Morin J.P. / INSERM Rouen France

Pro-oxidant impact of Diesel engine emissions according to fuel and after-treatment strategies : in vitro and in vivo evidences.

The antioxidant profile assessed through the measurement of Catalase (CAT), Gluthathione peroxidase (GPx), Superoxide dismutase (SOD) and Glutathione (GSH) has been assessed in lung, heart, liver, kidneys of rats exposed by inhalation to diluted Diesel engine emissions on the one hand and in rat lung slices in organotypic cultures exposed to the same aerosols.
In vivo in the rat, systemic oxidant stress has been evidenced in lung, liver and kidney tissues, as well as increased serum TNFalpha concentrations reflecting systemic inflammation. These in vivo data are in total agrreement and validate the observations made in vitro in the rat lung slices model.
In the absence of emission after-treatment system, oxidative damage was increased when reducing sulphur content in the fuel in a concentration related way.
For a given fuel, oxidative damage was more marked at medium rpm and medium load than at medium rpm high load.
The use of oxidation catalyst proved to induce the highest oxidative damage on both in vitro and in vivo systems. The oxidative damage after oxidation catalyst appears to be modulated by the presence of a particle filtrer on the exhaust line.
These data show consistant parallelism with the NO2/NOx ratio in the emissions (used as a marker of the pro-oxidant potential of the emissions) as discussed for in vitro data during the 8th ETH meeting.
From a recently developed technique consisting in aerosol reactive oxygen species (ROS) trapping with spin traps and subsequent electron spin resonance measurement, we demonstrate a very good correlation between the NO2/NOx ratio elevation and the increased occurrence of ROS emitted from Diesel engines.
We suggest that these emitted ROS present in the combustion aerosol are a major candidate being responsible for the observed tissular and systemic oxidantive stresses. Further studies will be conducted to identify and assay separately the major ROS occurrence according to the experimental setup.
Supports from EC QLK4-CT62002-02357 MAAPHRI program, ADEME, Direction Generale de la Sante and Région Haute Normandie are greatly acknowledged

back to index