PhD position in Toxicology (2022-2025) at INERIS (France).

WOODTOX: Pulmonary toxicity evaluation and comparison of cellular mechanisms involved after exposure to primary and secondary biomass burning emissions.

Keywords
Pulmonary toxicity, In-vitro, Biomarkers, Air quality, Particulate matter, Biomass burning, Secondary organic aerosols (SOA).

Context and objectives

It is widely recognized that airborne particles (aerosols or particulate matter, PM) have significant health impacts especially at the pulmonary, cardiovascular and neurological levels. Among ambient air PM sources, biomass burning, including residential wood heating, contributes significantly to the PM concentrations observed in ambient air notably in winter period. This source also emits large quantities of volatile and semi-volatile organic species leading to the formation, via (photo-)chemical processes, of secondary organic aerosols (SOA) accounting for a substantial part of fine PM concentrations. To date, the comparative toxicological effects of primary and secondary emissions from biomass burning are relatively unknown. *In vitro* cell methods are an alternative to animal testing to assess air pollutants toxic effects. Conventional approaches, using PM collected on filters then extracted and exposed to cells by submersion, suffers from different limitations and does not allow to expose cells to the entire emissions (gaseous and particulate phases). In contrast, cell exposure at the air-liquid interface (ALI) is a more realistic approach to evaluate cellular toxicity. However, it has been weakly applied in the *in vitro* toxicity of biomass burning emission studies, and even less in the case of SOA. In this context, the main objectives of this PhD work are to evaluate and compare the pulmonary toxicity of primary and secondary emissions from biomass burning and to study the inherent cellular mechanisms involved. Pulmonary cells will be first exposed at the ALI to SOA formed from aging experiments of precursors species typically emitted by biomass burning (e.g. polycyclic aromatic hydrocarbons (PAHs) and phenolic compounds). Different oxidation conditions ($OH^{\bullet}$, $NO_3^{\bullet}$ or $Cl^{\bullet}$ radicals), simulating the diurnal, nocturnal or under marine influence atmospheric processes, will be studied. A comparison of biological responses obtained during short-term (2-4 h) exposures with high SOA levels and long-term (24 h) exposures with low SOA levels, will be also performed. Finally, the comparison of biological responses between primary and secondary emissions obtained during experiments performed in simulated real-world conditions (aged emissions from a wood log stove) will be studied. In addition to conventional toxicity biomarkers (cytotoxicity, inflammation, oxidative stress), differential expression of some genes (mRNA quantification), potentially more sensitive, will be investigated to identify specific biomarkers of the nature of the PM and the signalling pathways involved. Finally, analysis of potential links between the biological responses and the detailed physicochemical characterization of the gas and particulate phases obtained in another PhD work focusing on atmospheric chemistry (BOISSOAM) which will take place jointly with the WOODTOX PhD work, will be performed.

Candidate profile

- Master 2 or equivalent in Toxicology or Environmental toxicology
- In vitro cell culture experience is mandatory
- ALI cell exposure experience will be even better
- Strong experimental and lab work interest
- Knowledge in toxicology
- Basic knowledge in chemistry
- Knowledge in data and statistical analysis
- Autonomy, scientific rigour, adaptability, teamwork, open mind, synthesis and writing abilities.
- Good English level.

Useful information

Place of PhD work: INERIS (Verneuil en Halatte, France) = 100 %

PhD in co-supervision: with University of Lille (Guillaume Garçon).

PhD start: September - October 2022

To apply: Send CV, cover letter and any recommendation letter before 10/06/2022.

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