Master 2 internship topic: Biothermochemical factors favouring vegetation self-inflammation

Location: ENSMA, IC2MP, EBI (Poitiers)

Profile: pyrolysis, combustion, analytical chemistry, physiology

Gratifications : ≈ 650€/mois (4,35 €/heure)

Description of the research project and expected results: In view of the increase in forest fires worldwide – California, around the Mediterranean, but also in the Nouvelle-Aquitaine region, which experienced an extreme year in 2022 – we are proposing to look for biothermochemical indicators that promote plant auto-ignition and therefore fire spread.

The aim of the project will be to improve an experimental set-up and its protocol to determine the biothermochemical factors (physiology, nature of emissions, temperature) that promote the auto-ignition of plants involved in forest fires. To do this, three infrastructures are available:
- The greenhouse and physiological monitoring equipment at the EBI laboratory in Poitiers
- The PERICLES fire platform at the Institut P' in Chasseneuil (ENSMA) to carry out auto-ignition tests
- Chemical analysis equipment at the IC2MP in Poitiers.

The long-term objective is to understand the mechanisms involved in the propagation of extreme forest fires that occur during periods of drought and endanger firefighters because of their unpredictability and speed: megafires, impossible to contain because of their power, and eruptive fires (also known as thermal phenomena or flashover fires). With climate change more and more areas are prone to wildfire, like the Poitou-Charentes region, which already has some risky zones such as the Pinail natural reserve, made up of moorland vegetation. Schneider et al. (2021) have highlighted the great need to improve our knowledge of forest fire propagation mechanisms to improve the scientific tools needed to fight and prevent forest fires.

Once the system and the protocol have been established, the first part of the project will consist of collecting samples of the plants we wish to test and characterise them from a biological point of view. The second part will consist of subjecting the plants to thermal radiation until they reach the auto-ignition temperature, while characterising their emissions (evapotranspiration, dehydration and pyrolysis) - including the isoprenoids, which are the most flammable compounds and probably drive ignition.

Emissions can be characterised on a continuous basis using an FID analyser, and punctually by using adsorbent tubes (SPEE). These SPEEs can be analysed at the IC2MP using a pyrolyser coupled to chromatography and mass spectrometry (Py-GC-MS).

Supervisors: Bruno Coudour from the Institut P' (physics), Laurent Lemée from the IC2MP (chemistry) and Fabienne Dédaldéchamp from the EBI laboratory (biology).

Scholarship will be funded by the regional research network on anticipation to climatic changes (Futurs-ACT) and will be carried out as part of the ANR JCJC TSWP project attached to the University of Poitiers.

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