Emissions of passenger cars with different engine and aftertreatment technologies

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INRODUCTION

Legislative actions and technological development of engines and aftertreatment systems have significantly cut exhaust emissions of vehicles. For instance, NO_x and PM emissions of diesel vehicles have decreased as well as THC emissions in gasoline vehicles when shifting from older Euro 2 and Euro 5 levels to Euro 6 [1]. On the other hand, emissions of some components such as N_2O or NH_3 may even have increased [1].

METHODS

Emissions of passenger cars were tested on light-duty chassis dynamometer in a large joint measurement campaign. Emission measurement setup consisted of legislative measurements and large set of additional measurements. Here, gaseous emission data from Fourier-transform infrared spectrometer (FTIR, BOB-1000, Best Instruments Co. Ltd.) will be presented with focus on unregulated emission species.

Emission tests were conducted for 7 vehicles with different type of power train technologies and aftertreatment systems. Emission levels ranged from Euro 4 to the newest Euro 6. Two plug-in hybrid vehicles were included in the tests as well as one compressed natural gas (CNG) vehicle. Emission tests were conducted on a chassis dynamometer with a cycle derived from real driving. Temperatures in the dynamometer space were varied between -9 and 35 °C.

RESULTS

In general, the newest vehicles produced only low emission of traditional pollutants such as CO, NO, NO_2, especially compared to older Euro 4 diesel vehicle as illustrated in Figure 1 for NO_x. The newest vehicles with diesel engines produced more N_2O than other vehicles, see Figure 1. Euro 4 diesel vehicle produced similar N_2O concentrations as gasoline and CNG vehicles. The N_2O emissions were most likely originating from the exhaust aftertreatment system as an earlier study suggests [2]. NH_3 was detected from exhaust of vehicles with gasoline and natural gas engines, except one Euro 6 gasoline vehicle produced almost

zero NH_3 concentrations, similar to diesel vehicles. Previously, natural gas heavy-duty vehicles have been found to emit NH_3 [2], and our results indicate similar behaviour.

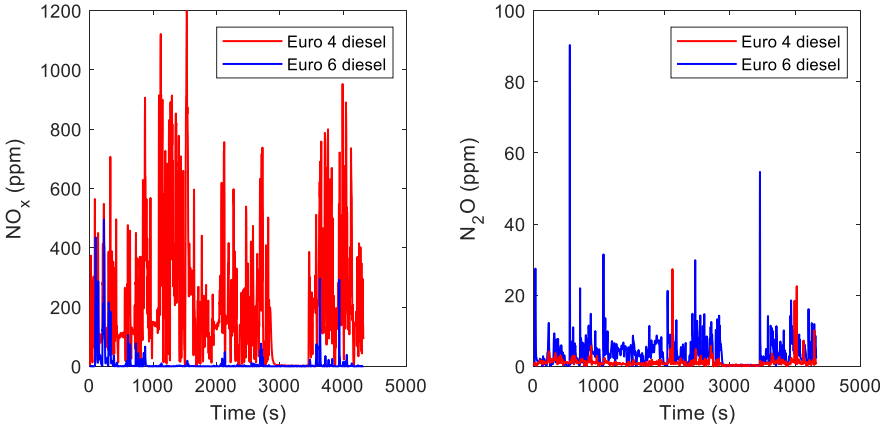

Figure 1. Example time series of NO_x and N_2O tailpipe concentrations from two diesel vehicles with different emission levels.

CONCLUSIONS

The newest technology was seen to cut most of the emissions species. However, components such as N_2O or NH_3 were emitted in similar or even higher levels by the newest vehicles.

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