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IMPROVED EXTINGUISHER 'S LABORATORY TESTS

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Abstract. This article presents the results of improving the design of the exhaust gas exhaust system (suppressor) of internal combustion engines and evaluating its environmental and energy efficiency in laboratory conditions. The study proposes a method for additional combustion of unburned hydrocarbons in the exhaust gases by installing one and two spark plugs in the intake pipe of the suppressor. The experiments were conducted on a special laboratory stand based on the RU-1500 electric generator engine, and the engine power, fuel consumption, and the amounts of CO, CH, and NO_x in the exhaust gases were analyzed. The test results showed a decrease in fuel consumption, a slight increase in engine power, and a significant decrease in the amount of toxic gases when using the improved suppressor. In particular, the design with two spark plugs demonstrated the highest efficiency and was recommended as a promising solution for further research.

Keywords: improved muffler, internal combustion engine, exhaust gases, laboratory tests, spark plug, exhaust system, carbon monoxide (CO), hydrocarbons (CH), nitrogen oxides (NO_x), fuel consumption, environmental performance, engine power, emissions, automobile, environmental safety.

The task of reducing the amount of toxic compounds in exhaust gases from automobiles is recognized as one of the global environmental problems worldwide . As a result of the annual increase in the number of vehicles , carbon monoxide (CO), hydrocarbons (CH) and nitrogen oxides (NO_x) contained in exhaust gases from automobiles are released into the atmosphere . and particulate matter have a serious negative impact on human health and the environmental balance. Therefore, developed and developing countries are implementing comprehensive measures aimed at solving this problem . In particular , improving internal combustion engines, using environmentally friendly and alternative fuels, and increasing the efficiency of catalysts and exhaust gas particulate filters. Extensive scientific and technical research is being conducted on [1-3] .

In addition , the level of control over the amount of toxic compounds in exhaust gases from transport is being increased through strict emission standards, improved testing methods, and the establishment of low-emission zones in urban environments . The results of the research confirm that *reducing* the amount of toxic compounds in exhaust gases from cars directly depends not only on technical solutions, but also on environmental policy, driving culture and environmental responsibility of society. As a result, scientific research and practical developments in this area are of great scientific and practical importance in ensuring the environmental safety of vehicles , improving atmospheric air quality and achieving sustainable development goals . At the same time, improving the environmental characteristics of cars , improving their quality and efficiency Special attention is paid to its implementation .

of the policy of reducing the amount of toxic compounds in exhaust gases from cars in our republic , several strategic directions have been identified. In particular, the gradual restriction of the movement of vehicles that do not meet Euro standards in central urban areas- The amount of toxic substances emitted into the atmosphere is significantly reduced. It is of great importance to conduct

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scientific research on reducing the amount of toxic compounds contained in exhaust gases emitted into the atmosphere from vehicles in use in our republic [4].

Exhaust gas exhaust system (silencer) is a device used to reduce the noise of gases or air from various devices emitted into the atmosphere. In ventilation systems, silencers are used to reduce the noise transmitted through the ducts from ventilation equipment.

At one time, cars were produced without mufflers at all. Clouds of smoke emerged from the short exhaust pipes, which made a terrible noise that was completely out of proportion to the small performance of the engines of that time. However, the complaints of pedestrians around (who were more numerous than cars at that time), as well as the fear of horses (horses were the main traction force in transport at that time), led to the need for noise reduction devices. The first muffler was installed on the Panard-Levassor car in 1897 [5] .

First extinguisher Since its introduction on the automobile, all mufflers manufactured to this day use the same operating and structural principles as in 1897. The evolution of muffler design has continued, mainly in terms of improving the composition of the materials used in its construction (for the housing, resonator, conductor and other parts) and manufacturing technology.

Current extinguishers are a metal body suspended on rubber supports, with a hole in the inside. There is a system of pipes and chambers. The exhaust gases lose energy and, accordingly, volume in them, forming a ring. And only after the muffler is the car's exhaust pipe sent out .

