

Impact of a diesel car on primary and secondary organic aerosols

R. Chirico, M. Heringa, P. DeCarlo, T. Tritscher, M. Steiger, E. Weingartner, G. Wehrle, R. Richter, A.S.H. Prevot, and U. Baltensperger
Laboratory of Atmospheric Chemistry, Paul Scherrer Institut
5232 Villigen PSI, Switzerland

Recent findings have shown that the particulate matter with a diameter lower than 2.5 μm (PM_{2.5}) emitted by a diesel power generator can decrease by 50% when the dilution ratio is increased from 20:1 to 350:1 (Lipsky and Robinson, 2006). This decrease is because primary organic aerosol (POA) contains semi-volatile organic compounds (SVOCs) that can evaporate. In the atmosphere these compounds can participate in photochemical reactions which generate products that have a lower volatility than the parent compounds and can condense onto pre-existing aerosol particles as secondary organic aerosol (Robinson, et al., 2007).

Photo-oxidation experiments were performed on diesel exhaust produced from a EURO 3 diesel car under different engine loads and at different dilution factors in the Paul Scherrer Institut (PSI) smog chamber. At high dilution, fresh aerosols consist mainly of black carbon (BC) with a low fraction of organic matter while a typical photo-oxidation experiment shows a substantial increase of organic aerosol. In fact, UV-initiated oxidation of diesel exhaust rapidly produces SOA which leads to an increased OM/BC ratio.

SOA production could be explained by a first condensation of photoemitting organic material such as polyaromatic compounds followed by a condensation of non-photoemitting compounds (Bukowiecki, et al., 2002).

References

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