Impact of fuel composition on primary and secondary aeronautic emissions: gaseous and particulate chemical characterization at molecular level

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One of the actual concerns of aviation industry is to reduce its impact on climate and air quality using for example Sustainable Aviation Fuels (SAF, [1]). As part of the UNREAL Project [2], the objective of this work was to study and compare chemically, at a molecular level, gaseous and particulate phases of primary and secondary emissions from various aircraft fuels, from the standard Jet A-1 to 100 % SAF (Alcohol to Jet). Related emissions from a liquid CAST burner [3] were injected into an atmospheric chamber (CESAM), and in parallel, into a Potential Aerosol Mass Oxidation Flow Reactor (PAM-OFR) to age the emissions (OH reactivity in both cases). To collect these fresh and aged particles, a system with two quartz fiber filters was used: the Front Filter (FF) traps the particulate phase while the Back Filter (BF) is coated with activated carbon to retain the gas phase [4]. Samples were analyzed with a Two-Step Laser Mass Spectrometry (L2MS) technique to study the chemical composition of emissions, in particular Polycyclic Aromatic Compounds (PAC) and sulfur such as SO2, SO3 or H2SO4. The chemical composition of the filter-deposited samples is compared to on-line measurements performed by an Aerosol Mass Spectrometer and an Aerosol Chemical Speciation Monitor for particles, and a Proton Transfer Reaction Mass Spectrometer (PTRMS) for gaseous species. A comparison of the primary and aged emission molecular chemical fingerprints obtained, as well as between both atmospheric reactors (CESAM vs PAM-OFR), will be proposed.

This work benefited from the support of the project UNREAL ANR-18-CE22-0019 of the French National Research Agency (ANR).

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