# Cloud condensation nuclei activation of Diesel and Kerosene flame soot particles aged in a smog chamber.

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Gas and particles emitted by jet aircraft engines lead to the formation of contrails in the upper troposphere that may evolve in persistent cirrus-like clouds when atmospheric conditions are favorable. The detailed mechanisms of the formation of contrails are still not well understood but it is assumed that soot particles may act as cloud condensation nuclei (CCN) or ice nuclei (IN). As soon as soot particles are ejected in the atmosphere, they undergo rapid chemical and physical transformation including photochemistry and radical chemistry on the surface, condensation of low-volatility species, change of size and/or morphology. In order to better describe the formation of CCNs from soot particles, each of these fundamental processes should be investigated using model soot particles and well controlled simulated atmospheric conditions. New experiments have been set-up in order to study the change of soot particles into cloud condensation nuclei due to atmospheric aging. Briefly, soot particles are sampled from a jet turbulent diffusion flame supplied with Diesel or Kerosene fuel using a home-made quartz diluting probe and introduced in the atmospheric simulation chamber CESAM(1) . Changes of the particle hygroscopicity have been studied by measuring their activation for three different sets of simulated atmospheric conditions in the chamber: irradiation by Xe lamps to simulate solar light, oxidation by ozone and oxidation by OH radicals. In the latter case, the CCN activation curves reach a plateau for supersaturation higher than 0.8% that leads to the determination of the critical supersaturation ($S_c$). All results are then used with $\kappa$-Köhler theory (2) in order to derive a single hygroscopicity parameter $\kappa$. Although the data analysis is still in progress, some early conclusions can be addressed already. The critical supersaturation is almost the same when comparing Diesel flame and Kerosene flame. For both fuels, soot particles become rapidly hydrophilic when OH radicals are generated in the simulation chamber. These original results bring new insight for understanding the process which transform soot particles into CCNs and give new insights on the formation mechanisms of contrails.

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(1) Wang et al, Atmos. Tech. Discuss., 4:315-384, 2011.

(2) Petters M. D. and Kreidenweis S. M., Atmos. Chem. Phys., 7, 1961-1971, 2007