

METHOD OF CLEARING OF THE PROCESSED GASES

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ABSTRACT

Preservation of the environment has turned the important social problem. In work analyzed the condition of pollution of biosphere by the motor transport, their harmful influence on a human body and methods of struggle for its reduction.

The stated essence of the offered combined liquid method of neutralization of the processed gases of motor transport with using of the pulse technology, allowing without inertial operate the regulation of intensity of submission of a liquid solution with taking into account of a condition and modes of engines of the automobile in according to conditions of its work.

Keywords: environment, biosphere, pollution, liquid solution, toxic components

I. INTRODUCTION

The problem of protection of air from pollution by its toxic components of the processed gases, unhealthy the human, is paid every year with the increasing attention. In the countries with the advanced industry and a high level of automobilization the protection of an atmosphere from toxic emissions has grown up to a level of urgent social problems. One of sources of pollution of air pool is the motor transport.

The main mass of toxic substances, emission by motor transport, is evolve with the processed gases which have the complex structure including up to 280 components [1].

By the influence on an organism of the human the processed gases are subdivided into 3 groups. In the first group entered nontoxic substances: nitrogen, oxygen, hydrogen, water pairs and carbonic gas. To the second group entered toxic substances: carbon oxide CO, nitrogen oxides NO_x, the numerous versions of hydrocarbon C_nH_m including paraffins, olefins, aromatics, aldehydes, soot. The third group is made with cancerogenic substances from which more fully investigated is aromatic hydrocarbon benz-a-piren or 3,4- benz-a-piren.

Some processed gases negatively influence an organism of the human. Under influence carbon oxide (CO) erythrocytes (red blood balls) lose ability to participate in a gas exchange. Norm of the contents CO in air a 1 mg to m³.

Oxides of nitrogen N_nO_m (NO, NO₂, N₂O₃, N₂O₄, N₂O₅), getting in respiratory ways, form with water of connection of nitric and nitrogenous acids which destroying acting on lung. Norm of the contents of oxides of nitrogen 0,1 mg on 1 m³ of air.

To the formation of oxides of nitrogen strongly influence of the temperature. By the data of N.N. Semenova at increasing of temperature from 2500 up to 2700 K speed of reaction increases to 36 times, but at reduction from 2500 to 2300 K speed of formation of oxides of nitrogen decreases to 8 times [3].

In carburettor and diesel engines the contents of oxides of nitrogen approximately equally. Toxic substances are hydrocarbons (ethane, methane, ethylene, benzene, prosir, acetylene, pairs gasoline). Harmful acting of aldehydes on nervous system and organs of breath of the human (formaldehyde, acrolein), they strongly irritate mucous membranes of a nose and an eye.

The processed gases contain also cancerogenic substances, for example benz-a-piren C₂₀H₁₂ and polycyclic aromatic hydrocarbons. At strong deterioration of cylindrical-piston group and the increased expenses of oil the contents benz-a-piren in the processed gases grows in tens times. At direct contact they result in occurrence of malignant tumours.

Soot (C) litters respiratory ways, causes chronic diseases of a nasopharynx and easy, is a carrier of cancerogenic substances.

The processed gases under the defined meteorological conditions form a poisonous fog - could. Under influence of solar beams occurs dissociation of molecules of NO₂ with formation of NO and ozone, in result are formed nitroperoxide connections. At their concentration more than 0,2mg/m³ come condensation of water vapor as the smallest droplets of a fog with toxic properties.

The contents of hydrocarbons C_nH_m in the processed gases grows on modes of compulsory idle running (for example, at braking by the engine). In such cases expediently in part or completely to stop submission of fuel through system of idle running. Allowable daily average concentra-

tion vapors of gasoline is 1,5 mg/m³.

II. BODY OF THE TEXT

At work of the engine on fuel, containing sulphurous connections, is forming sulphurous gas SO₂ and hydrogen sulphide H₂S. Sulphurous gas causes strong irritation of a mucous membrane of eyes and organs of sense of smell, perniciously operates on plants.

For clearing pollution of environment by the emissions of automobiles at their movement in various conditions, are developed methods of definition of quantity of the processed gases in modes of idle running, dispersal, constant speed and braking by the engine. These methods allow to define the general emission of the processed gases of automobiles without taking into account their structure and a degree of harm. Besides considered methods allow to define harmful emissions at the established operating modes of automobiles.

However results of these calculations for real conditions of operation are inapplicable because of significant errors and lacks. For in them are not taken into account the factors influencing quantity of harmful emissions in operational conditions.

Toxicity of the automobile in operational conditions depends on many factors:

- constructions parameters of the automobile; road parameters and the accepted methods of management of traffic; conditions of movement of the automobile in a transport stream; climatic conditions; experience, qualification of the driver.

While in service the automobile the engine works on various modes. Modes of engine are characterized by number of revolutions of a cranked shaft and developed power (loading, i.e. percent of the used power).

