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ŚLAD EMISJI POJAZDÓW W ŚRODOWISKU

Streszczenie: W artykule omówiono problem emisji pojazdów, biorąc pod uwagę obowiązujące limity emisji oraz procedurę certyfikacji, które były głównymi przyczynami tzw. afery "dieselgate". Celem niniejszego artykułu jest analiza emisji wybranych pojazdów przy użyciu różnych metodologii pomiarowych oraz porównanie otrzymanych wyników. W końcowej części pracy, przedyskutowano wpływ emisji pojazdów na środowisko.

Słowa kluczowe: pojazd, emisja, środowisko

EMISSION FOOTPRINT OF VEHICLES IN RELATION TO ENVIRONMENT

Summary:
This paper deals with the questions of vehicle emissions, taking into consideration the valid emission limits and certification procedure, which were the main causes of the known "dieselgate" affair. The aim of this article is emission analysis of the selected vehicles using different measurement methodologies as well as comparison of the obtained results. Finally, the article discusses an impact of vehicle emissions on the environment.

Keywords: vehicle, emission , environment

1. Introduction

Testing of the vehicles in Europe using the Portable Emissions Measurement Systems indicated already from the year 2007 an unfavorable fact that the light diesel engine vehicles, certified according to the standard Euro 4, 5 and 6, are producing several times more NO_X emissions than it is permitted by the corresponding emission limits [1-3]. This exceeding of the limits was caused due to several failures occurring in the approval procedures, namely due to low-level values of the vehicle acceleration and

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the narrow temperature range (from 20 to 30 °C) applied during the NEDC certification [4-6]. Nowadays these problems are solved by means of the Worldwide harmonized Light vehicles Test Procedure (WLTP) and the supplementary test Real-Driving Emissions (RDE). The analysis presented in this article includes 10 passenger motorcars tested by means of the NEDC under the laboratory conditions and on various routes in real transport. This presented research offers an alternative solution how to verify the vehicles and it enables identification of such vehicles that require a deeper evaluation of their capability.

2. Experimental methods and results

There were applied together 10 passengers cars in the role of experimental models, whereby three cars were equipped with the gasoline engines conforming to the emission standard Euro 5 and another seven cars were the diesel engine vehicles conforming to the standards Euro 4 ÷ 6 (Fig. 1-2). All the laboratory tests and also the road traffic tests are standardly performed using the customary fuels that are in accordance with the European Direction 2009/30/EU as well as according to the specifications defined by the automobile producer. The laboratory emission tests were realised on a testing stand and the NO_X and CO_2 emissions were determined with an analyser [7]. Measuring of the NO_X and CO_2 emissions in the case of the real road traffic was performed by means of the Portable Emissions Measurement System. The ambient temperature was measured at 1 Hz and the atmospheric probe is an integrated part of the measuring equipment. The momentary values of the NO_X and CO_2 emissions on terms of the real traffic are calculated according to the Direction 2016/427 (EU, 2016) with the frequency 1 Hz, using multiplication of the polluting substance concentrations by the mass flow of exhaust gases.

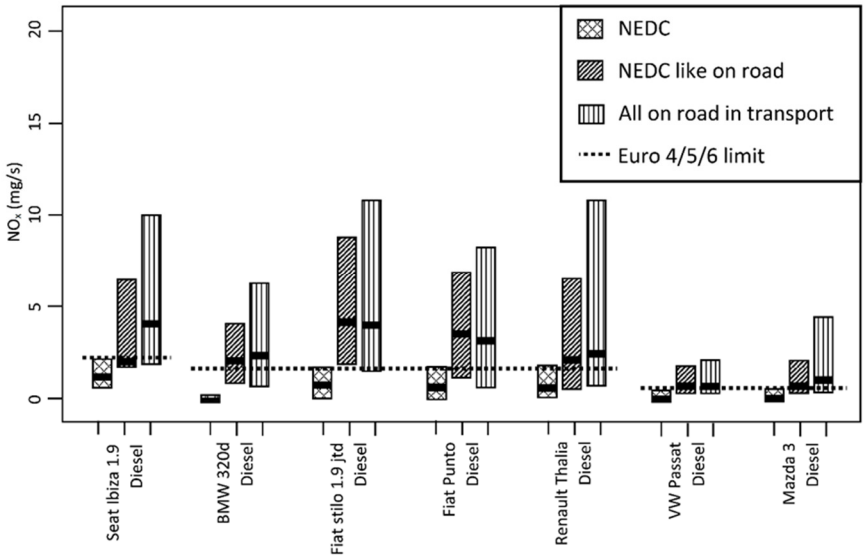

Figure 1. The column graphs of the NO_X emissions (mg/s) for diesel vehicles

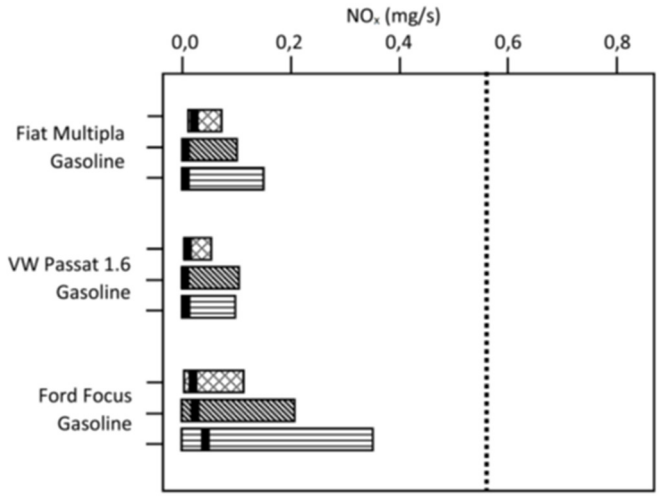

Figure 2. The column graphs of the NO_X emissions (mg/s) for gasoline vehicles

3. Discussion

It is possible to claim that the vehicles equipped with the diesel engines and gasoline engines have a tendency to fulfil the requirements of the corresponding emission standards in the case of the NEDC testing. The NO_X emission values (mg/s) of the diesel vehicles are presented in Fig. 1 using the column graphs and the NO_X emission values (mg/s) of the gasoline vehicles are given in Fig.2 analogically. It is evident from the column graphs presented in Fig.1 that most of the momentary NO_X emission values of all vehicles are situated below the emission limit during the NEDC testing (Fig. 3, the left columns in graphs). This fact corresponds to the above-mentioned statement. However, there are recorded significant differences in the case of data obtained on the road, because in this situation most of the momentary diesel engine emission values are highly exceeding the emission limit (Fig.1, the right columns in graphs). The on road NO_X emission values of the gasoline engines are also higher than the NEDC emissions, but they are always below the emission limit. If there are selected only driving conditions similar to NEDC, so the graphs (median values) mostly overlap the NEDC fields (Fig.2, the middle columns in graphs). This part of the analysis indicates a significantly different behaviour of the diesel vehicles during the NEDC testing in comparison with the drives on road using conditions similar to certification procedure.

4. Conclusions

The tested vehicles equipped with the diesel engines officially fulfil the emission standards Euro 4 ÷ 6, however they are markedly exceeding the NO_X emission limits during real traffic drives (i.e. the so-called on-road NO_X emissions). A quite different

situation is monitored in the case of the gasoline vehicles because their on-road NO_X emissions remain under the valid limit. The presented conclusions clearly demonstrate a fact that the vehicles equipped with the gasoline engines have much smaller impact on environmental pollution and there are still existing possibilities to improve them in order their efficiency will be closer to the efficiency level of the diesel driving units.

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