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MEASURES TO PROTECT THE ENVIRONMENT FROM THE HARMFUL EFFECTS OF MOTOR TRANSPORT

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Abstract
In this article, hybrid power devices, which are currently the most efficient in terms of economy and environmental parameters, are used: they work with an internal combustion engine on highways, and they work with an electric engine in urban areas, and a method of controlling the engine during idle running for cars in operation is developed using a software device implementation of cylinder deactivation according to a rational algorithm is shown.

Keywords: Cargo transportation, truck, operational conditions, construction, toxic gases, car.

Introduction

The integration of Uzbekistan into the world economy, the expansion of international transportation, and the participation of not only freight carriers but also private cars and buses, seriously increase the requirements for environmental safety, economic and other indicators. Certification of our country's cars ensures that they gradually approach European and world standards. This is reflected in the tightening of maintenance and repair [1].

When burning any fuel, various combustion emissions are released. These wastes have a major impact on human health and the environment. Factories, factories and transport companies in the city are the main sources of environmental pollution. Road transport is currently considered a more polluting source than factories and plants

In the use of motor vehicles, 3 different sources of environmental pollution can be seen: exhaust gases, crankcase gases and harmful substances formed as a result of fuel evaporation (from the fuel tank, carburettor, etc.

Exhaust gases make up 65-70% of harmful substances released into the environment as a result of car operation, and crankcase gases make up 20%. The biggest problem that needs to be solved at the moment is to reduce harmful emissions from the use of cars.

It has been determined that there are more than 200 harmful emissions in the gas produced by the combustion of fuel in the car engine. The most harmful of these include carbon monoxide - CO, unburned hydrocarbons - CH, and nitrogen oxides - NOx.

Many countries have regulations to allow these wastes. In the CIS countries, regulation of emissions from fuel combustion was introduced in 1970 based on the directive issued by the UN Economic Commission for Europe (ECEOON) [2].

Waste gases also contain harmless oxygen, carbon dioxide, nitrogen, and sulfur. But nitrogen at high temperatures and pressure form nitrogen oxides, which are very harmful. Harmful products in exhaust gases are not always in the same volume for many reasons. It depends on the type of engine, the mode of operation, the level of tuning, the technical service provided to the engine and the quality of the fuel.

A diesel engine is less harmful than a carburettor engine.

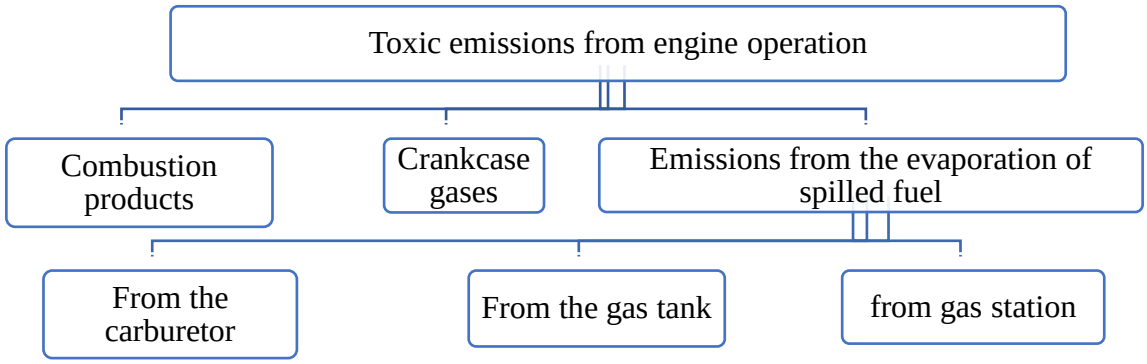

Figure 1. Harmful waste generated as a result of the operation of vehicles

During the operation of diesel engines, harmful gases such as CO, NOx and CH are released less, but the volume of the body, which contains harmful benzopyrene, is greater. Carburetor engines release lead compounds and diesel engines release barium compounds.

These compounds are formed as follows:

- as a result of adding ethyl alcohol to increase the anti-detonation properties of gasoline (ethyl alcohol contains lead);
- as a result of adding a special barium anti-smoke substance to reduce the ignition of diesel fuel.