Distinguish the following working modes of engines: 1) a mode of start-up of the cold engine; 2) a mode of idling; 3) a mode of average loadings; 4) a mode of the maximal loadings; 5) a mode of dispersal (acceleration) the engine.

The structure of the processed gases appreciably depends on power setting, its technical condition, conditions, operation. The structure of gases of carburettor engines basically is defined by the factor of surplus of air.

Submission of a gas mixture is adjusted by choker.

The enriched mix is necessary for reliable start-up of the cold engine. The factor of surplus of air should vary in repartitions 0,2-0,3.

Idling for steady work of the engine the mix should be enriched with $\alpha=0,8$. It explaining by the a significant contamination of the chamber of combustion by the processed gases and with small pressure at the end of compression.

The engine the most part of time works in a mode of the average loadings, according 20-80 % of opening of a throttle. For profitability the structure of a mix should be a little bit impoverished with $\alpha=1,11-1,15$. On small loadings the economic mix will be at $\alpha=0,9$.

At full opening a throttle the engine should develop the greatest power. Power of the engine depends not only on

quantity of a burning mix, but also from speed of its combustion. A little bit enriched mix with $\alpha=0,9$ fastly burns. Therefore at full opening a throttle it is necessary to enrich a mix, though it and goes to the detriment of profitability.

At dispersal of the automobile the gas mixture should be quickly enriched.

In Azerbaijan the share of the toxic substances evolve by motor transport while is much lower, than in other advanced countries that explain, mainly, a smaller specific saturation automobiles.

The effective direction, allowing to lower pollution of atmospheric air by the processed gases of engines, is the increase in densities in structure of park of automobiles with diesel engines which evolve in 2-5 times less than toxic substances, than automobiles with carburettors engines.

At average speeds and loadings at combustion of gasoline of 1 kg is evolve about 300-310 gramme, and at combustion of 1 kg diesel fuel 80-100 gramme of toxic components. The provisional structure of the processed gases is resulted in table 1.

Table 1.

№	Components (in grammes)	Petrol Engines	Diesel Engines
1	Oxides of carbon	225	20-30
2	Oxides of nitrogen	55	20-40
3	Hydrocarbons	20	4-10
4	Oxides of sulfur	1,5-2,02	10-30
5	Aldehydes	0,8-1,0	0,8-1,0
6	Soot	1,0-1,5	3-5
Total:		303,3-304,52	57,8-116

Now the motor transport is the basic pollutant of an environment. So, in many industrially advanced countries of the world automobile engines evolve in an environment of 60 % oxides of carbon carbon, 50 % of hydrocarbon and up to 40 % of oxides of nitrogen from the general emissions of all kinds pollutant [4].

From the point of view of clearing air application nuclear, a solar energy and hydrogen is very perspective, but demands significant time before their practical use.

Now carried out researches on application on motor transport alternative fuels: spirits, hydrogen and ammonia. To synthetic spirits used on motor transport concern: methanol or methyl spirit, ethanol or ethyl spirit. Power consumption of methanol in 2 times is less, and the density is more, than gasoline. Therefore, for preservation of a stock of a course of the automobile, it is necessary to increase capacity of an existing tank in 2 times.

One of possible directions of preservation of the environment from harmful influences of motor transport is use of the electromobles which are practically not polluting the air environment. However for application of electromobles and the engines working on hydrogen it is necessary to solve a number of problems. Therefore it is a problem of the future.

On a way of neutralization of toxicity of the processed

gases used methods are subdivided on catalytic, thermal and liquid. All of them are applied as the additional equipment. The method catalytic neutralizations is rather simple and consequently has received a wide circulation. Suitability of the given method for any kind of transport makes its by one of popular methods of neutralization in world practice.

Influence of separate components on an organism of the human is investigated rather full. Practically for each component the maximum permissible norm is established. Standards on maximum permissible emissions of harmful components of cars which in structure of park the USA make up to 90 % have been developed. Alongside with it has created construction of antitoxic means of automobiles. In the USA have been offered and applied for neutralization of harmful components various types of antitoxic devices:

- catalytic neutralizer with neutralization oxide of carbon, hydrocarbons, oxides of nitrogen;
- recycling the processed gases;
- application of injection of fuel in exchange of carburizing;
- use of a pulsation of pressure for submission of air in system of release, etc.

On automobiles have started to be applied widely rather complex both expensive devices and additional systems in which the determining place was occupied with neutralizers of the processed gases. For the period of 1975-80 cost of neutralizers, in connection with application for them catalysts from scarce metals (a palladium and platinum), was estimated at a rate of 20 billion dollars. This sum has made more than 70 % of charges the USA on struggle against sources of pollution of an atmosphere. The resulted data show, that increase of ecological compatibility of the automobile causes essential growth of expenses by its manufacture.

