

Ph.D. Thesis proposal¹

General Information	
Ph.D. Thesis Title	<i>Characterization of Air Pollutants in the Region of Jounieh (Lebanon) and Identification of the Contamination Sources</i>
USEK Doctoral Program	<i>PhD in Chemistry</i>
Research Center	NA
Research Group	NA
Research Axis	<i>Chemistry (Analytical Chemistry and Environment)</i>
PhD Supervisor	Name & Title : Dr. Nathalie Estephan Email : nathalieestephan@usek.edu.lb University Address : Holy Spirit University of Kaslik-USEK
Co-supervisor (if applicable)	Name & Title : Prof. Henri Wortham Email : henri.wortham@univ-amu.fr University Address : Université Aix-Marseille
Location (s)	Location 1: USEK Work shift calendar /per year (%): 60%
	Location 2: Université Aix-Marseille Work shift calendar /per year (%): 40%
Applicant Profile and/or Special Requirements	Master degree in Chemistry
Comps Exam Language	<input type="checkbox"/> Arabic <input type="checkbox"/> French <input checked="" type="checkbox"/> English

Context of the Topic & Scientific Methods <i>(Research impact, objectives, design, methods, and outputs)</i>	
<p>In 2016, WHO confirmed that air pollution is responsible for 4.2 million premature deaths every year. In addition, 91% of the world's population lives in places where air quality exceeds guideline limits. This international crisis affects not only the ecosystem but also the human health. Reduction measures of air pollution should be undertaken. Therefore, the necessity to characterize the pollutants and identify the sources of contamination are becoming an urgent priority.</p> <p>Lebanon is especially affected by this crisis. In 2008, the Air Quality Research Unit (AQRU) was established to understand and solve air quality problems in Beirut. Unfortunately, they found that the levels of different particles in the air that adversely affect human health greatly exceeded threshold levels set by WHO. In 2018, Greenpeace released an analysis of satellite data where Jounieh city was classified among the world's top hotspots for nitrogen dioxide pollution, and ranked fifth in the Arab world and 23rd worldwide among the most polluted cities.</p>	

¹ Thesis proposal should not exceed two pages

Air pollution is the result of two types of sources: Natural and Man-made. The pollutants can be primary, which are direct result of the process, or secondary, which means they are caused by the intermingling and reactions of primary pollutants. The associations of the air quality monitoring regulate 7 pollutants which are the objective of continuous studies: SO₂, CO, NO₂, O₃, particles, C₆H₆ and Pb.

In this PhD thesis, a deep investigation and analysis will be carried out to characterize the air pollutants in the region of Jounieh with the identification of the sources of this contamination to be able to find solutions to reduce this pollution.

For this purpose, air pollution sensors will be placed in different key points in the region. Data will be collected and analyzed. The characterization of the air pollutants will be performed using analytical methods, based on gas and liquid chromatography, developed and implemented by the LCE-IRA research group in Aix-Marseille. Chemometrics tools will be then used for data treatment.

Outcomes (OCs) : What do we wish to achieve?

OC1:	Data collection and characterization of the air pollutants in Jounieh
OC2:	Identification of the sources of contamination
OC3 :	Building models to monitor air pollution and help improving air quality

References (R) (5 most recent peer-reviewed publications in the field)

R1:	Mattei, C., Wortham, H., Quivet, E., <i>Heterogeneous atmospheric degradation of current-use pesticides by nitrate radicals</i> , <i>Atmospheric Environment</i> (2019), 211, pp. 170-180
R2:	Mattei, C., Dupont, J., Wortham, H., Quivet, E., <i>Influence of pesticide concentration on their heterogeneous atmospheric degradation by ozone</i> , <i>Chemosphere</i> (2019), 228, pp. 75-82
R3 :	Morin, J., Gandolfo, A., Temime-Roussel, B., (...), Gligorovski, S., Wortham, H., <i>Application of a mineral binder to reduce VOC emissions from indoor photocatalytic paints</i> , <i>Building and Environment</i> (2019), 156, pp. 225-232
R4 :	Mattei, C., Wortham, H., Quivet, E., <i>Heterogeneous degradation of pesticides by OH radicals in the atmosphere: Influence of humidity and particle type on the kinetics</i> , <i>Science of the Total Environment</i> (2019), 664, pp. 1084-1094
R5 :	Strekowski, R.S., Alvarez, C., Petrov-Stojanović, J., Hagebaum-Reignier, D., Wortham, H., <i>Theoretical chemical ionization rate constants of the concurrent reactions of hydronium ions (H₃O⁺) and oxygen ions (O²⁺) with selected organic iodides</i> , <i>Journal of Mass Spectrometry</i> (2019), 54(5), pp. 422-428