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Abstract: The introduction in Russia of the Euro-5 standard and the tightening of rules on emissions of harmful substances has resulted in an overdue improvement in the methods and algorithms of calculation and design of toxicity decreasing systems to enhance the functioning of devices of these systems. Despite widespread methods of simulation and computer modelling for the study and testing of the proposed organizational and technical measures, it is relevant to assess the increase of exhaust recirculation motor units with the help of experimental studies. The purpose of the study is to evaluate emissions of harmful substances of the car exhaust and suggest an experimental device based on the apparatus and methodology for analysis of carbonyl compounds and volatile organic compounds. In assessing of the effectiveness of reducing the toxicity, significant attention is paid to methods of experimental studies. As an indicator of the effectiveness in reducing the toxicity of motor units, the volume of emissions of harmful substances was selected. The choice of the components of the experimental system for the automated processing of the environmental inspection results of motor vehicles was substantiated. These components are: software tools that implement the conduction of the test by a cold start of the engine and chassis dynamometer settings, as well as monitoring the progress of the experiment; interactive systems to transmit information between the posts of ecological police, private persons and legal entities, companies for the maintenance of vehicles.

1. Introduction
The introduction in Russia of the Euro-5 standard and the tightening of rules on emissions of harmful substances has resulted in an overdue improvement in the methods and algorithms of calculation and design of toxicity decreasing systems to enhance the functioning of devices of these systems. Despite widespread methods of simulation and computer modeling for the study and testing of the proposed organizational and technical measures, it is relevant to assess the increase of exhaust recirculation motor units with the help of experimental studies [1].

When testing standards for emissions of hazardous substances, the connection to a unified automated information system of technical inspection of motor vehicles (motor units) [2] shall be

provided for increasing the responsibility of technical inspectors for the more competent issuance of a diagnostic card or an international certificate of technical inspection of the vehicle (motor unit). However, the rules for inspection, when connected to a single information system remain unchanged.

The standards and methods of quantification of motor vehicle emissions and their danger to the environment and the biosphere are extremely difficult to implement in practice. European research methods are characterized by costly test processes using sophisticated equipment, and many measurement procedures are also difficult to implement in practice [3].

2. Method

For the purpose of studying the composition and quantity of the exhaust gases of a vehicle, a quantitative specific emission of each individual component of the composition of the exhaust gases based on engine load for one kilometer, taking into account regional environmental standards of background contamination of the surface layer of the atmosphere is usually determined [4]. In connection with the proposals for the replacement of vehicle tax for the environmental tax it is advisable to introduce environmental police posts which will be combined with inspection stations. For measurement of the quantitative composition of the exhaust gases of the vehicle on the ecological police posts it is advisable to use the instrument complex:

- Chassis dynamometer with a fan to blow air onto the vehicle during the test - This is necessary to simulate the air flow that cools the car.
- Classic electronic impactor with Teflon filters, which use accurate scales for weighing (the impactor is a device for fractional precipitation of aerosol particles).
- Portable pump for sampling the exhaust gases during the test.
- Special containers for samples of exhaust gases.
- Apparatus for high-performance liquid chromatography.
- Apparatus for gas chromatography of mass-spectrometry.
- Display on which the driver (environmental police officer) views the current parameters taken from the vehicle (momentum, work of the throttle, lambda-control, and so forth);
- Data collection system programmed for self-regulation of cold start tests on New European Driving Cycle.
- Personal computer (PC) with the necessary software to work with this equipment for ensuring the control of environmental standards of vehicles.

To study the composition and quantity of the exhaust gases it was proposed to identify the most harmful factors of the exhaust gases of the vehicle. The most toxic components of exhaust gases of gasoline engines are: carbon monoxide (CO), nitrogen oxides (NOx) and hydrocarbons (SnHm).

Carbon monoxide is produced during the combustion of fuel-air mixtures with a certain lack of oxygen, and also due to the dissociation of carbon dioxide that occurs at high temperatures.

