

INTERNSHIP - 2026

IFPEN Lyon – Physics and Analysis Division

Subject

Analysis of SAF matrices by comprehensive two-dimensional gas chromatography (GC×GC) coupled with chemical ionization (CI) high resolution mass spectrometry (HRMS).

Supervisor

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Context

Sustainable Aviation Fuels / Analytical chemistry / GC×GC / Chemical Ionization

Description

The global demand for biofuels is expected to grow during the present decade since they contribute to the decarbonization of long-distance transport. In the European Union the RED II legislation has set a series of measures and obligations that will guarantee that at least 6% of the aviation fuel has been produced from renewable feedstocks by 2030 and 70% by 2050. Several pathways for SAF production are being studied to ramp up the production capacities. Presently, there are 11 SAF production pathways approved and an important part of it leads to the production of SAF with high paraffinic compositions and mainly isoparaffins (iso-alkanes). One of the main challenges in Sustainable aviation fuels (SAF) development it's their compliance with the requirements in certification standard methods and compatibility with existing aviation turbine motors. Therefore, there is an increasing interest in accessing to a detailed molecular characterization of SAF's and particularly to isoparaffins molecular structure such as chain length, branching number and branching position since this impacts SAF's physical-chemical properties.

It is well accepted that two-dimensional gas chromatography (GC×GC) is a very powerful analytical characterization tool in which the carrier gas eluting from a first GC column is introduced onto a second GC column with different polarity characteristics and complementary to the first column. This way the sample is subject to two different separation processes within a single analysis, increasing significantly peak separation, resolution and identification compared to one dimension GC. However, identification relying only on retention times might not be enough because several compounds may have similar elution times in both dimensions. Therefore, this method is often coupled with high-resolution time-of-flight mass spectrometry. Most usually the MS energy source used is electron ionization (EI) leading to extensive fragmentation which is not adapted for saturated compounds such as isoparaffins. A lower energy source such as chemical ionization (CI) can be a good option since this approach usually yields ions that contain the intact analyte molecule and hence provide MW information even for large, saturated hydrocarbons, which enables their identification. Besides, CI can produce fragment ions with molecular structure information which can be complementary to information obtained from EI mass spectra.

In this context, the objective of the internship will be to develop rapid and accurate GCxGC methods with chemical ionization MS detection (and simultaneous FID detection) for the detailed characterization of SAF matrices. The candidate will have to optimize the different experimental parameters of the GCxGC-FID/MS method, validate the method and analyze some relevant samples. An appetite for the experimental work in the laboratory as well as data exploitation is needed. At the end of the internship a written report and a presentation summarizing all his/her results is expected.

Required profile

Required skills: Good skills in chemistry. Experience in analytical chemistry and separation science would be appreciated. Interested in laboratory work. Good writing skills

Rigorous, autonomic, dynamic

Languages: fluent English or French mandatory

Educational background

M1 or preferably M2 in chemistry or analytical chemistry, 3rd year of chemical engineering school.

Project leader

M. Lacoue-Nègre

N° project/study

PJP

Department Head

E. Lemaire

Section

R0520S

Additional information**Duration:** 5-6 months**Period:** February-July 2026**Workplace :** IFP Energies nouvelles, Autoroute A7, Rd point de l'échangeur de Solaize, BP3, 69360 SOLAIZE**Transport :** TCL, TCL à la demande**Remuneration :** Paid internship**Application :** please send a motivation letter and a CV to joana.fernandes@ifpen.fr