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EXECUTIVE AGENCY FOR HIGHER EDUCATION, RESEARCH, DEVELOPMENT AND INNOVATION FUNDING

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SURFACE PLASMON RESONANCE MULTI-SENSOR FOR REAL TIME ILLICIT DRUGS DETECTION (SNIFF)

Project type and contract number: ***41*** din ***04/01/2016***

Project Abstract:

All over the world, billions of dollars are spent annually on chemical/biological detection related to medical diagnosis, environmental monitoring, and public security and food safety because laboratory analysis using expensive equipment is usually cumbersome and time-consuming. During the last 20 years, global research and development on the field of sensors has expanded exponentially in terms of financial investment, the published literature, and the number of active researchers. Biomimetic sensors will be used as “on-site” method by the authorities to provide enough information for routine testing and screening of transportation. The main advantages of using versatile sensors for fast drug tracing refer to cost-efficiency and “on-site” legal measures to prevent drug traffic and consumption. The general objective of “SNIFF” proposal is to develop efficient optical micro sensor arrays (optical multisensory) using Surface Plasmon Resonance (SPR) for detecting various drug compounds i.e. LDS, cocaine or methamphetamine to prevent illegal transit and consumption of drugs. Furthermore, the sensitive membrane of the optical sensor will be tailored, using a molecularly imprinting technique (MI), to “sniff” (sense and detect) only the targeted drugs. The most obvious

advantage of SPR sensors using MIPs as selective films is having a wide range of low cost functional monomers as well as cross-linking agents available which may be selected by various experiments to match the functional groups of the template molecule. MIP are to be synthesized directly on the thin golden layer of SPR sensor using two procedures: deposition of the compatible synthetic MI layer directly on the golden concave surface and grafting the MIM onto the Au functionalized surface. Apart the low cost, the new sensor will have a very good resistance in time, due to the synthetic polymer, the possibility of continuous monitoring and of the recovery and reuse.

General objectives and foreseen results

The main objective of “SNIFF” project is to develop efficient optical micro sensor arrays (optical multi-sensor) using Surface Plasmon Resonance (SPR) for detecting various drug compounds i.e. LDS, cocaine or methamphetamine to prevent illegal transit and consumption of drugs. Furthermore, the sensitive membrane of the optical sensor will be tailored, using a molecularly imprinting technique (MI), to “sniff” (sense and detect) only the targeted drugs.

Project general objectives are:
- The enhancement of health security of the peoples, by preventing the illicit drug consumption, with impact on life quality;
- Developing of new materials, products and devices with low volume, but with high added-value;
- The optimization of the methods for border crossing controls;
- Development of new technologies for analytical devices.

Project specific objectives are:
- Obtaining of molecularly imprinted polymers by polymerization or electro polymerization (University of Toulon- MAPIEM). The outcome of this objective will be the technology for obtaining of MIP films on the SPR surface, by polymerization.
- Obtaining of molecularly imprinted membranes by phase inversion and sol-gel process (ICECHIM). The outcome of this objective will be the technology for obtaining of MIP membranes on SPR surface by phase inversion- inversion or sol-gel;
- Experiments for using MIP in SPR sensors for drug detection, including the soft of new sensor (Institute for Automation and Control Processes IACP FEB RAS). The outcome of this objective will be the technology for MIP-SPR biosensor;
- Testing of the new sensors, mechanical and electronic design and validation of the technical characteristics (SC Caloris). The outcome of this objective will be a demonstrator to prove the possibility to develop this kind of sensors at a commercial scale.

Foreseen results:

The achievement of the project tasks will allow a future commercial production of more reliable and less expensive on filed devices, for the detection and monitoring of illicit

drug transportation. Very important the new biosensors may be subsequently developed as automatic devices with remote control. This kind of devices is very useful for border passing controls, especially on the airport, where big flux of passengers and baggage are registered.
At the same time the project running will allow the acquisition of new knowledge about molecularly imprinted polymers (especially films and membranes) for SPR transducers, for electronic and soft development, allowing, at the level of the international consortium, the application for at least 2 patents, publication of at least 5 ISI articles and presentation of at least 4 communications at scientific events.

Economic results:

- Providing economic sustainable development, at regional and sectorial level;
- Increasing turnover and income value for the project involved SME;
- Development of technological performances and competitiveness on the market of the interested industrial partners.

Scientific results:

The innovative scientific potential of the expected results is very high, taking into consideration the many original aspects. This will enable the consortium to publish high quality articles and to ask patents in their countries and at European level. Till now few biosensors are produced at commercial scale. The need of such sensors and their lack on the market, as well as the importance of preventing illicit transport of drugs opens great opportunities for producing and selling these devices with high profit rate. The knowledge gained in the project could be used for other contraband substances detection and monitoring.

Ecological results:

The project contributes to a friendly environment through manufacture of new biosensors for the field monitoring of drugs. The project aims in environment protection are: monitoring illicit drugs transportation, obeying regulations concerning working place quality and of the whole environment, fulfillment of the requests related to quality of environment, including bioethics and biosecurity.