The reason for the formation of hydrocarbons is heterogeneity of fuel-air mixture in the combustion chamber as well as uneven temperatures and pressures in various parts of the chamber. In some areas of the combustion chamber fuel is not consumed since there is a breakage of a chain reaction of hydrocarbon oxidation. Nitrogen oxides in the exhaust gases are formed due to the reversible oxidation of nitrogen with oxygen under high temperatures and pressure in the combustion chamber. The Increasing of the maximum temperature of the work cycle and an excess of oxygen are the main factors for the formation of nitrogen oxides. PC software is used to communicate all of the hardware installation, obtaining the experimental values from this hardware, the conduction of cold start test of the engine and setting the chassis dynamometer, as well as monitoring the progress of the experiment.

The ecological cleanliness of exhaust must lie in the construction of domestic aggregates and motor vehicles at the design stage. Furthermore, the operating characteristics of toxicity should remain stable [5].

This research method can be applied to domestic cars at the development stage, and also for monitoring the environmental performance of exhaust (especially considering the fact that the vehicles with environmental class lower than the Euro 3 are prohibited from entering the Third Ring Road).

Multi-Automated Information System (MIS) for the processing of the results of environmental inspection of vehicles that is produced after appropriate examination. The MIS will include expert subsystem of diagnostics and forecasting. Expertise includes experimental measurement on the stand by the environmental police officers through specialized interfaces and a single database, ensuring the integrity and availability of personal data during their processing. The results of the examination and information about how the test of assessing motor unit exhaust was conducted must be available to employees of service stations to collect information for better understanding of what criteria the exhaust gases have been exceeded. This is necessary for a more accurate and rapid determination of what is not working properly, because some errors cannot be recorded in the driving unit of the vehicle.

3. The implementation of environmental control at the Centre of traffic management (CTM) and use of Automated Data Processing Center (ADPC)

The realization of ecological monitoring of vehicles was proposed with the assistance of CTM, the structure of which is shown in Fig. 1. Special positions for measuring the environmental performance of cars and trucks must be set up. Some systems of CTM are already well-developed, for example, automated traffic management system (ATMS). A hardware-software complex information system is used for the automated processing of the results of environmental inspection of motor vehicles during the implementation phase. Organizational and technical procedures for the sustainable functioning of the complex have yet to be developed [6].
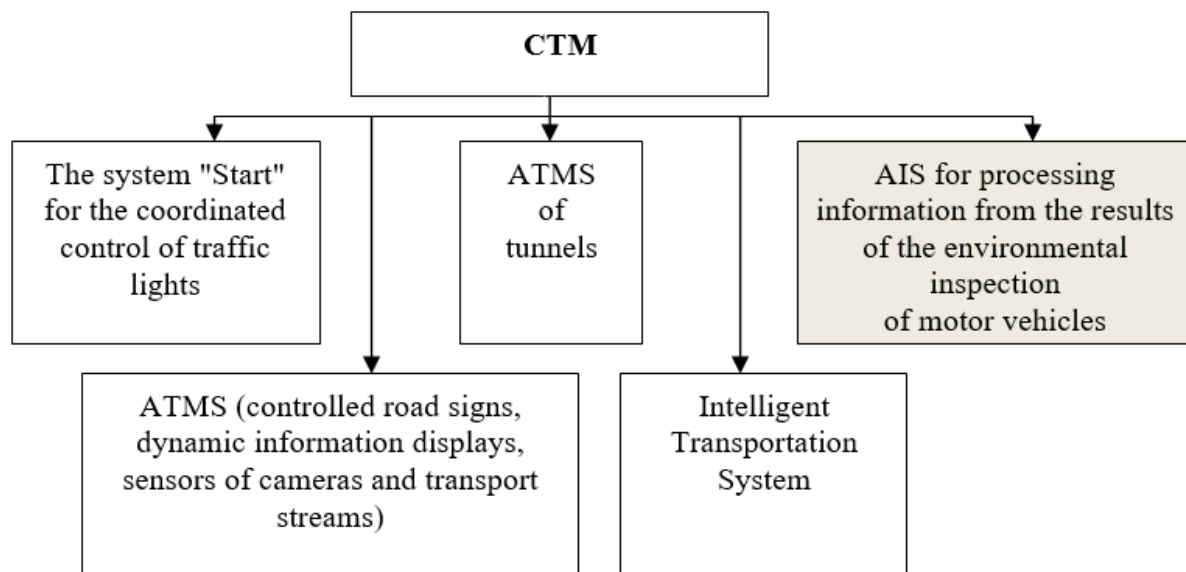
Figure 1. Structure of the CTM.

