

Controlled generation and determination of the toxicological impact of atmospheric secondary organic aerosols

The Department of “Atmospheric Sciences and Environmental Engineering” (SAGE) of the IMT Lille Douai Engineering School and Research Center in Douai, France (<http://sage.imt-lille-douai.fr/>) has ongoing research activities focused on the impacts of climate change on atmospheric composition and air quality in the north of France.

The laboratory “Impacts of the Chemical Environment on Human Health” (IMPECS) of the University of Lille, Faculty of Medicine / Research Center, aims at understanding the complexity of the response of human tissues exposed to atmospheric chemicals, at explaining the variability amongst individuals towards these substances, at evaluating the levels of risk and, therefore, at better predicting and preventing the effects of this environment on health.

In the frame of the CLIMIBIO project (<http://climibio.univ-lille.fr/>), SAGE and IMPECS will co-supervised a PhD work on the “controlled generation and determination of the toxicological impact of atmospheric secondary organic aerosols”.

Context and description of the project :

Air pollution is the first environmental cause of premature death in the world. The Hauts-de-France region in the North of France is affected by high levels of particulate matter (PM). PM is a heterogeneous mixture of variable composition in time and space depending on the sources of primary and secondary particles, resulting from photochemical reactions. The toxicological links of causality between PM and health effects are poorly understood. Most studies deal with primary PM (diesel soot), but not with secondary aerosols, which are difficult to produce, unstable and of varied composition. However, climate change (CC) modifies the characteristics of the atmosphere (temperature, photochemical reactivity). Higher expected concentrations of biogenic and anthropogenic volatile organic compounds (VOCs) and oxidizing species will increase secondary organic aerosol (SOA) levels. The health impact of these complex compounds can be assessed by producing custom synthetic SOA in the laboratory according to various controlled specifications. We will measure the physico-chemistry of produced SOA, their oxidation state and their oxidative potential (OP), before evaluating their toxicological effects on cultured epithelial cells (cytotoxicity, oxidative stress, inflammation, mRNA profiles and microRNAs). A comparison with urban and rural particles, collected in Hauts-de-France (SOA from isoprene) and in the Mediterranean (SOA from terpenes) will be realized. The relationship between physico-chemistry, OP and the toxicological response will help to understand the biological mechanisms involved and anticipate the measures to be considered to mitigate the effects of CC on air quality.

Keywords : climate change, Secondary Organic Aerosol, toxicology, oxidative potential

Candidate profile : Master 2 with experience in environmental chemistry and toxicology

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Doctoral School : Biologie Santé (Université de Lille)

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Contact : Send CV, motivation letter, Master’s transcript and two recommendation letters to :

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