

## General information

**Employment type:** postdoctoral contract.

**Period:** January 2024 – December 2026 (starting date can be modified).

**Funding:** AMIDEX interdisciplinary.

**Net salary:** ~2200 € (depending on candidate experience).

**Project title: Litter from Mediterranean urban green spaces and forest as a source of Volatile Organic Compound emissions: variability with abiotic and biotic factors and consequences for air quality.**

**Scientific field:** air quality, soil ecology, soil atmosphere exchanges

**Keywords:** Biogenic Volatile Organic Compound, bi-directional fluxes, decomposing organic material, soil, atmospheric chemistry, soil ecology, soil-atmosphere interactions, abiotic factors, biotic factors, secondary pollution precursors, secondary organic aerosols, ozone

**Hosting laboratories and working place:** LCE (Saint Charles) and IMBE (St Jérôme) (Marseille) + field work in urban green spaces in Marseille and O<sub>3</sub>HP site.

**How to apply:** send your CV (including your birthdate), two recommendation letters and contact details of your PhD postdoc supervisors and the copy of your PhD diploma to the contacts noted hereafter :

*Scientific contacts* [elena.ormeno-lafuente@imbe.fr](mailto:elena.ormeno-lafuente@imbe.fr), [julien.kammer@univ-amu.fr](mailto:julien.kammer@univ-amu.fr), [brice.temime-rousseau@univ-amu.fr](mailto:brice.temime-rousseau@univ-amu.fr)>

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**Application deadline: September 15<sup>th</sup> 2023.**

## State of the art

BVOCs are mainly formed through plant specialized metabolism and their emission is largely modulated by environmental conditions (temperature, light, humidity). At the ecosystem level, BVOC emissions from vegetation contribute to plant defense against biotic (e.g. herbivory, parasitism; Dicke et al. 2003) and abiotic stress (e.g. thermal or water stress; Vickers et al. 2009, Possell & Loreto 2013) and allow plants to interact with their environment. At the atmosphere level, BVOCs have a major role in the chemistry of the lower atmosphere. Indeed, via complex photochemical reactions in presence of nitrogen oxides (NO<sub>x</sub>) - from road transport in particular, BVOCs participate to the formation of secondary organic aerosols (SOA) and tropospheric ozone (O<sub>3</sub>), the latter being particularly concentrated in rural areas in the Mediterranean region. Knowing the sources of BVOC emissions and the parameters that drive their variations is therefore essential to further improve the models that aim to estimate air quality on a global and regional scales.

While BVOC emissions from trees and shrubs have been studied since the '70s as reported in thousands of scientific studies (Tingey et al 1980; Genard-Zielinski et al. 2018), the first studies that have targeted plant litter (i.e. dead leaf biomass deposited on the ground) as a source of BVOC emissions date from the 2000s.

This type of work remains rare (Isidorov et al. 2003, Peñuelas et al. 2014, Viros et al. 2020; Viros et al. 2021) while these latest studies demonstrate that, for a given plant species, emission fluxes from litter are 5-100 times lower than those from the canopy but can also be similar to canopy fluxes during the early stages of vegetation degradation in some forests (Viros et al 2021).

Given that litter is present throughout the year in the forest, the soil covered with litter can therefore represent an important source of BVOCs and contribute to formation of secondary pollutants such as SOA. This BVOC source is however totally neglected in air quality models given the lack of experimental data. In addition, the intensification of drought and warming in the Mediterranean region in future climate change scenarios (Cramer et al. 2018, IPCC 2019) could have an impact on BVOC emissions from litter, either directly or indirectly through modification of the microbiota communities associated to decomposing litter. While numerous studies have documented how abiotic and biotic factors modulate BVOC emissions from green leaves, little is known regarding the driving parameters of litter BVOC emission.

### Objectives

The postdoc will study BVOC emissions from litter as precursors of SOA, with a focus on litter from urban areas (Marseille) and, to a lesser extent, in a Mediterranean forest. This work is multidisciplinary (ecology, atmospheric chemistry, analytical chemistry) and has a strong experimental component.

The project tasks will be as follows:

- 1) Screen the BVOC emissions from ~20 plant species in the urban green spaces of Marseille.
- 2) Characterize the response of BVOC emissions to different masses of litter in the *Quercus pubescens* forest of the O3HP, (100 km north of Manosque, labeled AnaEE-France and AnaEE-ERIC, <https://www.anaee-france.fr/service/experimentation-in-natura/ecosystemes-forestier/ecosystemes-forestiers-mediterraneens/o3hp>). These masses represent different climate change scenarii.
- 3) Assess the response of those litter BVOC emissions to biotic (microbiota communities, microbiota respiration, litter degradation level) and abiotic (temperature, humidity) factors
- 4) Measure, in the laboratory, the reactivity of BVOCs from some of these litters with OH and O<sub>3</sub> to evaluate their potential to form SOA.

### Tasks the postdoc will endorse

- 1) Collection of litter BVOC emissions from urban and natural sites and BVOC analysis using PTR-ToF-MS.
- 2) Study SOA formation from litter BVOC emissions in the laboratory (LCE).
- 3) Laboratory work measuring biotic factors associated to litter degradation traits (IMBE).
- 4) Analysis and processing collected data.
- 5) Valorization of results with the two teams (LCE, IMBE) in the form of:
  - Publications in scientific journals of rank A,
  - Presentation of the results in one international congress at least,
  - Actions to popularize results with the general public (i.e. scientific culture missions).

## Required skills

The candidate is expected to have, at least, a completed PhD degree in atmospheric chemistry, organic chemistry or analytical chemistry with experience / knowledge about soil and plant ecology.

Ideally, the candidate must be motivated to conduct both field and laboratory experiments (including BVOC measurements, SOA formation experiment and measurement of biotic factors). He/she ideally is skilled in complex experimental setup for gas analysis, and has skills with handling big dataset and advance statistical analysis (using one of the common code languages, such as R, IGOR, Matlab, Python, Fortran, etc). Strong knowledges in VOC characterisation using PTR-ToF-MS is expected and being familiar with R language can be an added value.

The candidate must also be in possession of a B driving license (and, preferably, drive), be motivated to train in areas of skills complementary to their initial training, write scientific reports and articles in English, demonstrate organization, listening skills, dynamism and communication and have a minimum level of English level B2.

Experimental work in the field involves being able to work flexibly, as the dates of the campaigns can be modified according to the changing weather conditions. The candidate will therefore have to adapt to these changes.

The candidate will have to juggle between the IMBE and LCE teams located on the St Jérôme and St Charles campuses, respectively, and communicate with his supervisors in these two laboratories.

## Supervising team

The postdoc will be supervised by Elena Ormeno, research scientist at **IMBE** (Mediterranean Institute of Biodiversity and Ecology, UMR 7263 AMU-CNRS-IRD-UAPV), Julien Kammer and Etienne Quivet, associate professors at **LCE** (Laboratory of Chemistry and Environment, UMR 7376 AMU-CNRS) and a technical team in both laboratories. He/she will benefit from long-term expertise (20 years) of both teams on biosphere-atmosphere interactions through VOC emissions and their long-term collaboration (15 years long) through numerous research projects. The postdoc will also benefit from soil ecology skills at IMBE and atmospheric chemistry knowledge and **on-line measurements (through PTR-ToF-MS) at LCE**. **IMBE is located at St Jérôme Aix-Marseille University Campus and LCE Aix-Marseille University St Charles Campus**, and the postdoc will work in both sites in Marseilles.