

Morin J.-P. / University of Rouen

Lung toxicity emission NO₂/NO_x versus particulate matter in vitro and in vivo

The aim of the present study was to assess the respective lung toxicity contributions of PM phase and gaseous phase of Diesel engine emissions. This study was conducted in vitro on rat lung tissue in organotypic cultures exposed in a bi-phasic system to continuously sampled and diluted Diesel engine emissions with highly preserved physicochemical properties as described by Morin et al. (1999) LePrieur et al. (2000) and Bion et al. (2002). Soot content and size distribution were measured using an AVL415 reflectometer and SMPS respectively. CO, CO₂, NO, NO₂, HC and O₂ were measured using a Horiba Mexa 7000 analyser. To evaluate the respective effects of gases and PM on rat lung slices, more than 99.99% of DEPs are removed from the test atmosphere thanks to filter placed downstream the sampling line. This filtration which allowed to remove soot from the emissions did not modify the gaseous fraction characteristics. Engine was operated at different speeds, loads with various fuel qualities, and after treatment devices in order to quantitatively modulate pollutant emission. Inflammatory reaction and oxidative stress were characterized in lung tissue as acute toxicity endpoints. Beside the wellknown impact of PM emission, we have identified that the most significant trigger of toxicity reaction was the NO₂/NO ratio in the exhaust which varied from less than 0.1 up to more than 1.2, with very few modification of total NO_x. The observed alteration of CO, HC, and total NO_x were of little amplitude and could not be assigned as playing a major role in triggering the toxic lung response.

We could only evidence a role for PM for low concomittant NO₂/NO ratios (<0.2) while at higher NO₂/NO ratio, emission filtration did not modify the toxicity response pattern thus pointing out to a higher toxic impact of the gaseous phase compared to the PM phase itself. For the highest NO₂/NO ratios, we even observed lung tissue cytotoxicity and cell necrosis. We at present suggest that NO₂/NO ratio could be a good marker of the pro-oxidant potential of combustion engine emissions and could also be considered as a useful candidate-tracer of subsequent detrimental biological impact of these emissions when characterizing the potential biological safety of after-treatment devices. It is to date too early to state about the specific NO₂ action in these emissions which will be studied in a close future.

Supports from EC QLK4-CT62002-02357 MAAPHRI program and Région Haute Normandie are greatly acknowledged

[back to index](#)