Politecnico di Torino

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SUSTAINABLE MATERIALS, PROCESSES AND SYSTEMS FOR ENERGY TRANSITION

DM352-Comparative determination of environmental impact of technologies for a Sustainable mobility

Funded By	MINISTERO DELL'UNIVERSITA' E DELLA RICERCA [P.iva/CF:97429780584] UNIVERSITA' DEGLI STUDI DI NAPOLI FEDERICO II [P.iva/CF:00876220633]
Supervisor	LAMBERTI ANDREA - andrea.lamberti@polito.it
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Context of the research activity	The energy efficiency and the environmental impact of new technologies for a sustainable mobility strongly depend on fuel characteristics. The objective of this PhD research theme is the development of new procedures and protocols for the comparative determination of the environmental impact of innovative fuels including hydrogenated oils, oxygenated compounds, bio-derived oils, synthetic fuels and hydrogen blending
	Scholarship financed in the frame of DM 352/2022 by Università di Napoli Federico II/Eni SpA/MUR CUP: E12B22000920005 Main seat to carry out the research: Dipartimento di Ingegneria Chimica, dei Materiali e della Produzione Industriale, Università di Napoli Federico II (Napoli) Supervisor: Andrea D'Anna (andrea.danna@unina.it) Vehicles contribute to atmospheric pollution not just through their direct emissions measured at the tailpipe (primary pollutants) but, even more significantly, through photo-oxidation and gas-to-particle processes of initially gaseous exhaust components (secondary pollutants). Recent studies have shown that secondary particulate matter (PM) generated from combustion exhausts can be significantly larger than primary PM emissions. The effect of fuel characteristics and operating conditions on the formation of secondary aerosol (SA) is still controversial. Moreover, emerging fuels and/or new fuel formulations, because of existing differences in conventional fuel composition, may have impacts on SA yield not known or even predictable. Therefore, the effects of strategic reformulation or alternative fuels require further study. This aspect has induced the Università degli Studi di Napoli Federico II to

Objectives	study in collaboration with Eni the combustion behaviours and the propensity to form primary particulates and secondary PM precursors of new formulations fuels and their hydrogen blending. Moreover, we would develop and propose a measure protocol, based on smog chamber experiments, to simulate secondary aerosol mass formation potential in order to correlate fuel composition with SA formation. The combustion behaviours of the innovative reformulated fuels will be characterized in terms of fame stability and pollutant formation. In particular, besides the standard emitted pollutants, the experimental activities will be focused on the formation of particulate matter covering the entire range of particle sizes, from 1nm to 10 µm. By the use of an advanced differential mobility analyser and of advanced diagnostic techniques based on laser induced emission spectroscopy, the primary emission yields will be measured and correlated with fuel chemical composition. The propensity of primary emissions to form SA will be tested by using a photo-oxidation reactor fed with the exhausts of passenger-car engines run in different operating conditions and with different fuels. The PhD research program will take advance from the experimental diagnostics available in Napoli at the Università Federico II and in Eni, Milano, in the Emissions Lab. At Università di Napoli Federico II we have recently acquired, in the framework of the ACTRIS-IT project, an oxidation chamber simulating the photochemical transformation in the atmosphere (Oxidation Flow Reactor) and an Aerosol Mass Spectrometer with a soot probe (SP-Hr-TOF-MS). We had already available particle size measurement facilities (Scanning Measuring Particle Sizers and Differential Mobility Analyzers with resolution down to 1 nm and Electrical Low Pressure Impactors) and other measuring techniques for pollutants. All the equipment is hosted in the “Near-Surface Aerosol” lab at Napoli San Giovanni university site. An atmospheric oxidation modelling will be developed to complement the experimental activities.

Skills and competencies for the development of the activity	The candidate should have preferrably a background in chemical or mechanical engineering with skills in physic and chemistry of large molecules, clusters and condensed phase matter.