

Thesis in atmospheric chemistry

Laboratoire de Physico-Chimie Atmosphérique (LPCA)

Unité de Chimie Environnementale et Interactions sur le vivant (UCEiV)

Université du Littoral Côte d'Opale (ULCO, Dunkerque, France)

Title: Impacts on air quality and human health of new biofuels used for terrestrial transport.

Period: October 2022 - September 2025

Context

The increase of greenhouse gas atmospheric concentrations as well as the dependence on fossil fuels have favoured the development of biofuels. The use of biofuels in mixtures with traditional fuels in the sector of transport aims to answer to five essential issues: to reduce the emissions of greenhouse gases, anticipate the depletion of world oil reserves, reduce the energy dependence on oil, offer a supplementary opportunity for agricultural activities and create a sector of waste recycling. In a context of global warning linked to the emissions of greenhouse gases, fluctuation of oil prices and preoccupations on the security of energy supplies, biofuels constitute an alternative and renewable energy source. Since a few decades, technologies of biomass conversion have been developed to produce biofuels for transport, coming in complement or substitution of fuel fossils.

Objectives

The objectives of this thesis subject is to study the impacts on air quality and human health of new biofuels used for terrestrial transport. The research works will be performed in the atmospheric simulation chamber CHARME which is a PHARE-instrument of the regional platform IReNE. The targeted chemical species are Volatile Organic Compounds (VOCs) obtained from lignin (anisole, ortho-cresol...) and from lignocellulose (isohexene, isooctene, cyclopentanone...). Reactional mixtures containing one VOC and one atmospheric oxidant (OH, NO₃ or O₃) will be generated: their chemical composition will be followed versus the time by dedicated analytical technics (PTR-ToF-MS, GC-MS, SMPS...) and an exposure chamber (Vitrocell setup) will be coupled to CHARME to study the impact on human lung cells of these VOCs and their oxidation products.

The results expected by these researches are to determine the atmospheric lifetimes of these new biofuels, to characterise / quantify their gaseous and particulate (formation of Secondary Organic Aerosols - SOAs) oxidation products and to identify the action mechanism potentially involved in their toxicity.

This thesis subject fits into the scientific problematics studied in the frame of the Labex CaPPA¹ and the CPER ECRIN.

Candidate profile: A master in chemistry, physico-chemistry or atmospheric sciences is required. Knowledge in analytical chemistry (chromatography, mass spectrometry, spectroscopy...) are also desirable.

Application: Please send a detailed CV, a letter of application with research interest and contact details of the supervisor of the Master 2 internship to:

- Dr. Cécile COEUR ; cecile.coeur@univ-littoral.fr; <https://lpca.univ-littoral.fr/>.
- Dr. Sylvain Billet ; sylvain.billet@univ-littoral.fr; <https://uceiv.univ-littoral.fr/>.

¹ <https://www.labex-cappa.fr/>.