

On-road particle emissions of passenger cars using portable emission measurement system

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Abstract

The paper presents the results of on-road exhaust emission tests of Passenger Cars fitted with diesel engines. Under such conditions the authors could determine the actual vehicle emissions. The tests were performed on a road portion of a hundred kilometers or so – these tests provide information on the on-road emissions and are a basis for their ecological evaluation. For the measurement of the exhaust emissions the authors used a Portable Exhaust Emissions System. The used data were averaged within individual speed and acceleration ranges thus obtaining the characteristics of the share of operation in individual ranges and the characteristics of the emission matrices of the individual emission components. The above results served for defining of the emission level indicator of the vehicles that can be used for classification of vehicle fleet in terms of their emission level).

Methods, Results and Discussion

The measurement of the on-road exhaust emission was performed under real traffic conditions: urban drive, extra urban, freeway in the province of Wielkopolska (Poland). The tests consisted in the measurement of the exhaust components (CO, HC, NO_x, particle mass and number for each vehicle) and then with the use of the GPS and OBD data the road emission of each exhaust component was determined.

The obtained data served to prepare the relations that characterize the influence of the dynamic engine properties on the exhaust emissions. Dynamic engine properties were indirectly taken into account, using the division of the whole range of speeds and accelerations under real traffic conditions to develop the matrices of emission intensity.

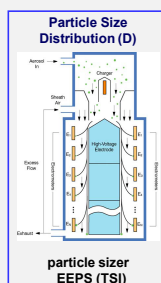
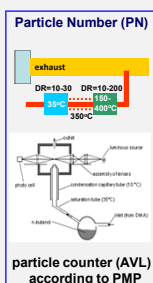
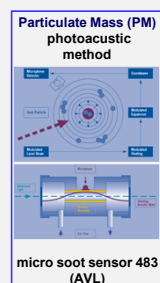
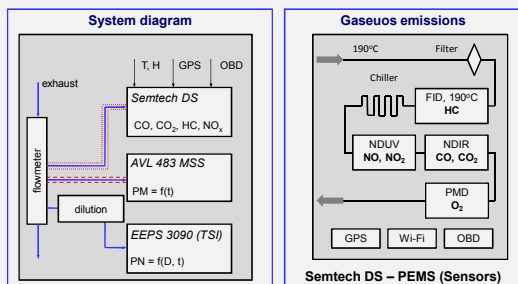
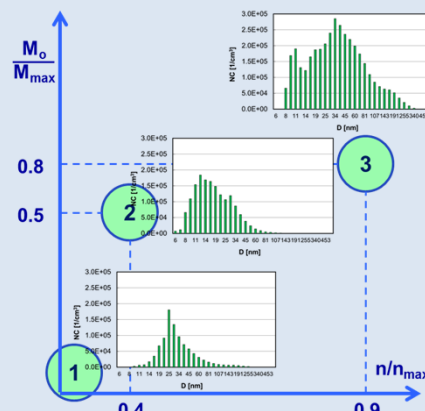
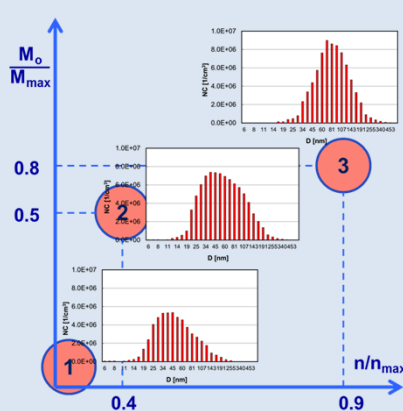
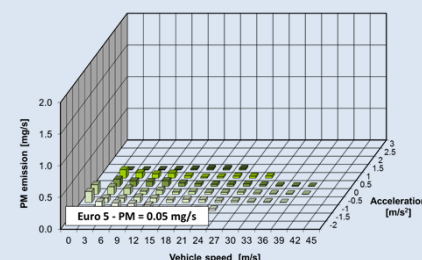
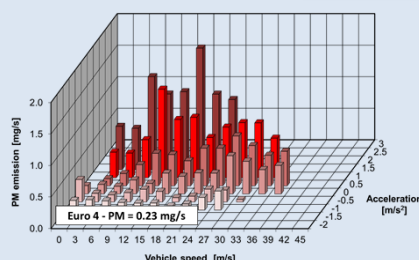
The obtained results of the duration of the road tests served for the verification of the hypothesis on the fulfillment or non-fulfillment of the normative regulations on the on-road emissions. Such a comparison served to determine the value of growth or reduction of the on-road vehicles emissions as opposed to the homologation tests.



Euro 4

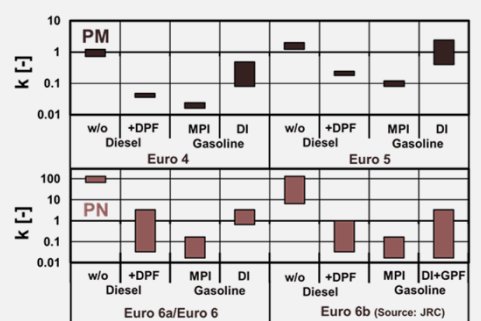


Euro 5



$$k_j = \frac{\sum_0^t E_{\text{real},j}}{E_{\text{normative},j}}$$

j – exhaust component, for which the emission indicator was determined
 $E_{\text{real},j}$ – on-road emission under real traffic from the start of the test (g/km)
 $E_{\text{normative},j}$ – normative on-road emission according to Euro 4/5 (g/km)



Conclusion

From the analysis of the data it results that the normative emission values for the tested SUV vehicles meeting different Euro emission standards and the on-road exhaust emission vary. These differences in the case of some exhaust components under analysis are significant – these are as follows:

- For the Euro 4 vehicle: CO is lower by 80%, HC is lower by 80%, NO_x is higher by 80%, PM is lower by 10%
- For the Euro 5 vehicle: CO is lower by 90%, HC is lower by 70%, NO_x is four times higher, PM is lower by 30%

The on-road emission tests indicate that in relation to some of the exhaust components the emission is several times higher. Hence, a trend is seen to legalize and enforce the on-road exhaust emission measurement in Europe.



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