Engine operating conditions play a major role in whether exhaust gases are harmful or harmless. The largest emission of CO is produced in the engine's pure operation mode when the engine is running on an enriched fuel mixture. At the same time, as a result of incorrect installation of the combustion system in carburettor engines, the voltage (spark) is transferred to the spark plug earlier or later than normal, which leads to incomplete combustion of the combustible mixture. A change in the distance between the switch contacts from the norm also causes a decrease in the voltage in the candles and a weakening of the spark, which also leads to incomplete combustion of the combustible mixture, as a result of which the amount of CO in the combustion products increases [6]

The change in the pre-spraying angle of the combustible mixture of the injectors of diesel engines and the irregularity of the spray angle (if the angle is low, the fuel spray speed increases and the fuel partially sits on the piston, if the angle is too high, the fuel i does not reach all parts of the combustion chamber) leads to deterioration of the combustible mixture and incomplete combustion of fuel. In these cases, the amount of harmful substances in exhaust gases also increases.

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Protection of the environment from the harmful effects of motor transport is mainly carried out in 2 different directions:

- improvement of cars and their engine designs;
- fight against the harmful operation of vehicles in operation.

Improvement of vehicles and their engine structures, improvement of engine operation mode, use of various auxiliary equipment and high-quality fuel, timely and high-quality performance of maintenance and repair works, as well as low-hazard gas turbine, external combustion - Stirling engine, is carried out by the production of electric cars, injection engines.

The fight against the harmful operation of vehicles in operation consists mainly of limiting the amount of harmful substances emitted by vehicles by the relevant legislation and controlling compliance with these standards.

According to the data of the World Health Organization, 142 million tons of harmful substances are released into the atmosphere every year in the USA, of which 86 million tons. tons are generated as a result of the operation of cars.

GOST 16533-70, introduced on January 1, 1971, limits the volume of CO, which is the composition of exhaust gases released as a result of the operation of gasoline engines.

GOST 21393-75 limits the emissions of diesel engines, 1980 GOST 16533-70 was replaced by a new state standard 17.2.2.03-77, which also limits the amount of CO in the exhaust gases of gasoline engines. This applies to trucks, cars and buses running on standard gasoline.

According to the new GOST, the volume of CO should not exceed 1.5% for all cars, and the inspection of the content of CO in the exhaust gases, with a population of more than 300 thousand and in capital cities, resorts, when 2-TX is carried out, maintenance after repair it is carried out by specialists of motor transport companies and employees of the road patrol service. European emissions standards, g/km, and NETSD-style ratings for passenger cars are given according to the New European Driving Cycle (EDC), which represents a combination of the urban (ECE-R) and modified suburban (EUDC) cycles. . According to him, the highest rating indicator goes up to 10 points. The rating takes into account engine power and performance, top speed, fuel consumption per EYaHD, CO_2 emissions and external noise levels.

Today, the cars of our country are being brought closer to European and world standards. According to the requirements and standards developed by the state standard, certification of new cars in our country according to EURO-4 and EURO-5 standards is provided for in the first stage. The transition to these standards will tighten the requirements of emissions by 5-6 times for passenger cars and 2-3 times for heavy-duty diesel, compared to the standards used until now, and the cost of production will increase, increases by an average of 10%. EURO-4 standards have been introduced to European countries since 2005. The transition of our country's industry to the production of cars that meet the EURO-4 standard occurred in 2017, and the replacement of the fleet in motion may last until 2025-2030.

In terms of technical use, in the coming years, maintenance and repair should be provided to domestic cars following EURO-3 and EURO-4 standards, and for imported cars in accordance with EURO-4 and EURO-5 standards. Late-model cars must be equipped with systems that are built into the diagnostics of environmental indicators, which identify high amounts of exhaust gas emissions as a violation.

To protect the environment from the harmful effects of motor transport, work is carried out mainly in 2 directions:

1- improvement of cars and their engine designs.

2- fight against harmful operation of vehicles in operation [5].

Improvement of the construction of cars and their engines, improvement of the engine operation mode, use of auxiliary equipment and high-quality fuel, timely and quality performance of maintenance and repair work, and low-harmful, gas-turbine, external combustion-Stirling engine, electric cars, injector is done with the production of engines.

