Développement de nez électroniques pour l'analyse des composés organiques volatils

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Stage pouvant se poursuivre en thèse : Oui

Résumé :

Nowadays, development of novel analytical technologies is driven by the ever-expanding monitoring needs of a variety of species in gases in diverse applications including environment monitoring such as air quality control, detection of pollution or leak of danger for personal/public safety, food safety and quality control, non-invasive medical diagnostics, etc. Traditional methods such as gas chromatography and mass spectroscopy, though accurate and reliable, require expensive analytical equipment and expertise to operate such instruments and they are often time-consuming and laborious to perform. Consequently, there has been an increase in demand for sensors able to provide reliable, inexpensive and rapid analysis such as electronic noses (eNs). In this internship, we propose a new paradigm to design and prepare novel sensing materials in order to improve greatly the performances of the electronic noses for analysis of volatile organic compounds (VOCs).

Sujet détaillé :

The last two decades witnessed a rapidly growing interest in electronic noses/tongues (eN/eT) due to their potential in a wide range of domains such as: controlling the quality of foods and beverages, monitoring pollutants and explosives in the environment and diagnosing diseases such as cancer. Inspired by mammals' olfactory system, the eN/eT is generally constructed using sensor arrays based on non-specific interaction and pattern recognition systems. They emerge as promising alternatives to traditional analytical methodologies (e.g., gas or liquid chromatography), that are accurate and reliable but often time-consuming and laborious to perform, in particular, for analysis of complex milieu, when a full component-by-component analysis is unnecessary, such as for comparisons against a standard, discrimination of subtle differences among mixtures, or detection of changes in the mixture as a function of time or conditions.

Recently we have developed a novel approach which simplifies largely the conception and construction of electronic noses/tongues system. By mixing only two small and easily accessible disaccharides as building blocks, an array of 11 differential receptors was prepared. Using an optical detection system surface Plasmon resonance imaging (SPRi) the obtained electronic tongue was efficient for analysis of not only pure proteins but also complex milieu such as milk. (For more information, please see:
http://onlinelibrary.wiley.com/journal/10.1002/(ISSN)1521-3773/homepage/press/201237press.html,
http://www.cea.fr/technologies/langues_electroniques-93545).

For this internship, we propose to explore further the potential applications of such a system particularly for analysis of volatile organic compounds (VOCs). One main objective is to design and prepare novel sensing materials in order to greatly improve the performances of the electronic noses in terms of sensitivity and selectivity. Meanwhile, different techniques concerning the conception and construction of classical biochips and novel electronic noses, surface functionalization (self-assembled monolayers, SAMs) and characterization, as well as sensing system based on SPRi will be used to realize the project. Moreover, data processing will be performed in close collaboration with a theorist of the laboratory SPrAM. The internship will be carried out in a multidisciplinary laboratory at the interface of physics, chemistry, biology and nanotechnology. In addition, this project is in close collaboration with a local star-up company. This internship could be followed by a PhD thesis.

Compétences requises :

Chimie, physico-chimie, avec un intérêt marqué pour la biologie et les nanotechnologies