

NOVA I4H – Thesis Proposal

Title: Development of method for automatic on-line monitoring of VOC in automotive plant and direct evaluation of its impact on employers.

Objectives:

Presently an environmental toxicology is very important topics on world science, which aims to protect the health by assessing potential hazardous exposures during occupational activities. In automotive industry a systematic employer's exposure to a wide range of industrial chemicals including degreasers, detergents, lubricants, metal cleaners, paints, fuel, solvents, etc., can result in various forms of chronic poisoning, skin diseases, hematological changes as a result of exposure to solvents, such as benzene and its homologues, toluene, xylene, etc., increased risk of cancer and organic brain damage due to inhalation of diesel exhaust fumes. For example, painters are commonly exposed by inhalation to solvents and other volatile paint components during spray painting.

The recent advances in technology and detection methods have pointed the Ion Mobility Spectroscopy (IMS) as a very promising technology for the analysis of Volatile Organic Compounds (VOCs) at very low concentrations (ppb_v – ppt_v range) by direct sampling and without use of any chemicals.

In this project, as a first objective, we pretend develop method for automatic on-line monitoring of VOCs in the environmental air of automotive plant using an outstanding sensitive analytical technology of Ion Mobility Spectrometry (IMS) . A mobile version of IMS apparatus shall be able mapping all relevant places in the automotive plant, including the painting department, giving in-situ the quantitative analysis of VOCs in the air.

The second main objective of this project consist in the direct evaluation of environmental impact onto employer's health. It could be assessed by examination of VOCs in exhaled breath and analysis of emissions from skin, allowing to monitor biochemical processes within the human body in a non-invasive manner. This innovative study could generate a new interesting data and contribute to occupational health solutions.

Framework:

The LIBPhys-UNL is only team in Portugal using an innovative technology of Ion Mobility Spectroscopy and recently has accumulated know-how in its application to environmental toxicology.

Volkswagen Autoeuropa is one of automotive production plants from Volkswagen Group in Palmela. It represents the largest foreign investment into Portuguese industry, having a very positive impact on the national and regional economy.

This project will be developed in collaboration between LIBPyhs-UNL and Autoeuropa and will be supported by a company/faculty PhD grant assigned by FCT.

Tasks: During the PhD Thesis the following specific objectives shall be achieved:

- State of the art of environmental toxicology and safety regulations at the automotive plant Autoeuropa.
- Learning to work with Ion Mobility Spectrometer with GC Column pre-separation, calibration of apparatus and a software tools for analytical analysis;
- Development of experimental protocol for automatic on-line monitoring of VOCs in the environmental air of a plant;
- Experimental measurements of VOCs in the air at the automotive plant in order to mapping all relevant places, including the painting department;
- Protocol development and experimental in-situ examination of VOCs in exhaled breath of employers and analysis of emissions from skin after working day.
- Statistical analysis of obtained results and its discussion in the focus of direct evaluation of effect of environmental exposure.
- Writing theses and publication of intermediate and final results on papers in peer-reviewed international journals and/or conferences.

Venue: The work will be initially developed at Biomedical Lab of Faculdade de Ciências e Tecnologia da Universidade Nova de Lisboa with periodic visits to the in Volkswagen Autoeuropa plant in Palmela.

Candidate profile: Interest and strong knowledge on instrumentation and analytical methods of VOC analysis. Knowledge on physiology and computing tools are desirable, as well as the comfortable working in an industrially driven environment.

Supervisor

- Name: Valentina Vassilenko
- Institution: LIBPhys - FCT UNL
- Email: vv@fct.unl.pt
- ORCID ID: 0000-0002-7913-7047

Co-Supervisor

- Name: Carlos Fujão
- Institution: Volkswagen Autoeuropa
- Email: carlos.fujao@volkswagen.pt
- ORCID ID: 000-0002-1433-5712