Social results:

- Providing human health, setting up opportunities for education;
- Creating new jobs in the research unities and in interested beneficiary,
- Drawing young students and graduates in research activity.

The main social impact will be of maintaining the health of the population from UE countries and Russia by preventing the illicit commerce with drugs. All over the world, billions of dollars are spent annually on chemical/biological detection related to medical diagnosis, environmental monitoring, and public security and food safety because laboratory analysis using expensive equipment is usually cumbersome and time-consuming.

Consortium composition

Coordinator
Institute of Automation and Control Processes of Far Eastern Branch of Russian Academy of Sciences having headquarters at 5, Radio Str., Vladivostok, 690041, Russia, project director and Coordinating director; prof. Oleg Vitrik

Partner 1 - **National Research- Development Institute for Chemistry and Petrochemistry ICECHIM**, having headquarters in Bucuresti Splaiul Independentei nr. 202, sector 6, tel.0213153299, fax 0213123493 **Project director**: **Dr.ing. Andrei Sarbu-** Main Scientific Researcher I degree

Partner 2 - University of Toulon, Acting in the name of and behalf of Laboratory MAPIEM having headquarters at Avenue de l'université – 83130, La Garde - France, Project director, **prof. Hugues Brisset**

Partner 3 S.C. Caloris Group S.A. having headquarters at 8 A, Soseaua Berceni Street, 041914, Bucharest, Romania, **Project director Dr.ing. Nicolae Maruntelu**, Scientific Researcher II degree

Funding Authority of the project for CALORIS GROUP SA

EXECUTIVE UNIT FOR FINANCING HIGHER EDUCATION, RESEARCH DEVELOPMENT AND INNOVATION (UEFISCDI)

Program 4 – Partnerships in priority areas *Director General* **Adrian Curaj** Tel: 0213071910 Fax: 0213071919 Address: UEFISCDI Str. Mendeleev, nr. 21-25, Etaj 3, cam. 321, Sector 1, Bucuresti **Cofounded by European Commission** Project duration From January 2016 + June 2018 (30 months)

Activities and responsibility of CALORIS GROUP SA (working plan)

Stage 1 Studies and preliminary researches for the identification of the main parameters for the obtaining of new drug sensors Activities 1.1 Industrial research in effective collaboration and dissemination of results – milestone 30.06.2016 Report: Studies to identify key parameters and to get new drug sensors - Technical study on optimal constructive variants of new drug sensors based on Surface Plasmon Resonance (SPR)

Stage 2 Elaboration of the technologies for the production of the new drug sensors Activity 2.1 Studies to identify key parameters and to get new drug sensors. Works on the electronic part of the SPR sensor. Elaboration of specification for SPR sensor design. – milestone 30.12.2016

Stage 3. Developing technologies for obtaining new sensors for drug detection. Designing the prototype sensor type SPR for drug detection

Activity 3.1 Industrial research in effective collaboration and dissemination of results – milestone 30.06.2017

Report: Designing the prototype SPR sensor device for drug detection

Stage 4 Developing technologies to obtain new drug detection sensors. Design of prototype device for drug type SPR - Finalization of execution project. Execution and experimental prototype testing.

Activity 4.1

- Design of SPR sensor prototype for drugs;
- Completion of project execution;
- Experimental prototype execution and testing.

Stage 5 SPR Technology Using MIP (Molecular Imprinted Polymers) for Electronic Part of Drug Detection Sensors "

Activity 5.1

- Validation of technology detection with new SPR sensors using MIP.

Team Staff

Dissemination of the obtained results

See Annex 2 Dissemination of unpatentable results

Final results

- **SNIFF demonstrator;**
- **1 patent application submitted to OSIM;**
- **Disseminations:**
    - **XIIème Colloque Franco-Roumain sur les Polymères, 5-7 September 2016 -** Sensitive polymer layers for biosensors**;**
    - **XIIème Colloque Franco-Roumain sur les Polymères, 5-7 September 2016 -** Drug selective nano-layers for surface plasmon resonance-based sensors;
    - **XIIème Colloque Franco-Roumain sur les Polymères, 5-7 September 2016 -** Synthesis and characterization of novel [N-(2-aminoethyl)-3-

aminopropyl trimethoxy silane]-based molecularly imprinted films for bisphenol A recognition;

- **2th Symposium SICHEM, 08-09.09.2016, Bucuresti, Romania -** Obtaining of molecularly imprinted films via electropolymerization based on [tetrakis(2,2'-bithiophene-5-yl)silane] monomer;
- **17 International Multidisciplinary Scientific GeoConference SGEM 2017**, 27 June - 6 July, 2017, Albena, Bulgaria - Innovative polymer membranes with active carbon content,

Links to other related web pages

http://uefiscdi.gov.ro/

http://www.caloris.ro/en/

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