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SUBSTANTIATION OF THE USING EXPEDIENCY THE COMPENSATORY SAMPLING GAS METHOD IN THE ENVIRONMENTAL DIAGNOSTICS SYSTEMS OF TRANSPORT DIESEL ENGINES

Polyvianchuk Andrii

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Petruk Roman

Doctor of Technical Sciences, Professor
Vinnytsia National Technical University

Semenenko Roman

Postgraduate Student
Vinnytsia National Technical University

Actuality of theme. Mobile sources of pollutant emissions from transport diesel engines - cars, buses, locomotives, tractors, etc. - make a significant contribution to the problem of urban air pollution by toxic combustion products of various fuels. To improve the environmental friendliness of these facilities, diesels are diagnosed according to the standardized indicators of exhaust gas toxicity (EG) using special equipment and measuring systems. One of such systems is a compact universal measuring complex with a microtunnel for control of particulate matter (PM) emissions from diesel engines of different types [1, 2]. This system simulates the natural process of PM entering the atmosphere by diluting the share of EG selected from the diesel exhaust pipe in a special pipeline - microtunnels with a diameter of ~ 3 cm and a length of ~ 30 cm [3, 4].

The urgent task of designing modern microtunnels is to choose an effective - accurate and inexpensive method of control of the EG sample, which enters from the diesel engine to the dilution pipeline of the EG tunnel. This method is indirect because the direct control of the EG sample is complicated by its high temperature - up to 600 °C, chemical aggressiveness and the presence of diesel PM. In order to solve this problem, the authors developed a compensatory method of control of EG sample (Fig. 1), proved its effectiveness by comparison with a known analogue - the differential

method used by microtunnels AVL SPC 472 [5] and experimentally confirmed the practical applicability of the proposed method during non-motorized tests of the gas sampling unit of the microtunnel [6].

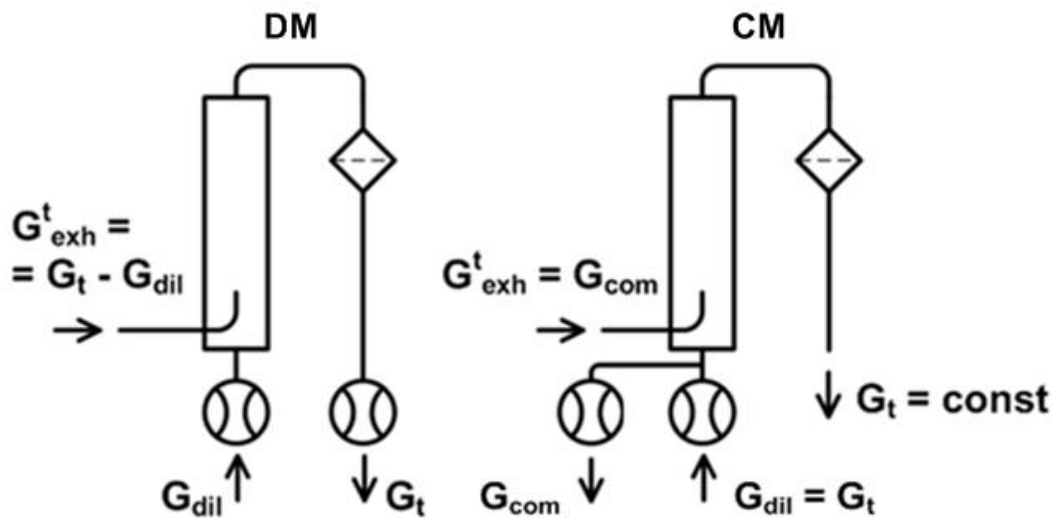


Figure 1. Principal diagrams of differential (DM) and compensation (CM) methods for measuring VG samples

Purpose: to develop, implement and confirm the practical applicability of the compensatory method of gas sample control in microtunnels, which is much cheaper than known analogues, in particular the differential method used in the measuring system AVL SPC 472.

Tasks: 1) analysis of differential and compensatory methods of sample control; 2) development of a method for calibration of flowmeters of the compensatory method of sample control; 3) development of a method for determining the value of the mass flow of the sample by the compensation method; 4) experimental evaluation of the accuracy of the compensatory method of sample control.

Research methods: analysis and synthesis of information, mathematical modeling, experimental planning, experimental research, computational experiment.

Research results. For experimental use of the offered method of sampling of EG the complex of applied techniques which allow to solve the following problems is developed: calibration of flowmeters of the sampling system; determination of the mass flow rate of the EG sample taken from the exhaust system of the transport diesel engine; adjustment of the coefficient of dilution of the EG sample with air in the tunnel.

These measures were implemented on the basis of a non-motorized test bench with MKT-2 microtunnel, which used standard narrowing devices - collector and diaphragm, designed in accordance with the established requirements to measure the mass flow of dilution and compensated air [6,7].

Scientific novelty: it is proposed to use a compensatory sample control method in microtunnels for the control of a hazardous urban air pollutant - diesel particulate matter, which is cheaper than the well-known analogue - the differential method used in the AVL SPC 472 microtunnel.

Practical value: experimentally confirmed that in the implementation of the compensatory method of sample control inexpensive flowmeters - standard narrowing devices with an accuracy class of 1.5 provide the required accuracy of measurements of dilution of exhaust gases with air with an error not exceeding the allowable value - $\pm 4\%$ and can be used in universal systems of ecological diagnostics of diesels - microtunnels.

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