Research Field: Chemistry and Environment

Institute: Institute of Environmental Assessment and Water Research. CSIC (Barcelona)

Research Group: Geochemistry and Pollution

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Research Project: INFLUENCE OF THE TEMPERATURE INVERSION ON ATMOSPHERIC ORGANIC POLLUTION (INTEMPOL, Ref. PGC2018-102288-B-I00)

Keywords: Atmospheric pollution, temperature inversion, organic pollutants, vertical distribution, drones, chemical analysis, toxicological analysis.

Project Description. The present project is aimed to give a strong leap forward into the understanding of the changes in chemical composition of atmospheric organic pollutants under temperature inversion. These episodes often involve precautionary health warnings or contaminant emission restrictions in urban areas as they encompass strong increases of atmospheric pollutant concentrations. Restricted dispersion of organic compounds and photo-oxidation in the upper air layers lead to qualitative and quantitative changes of atmospheric pollutants that are largely unknown. Understanding the main changes in composition of these compounds will help to define the best strategies to deal with the health risks of the temperature inversion episodes.

Organic pollutants generated under several types of temperature inversions in urban, rural and high mountain environments will be studied. Urban areas will involve two distinct examples such as Madrid and Barcelona. The former represents continental environments where soil radiative forcing is the main driver of the vertical structure. The second constitutes an example of coastal environments with significant breeze regime influence, involving eventual photo-oxidation in the marine atmosphere and inland transport. Rural environments will be represented by the temperature inversions in the area of Osona where highest summer O3 concentrations among those recorded in the Iberian Peninsula have been observed. The temperature inversions in the mountain-plain systems and their associated transport of organic pollutants uphill (day) and downhill (night), prior and after respective photo-oxidation will also be considered.

The study of all cases will include sampling and analysis of the vertical distribution of organic pollutants which will be performed with the use of drones equipped for gas phase and particulate sampling of organic compounds. This approach will constitute a technological breakthrough that is feasible considering the expertise of the team that is authoring the present proposal. Obviously, the qualitative and quantitative vertical distributions of organic pollutants will be studied in regular conditions of environmental lapse rates and temperature inversion.

The gas phase pollutants studied will encompass organochlorine solvents, 1,3-butadiene, formaldehyde and other aldehydes, nicotine, benzene, toluene, xylenes and other gasoline or

Diesel components. Isoprene, terpenes and their oxidation products will also be analysed, The particle associated pollutants will involve PAHs, PCBs, DDTs, again nicotine, hexaclorobenzene, phthalates and their photo-chemical derivatives. Newly formed compounds will also be studied using a Q Exactive GC Orbitrap GC-MS/MS instrument recently acquired in IDAEA. This equipment has a high sensitivity and selectivity providing high resolution mass spectra with low amounts of compounds.

The toxicity of the organic matter fractions isolated from these samples will be examined using diverse validated tests for airborne organic extracts developed in the IDAEA with proven feasibility. These tests will be useful to know what is the toxicity degree of the compound mixtures resulting from photo-oxidation and the interaction of the pollutants with inorganic oxidizers and particles.

Conditions: The candidate will be presented to the competitive call of predoctoral contracts FPI-2019.

Applications: Interested people should send a letter of motivation, CV and complete academic record by email indicating **Beca Predoctoral INTEMPOL** in the subject.