The design of the mufflers is very simple, but very precise. Inside the mufflers there is a mesh-like inner part that absorbs sound waves, and then pipes with holes that direct them outward. The sound waves enter through the central tube, hit the back wall, pass through the hole, enter the central chamber, and are attenuated and exit.

However, currently manufactured extinguishers fail to capture and release unburned hydrocarbons, carbon monoxide , nitrogen oxides, and sulfur oxides [6] .

In order to improve the engine power, fuel consumption and toxicity of exhaust gases by burning unburned hydrocarbons in the engine cylinders in the exhaust, we proposed to install a spark plug at the beginning of the exhaust - in the intake pipe . For this, as an example, the exhaust of the Onix and Kobalt cars manufactured by UzAvtodvigatels JSC (Fig . 1) was improved, that is, spark plugs were placed in the initial intake pipe of the exhaust (Fig. 2) [7] .

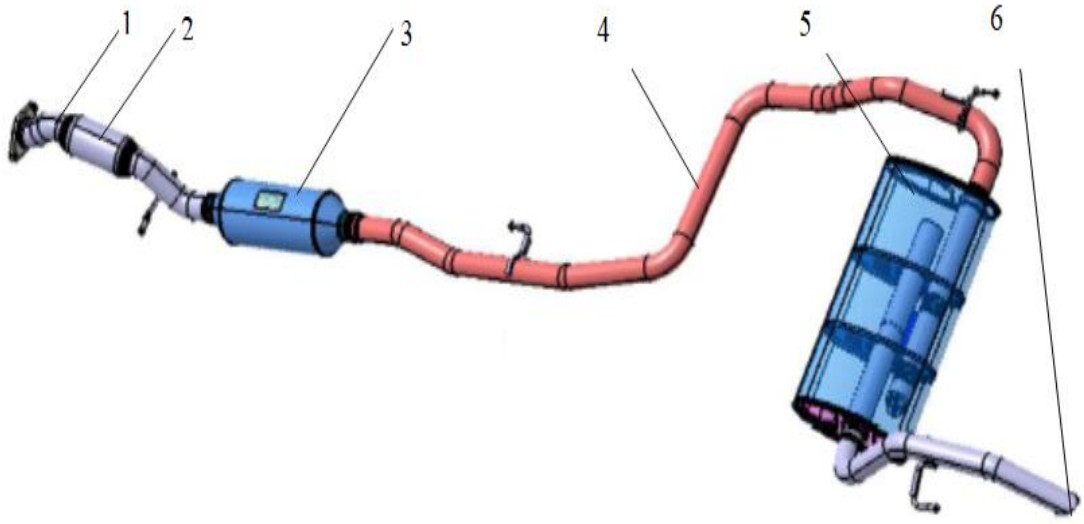
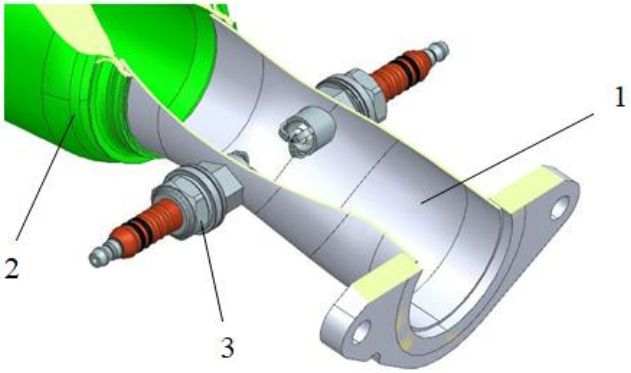