- The use of electronic carburettor control systems makes it possible to increase the accuracy of fuel dosing in different operating conditions and to reduce the amount of toxic substances emitted by reducing the time it takes to change its consumption when the operating mode changes.
- Transistor and thyristor ignition systems provide increased engine power. As a result, reliable ignition of the mixture is achieved. This situation leads to a decrease in the emission of SO and SN. Thyristor systems create a much steeper front of the voltage rise during the spark discharge, which increases the reliability of ignition even when the spark plug is contaminated with soot and oil.
- Oxidative catalytic neutralizers used in conjunction with exhaust gas recirculation systems are also used. When using ethylated gasoline, lead compounds cause the catalytic neutralizer to fail after 100-200 hours of operation. Its operability can only be restored by reactivation.
- All types of neutralizers (especially catalytic neutralizers), which are a reliable way to reduce the toxicity of exhaust gases from internal combustion engines, significantly increase the cost of the vehicle. In addition, they increase the back pressure at the outlet (especially in the partially filled state), which leads to a 5-15 per cent decrease in the power of internal combustion engines, a decrease in receptivity and, accordingly, a deterioration in fuel economy. Therefore, it is advisable to use them only in cases where the amount of toxic substances emitted is strictly limited, or when internal combustion engines work in special conditions (tight rooms, workplaces with limited ventilation).
- It is desirable to make gas-powered cars with injectors as much as possible because the maximum power of the engine is approached, environmental friendliness is improved, and the motor works smoothly and for a long time.
- Engines of gas-cylinder cars work for a longer period of time compared to engines running on gasoline or diesel, if the mentioned requirements are observed, the service life of the engine oil will be extended due to the significant reduction of oil burning in gas.
- The fact that gas is much cheaper compared to gasoline and diesel fuels also makes it much cheaper for the national economy and for people to travel by car.

Exhaust gas re-introduction (recirculation)

The essence of this method is that a certain part of the exhaust gases is separated from the exhaust system and to occupy a part of the new charge Internal combustion engines are routed to the input channel. The amount of exhaust gases is changed by means of special adjustment structures depending on the operating mode of internal combustion engines. Due to the high

heat capacity of the processed gases re-entering the chamber, it reduces the combustion temperature, which significantly reduces the emission of nitrogen oxides. In this case, the combustion process deteriorates, as a result, the amount of SO and SN increases slightly, and in diesels, the amount of smoke in the exhaust gases increases. In some cases, the amount of SN also decreases due to the prolongation of combustion and the increase in temperature at the end of the expansion.

The re-injection method is used in both spark-ignition internal combustion engines and diesels. In the first case, the exhaust gases are transferred to the intake system after the carburetor, so that the mixture formation process is not disturbed. The expansion of the use of exhaust gas re-injection in gasoline-powered internal combustion engines (in conjunction with rapid combustion chambers) helps to transfer them to work on liquid mixtures. This leads to an increase in the release of nitrogen oxides. Reintroduced exhaust gases displace part of the fresh mixture, causing a reduction in power. In this case, the deterioration of the combustion process leads to poor utilization of heat in the cycle.

The share of recycled gases (relative to the total amount of processed gases) does not exceed 15 per cent, and in most cases, it is at most 10 per cent. According to the experimental data, when 5 per cent of the processed gases are re-introduced, the release of nitrogen oxides decreases to 40 per cent from the initial level, and when 15 per cent is re-introduced to 60-70 per cent. This method is widely used in passenger car engines in countries where the amount of nitrogen oxides is strictly limited, together with other measures, for example, the oxidative neutralization method.

Neutralization of exhaust gases

This method involves passing the treated gases through a special structure - neutralizers installed in the exhaust system of internal combustion engines. Currently used neutralizers are divided into thermal, liquid and catalytic types according to the principle of operation.

The work of thermal neutralizers is based on burning SO, SN and aldehydes until they turn into combustion products: carbon dioxide and water vapour. This process is carried out in special chambers-reactors working at high temperatures. If internal combustion engines are operating in a thick mixture, additional air is introduced into the reaction zone. SN begins to oxidize at 400 °C and SO at 500 °C, and this process occurs almost all the time in the exhaust systems of internal combustion engines operating with medium and high loads. To increase the completeness and speed of oxidation, the working temperature of the reducer is brought up to 600 °C and increased.

