PhD position at CEA-Grenoble

Title: Development and application of electronic noses for the safety management of contaminants in recycled plastic materials for food contact

Context: Following the European Green Deal and France's anti-waste law, the new EU Regulation on Packaging and Packaging Waste sets ambitious recycling targets, introducing stringent standards for packaging recyclability and establishing categories for contact-sensitive plastic packaging intended for children. It mandates recycling 65% of packaging waste, including 50% of plastics, by 2025. Despite the advancement, this represents a great challenge and requires development of robust methods for authenticating the origins, processing histories, and decontamination levels of recycled materials.

Objective: This PhD project is a part of an ambitious collaborative project TWINLOOP (funded by AMI from ANR in 2025). The objective of this PhD is to develop and integrate state-of-the-art technologies, such as electronic noses (eNs), to enhance the safety and efficiency of recycling processes for plastics in food contact applications. At SyMMES lab, we have developed biomimetic eNs based on biological sensing materials such as peptides and an optical detection system, surface plasmon resonance imaging (SPRi) [1-5]. Our eN has demonstrated excellent performances in terms of sensitivity and selectivity. In addition, our technology has been valorized by the creation of a company for the development of portable device for artificial olfaction. In this project, in close collaboration with this company, the electronic nose will be applied for the analysis of recycled plastic materials to detect chemical contamination across various recycling stages. Novel peptides with higher selectivity for target volatile organic compounds will be designed based on virtual screening approach to further improve the performances of the eNs. Besides, strategies for adapted gas sampling and pre-concentration will be explored and integrated into the electronic nose system with the aim of optimizing and testing inline applications of eNs. Finally, the project includes also the development of data treatment based on machine learning.

Background of candidates: We are seeking a highly motivated researcher who has recently completed a master's degree in physics, chemical physics, or chemical engineering with strong interest on the biology and nanotechnology. Experience with numerical simulations and AI are highly appreciated. This PhD candidate will be based at CEA-Grenoble and will start ideally on September/October 2025.

References:

(1) S. Brenet, et al., Y. Hou*, "*Highly-Selective Optoelectronic Nose Based on Surface Plasmon Resonance Imaging for Sensing Volatile Organic Compounds*", **Analytical Chemistry**, 2018, 90 (16), 9879.
(2) S. Gaggiotti, et al., Y. Hou*, D. Compagnone*, "*Development of an optoelectronic nose based on surface plasmon resonance imaging with peptide and hairpin DNA for sensing volatile organic compounds*", **Sensors and Actuators: B. Chemical**, 2020, 303, 127188.
(3) S. Brenet, et al., Y. Hou*, "*Improvement of Sensitivity of Surface Plasmon Resonance Imaging for the Gas-Phase Detection of Volatile Organic Compounds*", **Talanta**, 2020, 212, 120777.
(4) J. S. Weerakkody, et al., Yanxia Hou, * "*A Surfactant-like Peptide Self-assembled into a Biohybrid Multi-sensor Array for an Electronic Nose*", **ACS Nano**, 2022, 16, 3, 4444.
(5) M. El Kazzy, et al., Y. Hou,* "*Study and Optimization of the Selectivity of an Odorant Binding Protein-based Bioelectronic Nose*", **Biosensors and Bioelectronics**, 2025, 268, 116879.

For application, please send your CV, letter of motivation, and bachelor/master transcripts before to: Dr. Yanxia HOU-BROUTIN, Dr. Arnaud BUHOT
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