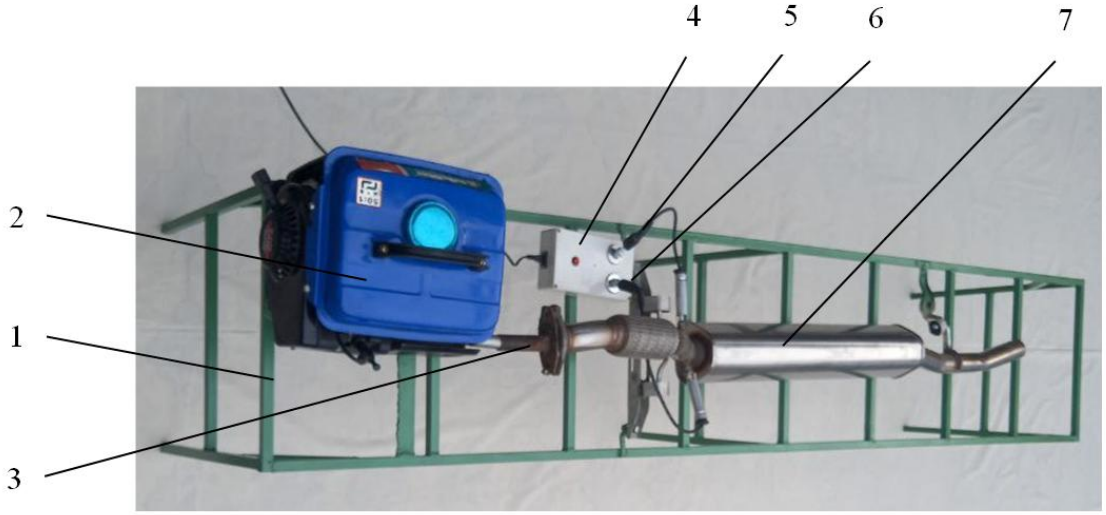
Figure 1. “ Onix ” car engine worked gases exhaust system: 1-intake pipe ; 2-corrugation; 3-resonator; 4- middle pipe ; 5- muffler; 6- rear pipe

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2 - Fig. Improved exhaust system of the Onix car (top view): 1- intake pipe; 2- corrugation; 3- spark plugs.

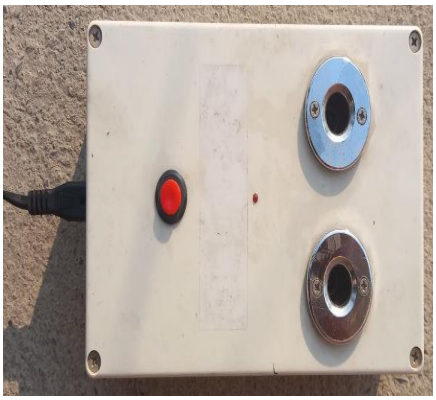
First of all, for the experiments, the exhaust system-suppressor of the “Onix” car (Figure 1) and the RU-1500 electric generator (Russia) with an internal combustion engine were purchased for preliminary testing in laboratory conditions (Figures III.4.1). Also , the laboratory tests transfer for special experience stand (Figure 3) was made [8] .



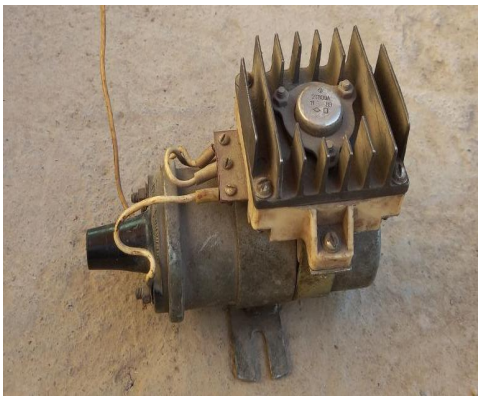
3 . Laboratory tests transfer for made stand : 1- frame ; 2- interior combustion with engine RU-1500 electric generator (Russia) ; 3- generator extinguisher ; 4- spark plug harvest 5- first grass shaving candle ; 6th second grass shaving candle ; 7- " Onix " car extinguisher .

plugs are used to burn off toxic substances contained in the exhaust gases of the engine. necessary was sparkly discharge device A device that operates on a 220 V power line and a device with an ignition coil that operates on a 12 V power line using harvest (Figure 4) [9] .