For this purpose, heat shields made of stainless steel are installed on the exhaust nozzles, and also the reaction chambers are made heatproof, or the ignition advance angle is reduced. The last event, in turn, slightly reduces the release of nitrogen oxides. The efficiency of the thermal neutralizer, i.e., the completeness of the elimination of premature combustion products, is at its highest level when the engine is operating with a high load, and it decreases when it is operating with a low load (in which the temperature in the reaction zone is insufficient). Their efficiency can be increased by reducing the speed of movement of the processed gases through the reaction zone, but for this, it is required to increase the dimensions and mass of the neutralizer. The service life of the neutralizer is 160,000 kilometres based on the mileage of the car.

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Neutralizers do not lose their effectiveness when using ethylated gasoline, but their service life is shortened. They are mainly used in spark-ignition internal combustion engines, often in combination with other methods of reducing the toxicity of exhaust gases, because they do not reduce the amount of nitrogen oxides emitted into the atmosphere. The use of diesel neutralizers is inefficient because they do not emit much SO and SN and the temperature of the exhaust gases is lower, which does not provide sufficient purification of the exhaust gases from incomplete combustion products. Thermal afterburners operating with air and fuel are rarely used because, although they work with high efficiency at all loads of internal combustion engines, they are expensive and require additional fuel consumption.

Liquid neutralizers work based on passing treated gases through a solution of chemicals (sodium sulfate and sodium carbonate). In this case, toxic substances are dissolved in this solution or chemically combined. These neutralizers act at a temperature of 40-80 ℃ and mainly neutralize aldehydes, soot, benzopyrene (up to 60-80 per cent), and nitrogen oxides to a lesser extent (up to 30 per cent). A water-based neutralizer is an independent neutralizer. It reduces the amount of soot, aldehydes, and sulfur compounds in the processed gases. Liquid neutralizers are mainly used in diesel. Their disadvantage is that when internal combustion engines are not working, they can freeze when the temperature of the surrounding air is low. They require rapid replacement of the liquid solution. Catalytic neutralizers ensure that reactions of transformation of toxic products into harmless substances (carbon dioxide, water vapour and nitrogen) pass without flame. In this case, the reactions take place on the surface of the catalyst. Reactions take place at moderate temperatures. When there are conditions for effective operation, modern catalytic neutralizers allow reducing the amount of toxic substances in the treated gases to a percentage. Their service life is quite long. Their effectiveness is determined by the temperature of the environment, the duration of interaction of the substance with the catalyst, toxic substances and the description of the environment in the field of reactions.

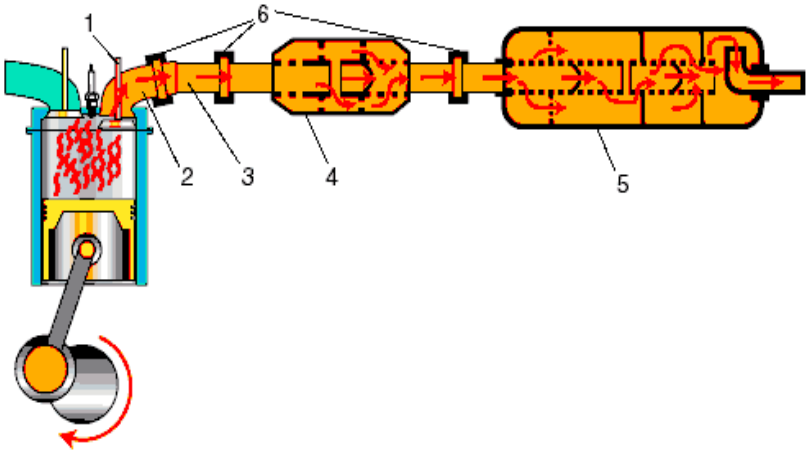

Figure 2. Exhaust system

1- exhaust valve; 2- exhaust collector; 3- extinguisher pipe; 4th additional extinguisher; (resonator); 5- main switch; 6- connecting clamps

Rare and original metals (platinum, palladium, radium, ruthenium and their combinations) are used as catalysts working at high temperatures (their effective range corresponds to levels above 300 ℃). They are covered on the surface of a whole ceramic carrier, or alumina grains.