Functions of AIS that are developed for the processing of the results of motor vehicles environmental:
- Reducing the number of vehicles with poor environmental performance;
- Analysis of carbonyl compounds and volatile organic compounds;
- Analysis of particulate emissions;
- Informing drivers about the requirements for the environmental performance of vehicles.

Expert subsystem will use the Automated Data Processing Center (ADPC) to gain access to databases of traffic safety inspection. For information on vehicle registration and information about the driver, as well as for checking from where the car was sent to the environmental emissions test centre. For example, vehicles with an ecological class lower than Euro 2 are forbidden within the

MKAD ring road, and vehicles with an ecological class lower than Euro 3 are forbidden within the TTR (third transport ring). In the event of a car being stopped within the TTR and sent to the test centre, it became clear in the test that its environmental class was below the permissible level in this area. The test results are then sent to the Department of Traffic Safety Inspectorate, in which the car is registered, for reconciliation with the traffic officer. The traffic officer, according to the test results, will write the decision of an administrative offence. It is necessary to develop a resource (knowledge base), where information about a particular car and standards for exhaust will be available and regulated by the manufacturer, the test results and information about the factors of external and internal environment during the test (room temperature, pressure, humidity, amount of fuel), as well as all information about how the test was conducted.

This is necessary to ensure that in cases where the vehicle does not pass the test for ecological compatibility of exhaust on various parameters, or passes, but its ecological class is lower than that stated by the manufacturer (say the passport vehicle complies with environmental class Euro-6, and the test showed that the ecological class of the car matches only Euro-4), specialized service stations (SSS) can access this information for a better understanding of which particular node in the car may not be working properly, as some errors are not recorded in the control unit of the car, for example the swirl flaps in the intake manifold on the Volvo XC70 with the motor D4 are not always recorded in the control unit and can adversely affect the ecological compatibility of the exhaust, and the driver will be unaware of this.

The opportunity for responsible citizens, who want their car to be environmentally-friendly, to register for a test over the Internet should exist, and partitions must be created for private and legal entities if a transport company wants to test a fleet of vehicles to avoid problems that may arise in the event of violations of environmental regulations. It is essential that companies that conduct technical inspections have access to information about tests for environmental friendliness so that they have enough information to decide on the car's technical condition – a diagnostic card, which is required for obtaining insurance on Vehicles from 2019.

4. Conclusions
An experimental device for evaluating the exhaust of the car is suggested, based on the apparatus and methodology for analysis of carbonyl compounds and volatile organic compounds. The device is implemented in practice. Compared regulated and unregulated emissions, including particulate matter from both gasoline and gasohol types of fuel.

Additional analysis of fuel economy, along with the possibility of predicting the health impact when burning the fuel with low methanol content, as an alternative was substantiated. Also, the choice of the components of the ES for the automated processing of the environmental inspection results of motor vehicles was substantiated. These components are: software tools that implement the test by a cold start of the engine and chassis dynamometer settings, as well as monitoring the progress of the experiment; interactive systems to transmit information between the posts of ecological police, private persons and legal entities, companies for the maintenance of vehicles.

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