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a



b

Figure 4 . **If** the following devices are not designed to burn toxic substances contained in the exhaust gases of the engine : a- a device operating on a 220 V power supply ; b- a device with an ignition coil operating on a 12 V power supply .

Laboratory in the conditions tests 1 herb shaving candlestick device from trying started (Figure 5) . Efficiency further increase for the purpose 2 herbs shaving candlestick device (Figure 6) also tested was held .

Tests in evaluation Data from the KP836 Portable multi-gas detector gas analyzer were used (Figure 7) .



Figure 5. 1 piece of grass shaving candlestick device test



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Figure 6. 2 grasses shaving candlestick device test





Figure 7. KP836 Portable multi-gas detector gas analyzer

Table 1 .
In laboratory conditions , of tests results

No.	Engine Types of excretory system	Number of revolutions of the crankshaft , rpm	From the generator came out vine voltage , V	Engine power, kW	Fuel consumption, l/h	CO content in exhaust gases, %	Worked CH in gases amount of medicine , %	Worked NOx in gases amount of medicine , %
1.	Standard exhaust system (control)	1 3 0 0	210	1.3 2	1.58	4.06	8 ,1 3	3 , 24
2.	Release to the system 1 spark plug installed	1 3 0 0	211	1.3 2	1.57	2 ,2 9	4 ,2 5	2 , 59
3.	Release to the system 2 spark plugs installed	1 3 0 0	213	1.3 3	1.56	1.8 8	2 , 96	1 , 72

The test results show that when the engine of the experimental RU-1500 electric generator (Russia) was operated with a conventional exhaust system (control), the engine power was 1.32 kW, and the fuel consumption was 1.58 l/h. When operating with 1 spark plug installed in the exhaust system (option 2), the engine power was 1.32 kW (remained unchanged), and the fuel consumption was 1.57 l/h. In option 3, that is, when operating with 2 spark plugs installed in the exhaust system, the

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engine power was 1.33 kW (partially changed), and the fuel consumption was 1.56 l/h, which decreased insignificantly. In option 3, the main reason for the slight increase in engine power and the reduction in gasoline consumption was the rapid exit of exhaust gases from the exhaust pipe in exchange for the connection of a spark plug to the usual gasoline-air mixture in the engine's exhaust system.

carbon monoxide (CO) in the exhaust gases when the engine is operated with a conventional exhaust system (control) is 4.06% (Table 1) , the amount of hydrocarbons (CH) is 8.13% and the amount of nitrogen oxides is 1.1 %. (N Ox) was 3.24%, while in option 2, carbon monoxide (CO) was 2.29%, hydrocarbons (CH) was 4.25%, and nitrogen oxides (NOx) was 2.59%. In option 3 , carbon monoxide (CO) was 1.88 %, hydrocarbons (CH) was 2.96 % , and nitrogen oxides (NOx) was 1.72 % . To experiments mainly 3rd option - install and operate 2 spark plugs in the exhaust system next research for selectively was obtained [10-14].

In conclusion, the RU-1500 electric generator (Russia) is equipped with 2 spark plugs in the standard exhaust system of the engine, gasoline consumption is 0.02 1 /h. The amount of carbon monoxide (CO) in the exhaust gases is 2.18 % , hydrocarbons (CH) content 5.17 % and the amount of nitrogen oxides (NOx) increased by 1.52% . decreased.

Since the object of this study is not a car, but an electric generator engine, it is not possible to directly apply the g/km indicators of the EURO standards. Therefore, in our work , a relative ecological assessment method was chosen based on the volume fraction (%) of CO, CH and NOx in the exhaust gases. The results obtained were compared with the control option and it was found that emissions were significantly reduced, which scientifically substantiates the fact that the engine's ecological indicators approached the EURO-2 level.

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