imunobiosensor for detection of carbamate pesticide residues in horticultural products**

Phase deadline: 30.06.2016

#### **Expected results from Phase III:**

- Experimental model immunobiosensor.
- Publications / scientific communications.
- Documents relating to the protection of intellectual property/industrial rights.

### **Partners:**

- [Institutul National de Cercetare-Dezvoltare pentru Inginerie Electrica \(INCDIE ICPE-CA\)](#)
- [Institutul National de Cercetare-Dezvoltare pentru Microbiologie si Imunologie "Cantacuzino \(IC\)](#)
- [Institutul de Cercetare si Dezvoltare pentru Industrializarea si Marketingului Produselor Horticole "HORTING" \(HORTING\)](#)
- [Beia Consult International S.R.L \(BEIA\)](#)