Although the activity of low-temperature catalysts (their effective operating range is in the range of 100-300 °C) is noticeably lower than that of the above catalysts, they are several times cheaper. Metal oxides (copper, nickel, chromium, manganese oxides) and various alloys (stainless steel, bronze, brass, copper-nickel compounds) are used as such catalysts. A reducing medium (ie, $\alpha < 1$) is present to neutralize nitrogen oxides. At 0.05, the recovery efficiency drops dramatically. An oxidizing medium is required for the removal of SO, SN, and aldehydes, so air is introduced into the reaction zone when there is insufficient oxygen in the treated gases. The heat released in oxidation reactions is used to maintain the required temperature of the system. In gasoline-powered internal combustion engines, the highest efficiency in exhaust gas cleaning can be achieved when using a three-way (that is, designed for a three-toxic substance) catalytic neutralizer. This neutralizer also acts as a muffler in the exhaust system. In this case, internal combustion engines are adjusted to operate on a slightly leaner, or stoichiometric, fuel mixture. In the first chamber of the neutralizer, nitrogen oxides are regenerated, and in the second, secondary combustion products are further oxidized when additional air is supplied [12].

In order to achieve the highest useful efficiency of the neutralizer, systems for controlling the fuel supply to reciprocating internal combustion engines through an oxygen partial pressure sensor are used. This sensor is installed at the entrance to the neutralizer of the sensor when the mixture passes through the stoichiometric composition EYE changes dramatically. In this case, this signal is transmitted to the electronic structure that controls fuel consumption.

Oxidizing catalytic neutralizers used in conjunction with the exhaust gas recirculation system are also used. When using ethylated gasoline, lead compounds disable the catalytic neutralizer after 100-200 hours of operation. Its functionality can only be restored by reactivation.

The use of catalytic neutralizers in diesels is less effective: they only reduce emissions of SO, SN and aldehydes, which are much lower than in spark-ignition internal combustion engines. Nitrogen oxides are almost not released, because the exhaust gases of diesel contain a lot of oxygen and an oxidizing environment is created in the neutral generator.

In addition, the temperature of the gases processed in diesel is low, so there are no conditions for the effective operation of the neutralizer. Soot in diesel gases quickly fills the neutralizer and increases its internal resistance, as a result of which the power of internal combustion engines decreases. Therefore, it is necessary to use the neutralizer together with exhaust gas filters or to use other methods of reducing nitrogen oxide emissions (re-introduction of exhaust gases, reduction of the fuel acceleration angle). All types of neutralizers (especially catalytic neutralizers), which are a reliable way to reduce the toxicity of the exhaust gases of internal combustion engines, significantly increase the cost of the vehicle. In addition, they increase the back pressure at the outlet (especially in the partially filled state), which leads to a 5-15 per cent decrease in the power of internal combustion engines, a decrease in receptivity and, accordingly, a deterioration in fuel economy. Therefore, it is advisable to use them only in cases where the amount of toxic substances emitted is strictly limited, or when internal combustion engines work in special conditions (tight rooms, workplaces with limited ventilation) [14].

2. The fight against the harmful operation of cars in operation consists mainly of limiting the amount of harmful substances emitted by cars in accordance with the relevant legal documents and controlling the observance of these standards.

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The currently used methods for reducing toxic substances can be divided into three categories: improvement of the work process, first of all, the mixture formation and combustion processes, special adjustment of the work process and making appropriate changes to the design of internal combustion engines; application of measures aimed at the goal. Among them, the first category of measures is considered the most appropriate and correct. Because they are almost always aimed at improving all indicators of internal combustion engines, and fuel economy. The first two categories of measures related to performance, design, or emissions characteristics are different for diesel and spark-ignition internal combustion engines; and the measures of the third category, reflect the acuteness of the problem, or the general principles of the formation of toxic substances, are essentially the same for both types of engines [15].

Conclusions

In conclusion, the cylinder deactivation method developed in this article reduces fuel consumption by 13% and the amount of produced gases by 11% when the electronic injection system engine of passenger cars is running alone, taking into account the operating conditions and the algorithm of the cars.

The developed standard of differentiated fuel consumption of motor vehicles allows for taking into account the real operating conditions and the engine cylinder deactivation algorithm. Using this methodology, the standard fuel consumption of passenger cars in one shift is reduced by 7-18% compared to that in the instruction document R 3112194-0366-03.

A method of controlling the engine during idle running has been developed for cars in use, and cylinders are turned off according to a rational algorithm with the help of a software device.

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