It is necessary to note, that every year the tendency of toughening of allowable specifications of environmental contamination is observed by motor transport. It is enough to look at table 2.

Table 2

Ecological The specification	Term of introduction in the countries of EU	CO	CH	NO _x	PT
Euro-1	1993	4,5	1,1	8	0,36
Euro-2	1996	4	1,1	7	0,15
Euro-3	2000	2,1	0,66	5	0,1
Euro-4	2005	1,5	0,46	3,5	0,02
Euro-5	2008	1,5	0,46	2	0,02

As visible from the table, significant reduction of a share of each of components of emissions that predetermines a urgency of researches in this area is provided.

Actions on decrease of pollution of an atmosphere by the processed gases of engines of automobiles can be subdivided into four directions:

- 1) Improvement of designs of engines, improvement of quality of their manufacturing;
- 2) Creation energypowering equipment for the automobiles which are thrown out smaller quantity of harmful substances;
- 3) Search of new alternative kinds of fuel, improvement of quality of the combustive-lubricating materials used in engines of internal combustion, application of various additives;
- 4) Development of methods and the devices lowering the contents of harmful components in processed gases;

Thermal neutralizer represents heat-insulated volume with the set process of current of the processed gases at which occurs thermal to oxidation their toxic components. Thermal neutralization does not depend on a kind of burnt fuel and presence in them of additives and consequently allows to use in engines этилированный gasoline. A line of foreign firms carries out work on use thermal and catalytic neutralizations of the processed gases of engines with the stratified charge, that essentially reduces toxic emissions of automobiles.

It is necessary to relate to lacks of thermal neutralization: necessity of application of heat resisting materials for manufacturing reactors, some reduction of capacity of the engine and increase of the charge of fuel because of increase противодавления in system of release of the engine. It required relative a lot of place in a motor compartment since it should be placed near to the head of the cylinder of the engine.

The essence of liquid neutralization will consist in пропускании the processed gases through a layer of water or other chemical solution. As a result of this clearing aldehydes, oxides of sulfur, soot and other disperse particles are caught by a liquid, however oxides of carbon and oxides of nitrogen are not neutralized.

The efficiency of performance of liquid neutralizer depends on modes of work of engine. Such neutralizer is most effective at a mode of the engine with moderate temperatures and charges of the processed gases. Lack of liquid neutralizers is possible freezing solutions in winter conditions at the idle engine.

Process of liquid neutralization includes the following stages: catching small disperse particles, adsorption, condensation and a filtration. However operation of liquid neutralizer is more expensive in comparison with other methods as demands daily removal and recycling of solutions and swarfs, washings of system and filling with a fresh liquid.

Due to the first approach the big family of the advanced engines has been created. However, despite of high expenses, toxicity of the processed gases remain still high.

In a second way to the approach there is a set of development, variants of circuits recuperation energy of braking, however for today such accumulators possess limited power consumption, are difficult in manufacturing and management.

The principle of work of the combined method - liquid neutralizer of the processed gases of the automobile offered by us consists that from the receiver 2 exhaust gas is soaked up by the device 3, due to movement of the liquid acting from the tank 4. Movement of a liquid creates a condition exhaustion of gas and their long joint interaction.

The received mix acts in a separator 5 in which heavy making mixes are separated. The easy fraction of a mix acts in the chamber 6 where, mixing up with an oxidizer, having cleared of pollution, acts in an atmosphere 7.

The scheme of the combined neutralizer of the processed gases is submitted on fig.

Solutions Na_2SO_3 were applied to increase of efficiency

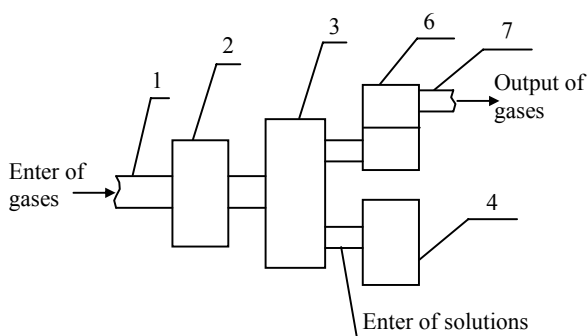


Fig.1. Principal block-scheme of clearing processed gases of automobiles

1- silencing pot, 2-receiver, 3-equipment for interacting of liquid and gas, 4-tank for solutions , 5-seperator, 6-clearing chamber, 7- mouth

of cleaning process instead of water, Na_2CO_3 and hydroquinone.

III. CONCLUSION

Summarizing article it is possible to note, that while in service the automobile its engine works on various modes from which depends not only quantity of a combustible mix, but also speed of its combustion, hence, the structure of the processed gases changes.

The offered method takes into account these nuances and with application of modern electronics, in particular pulse technics, the opportunity without inertial to operate is represented by regulation of intensity of submission of a liquid solution.

The carried out experiments have confirmed viability of the offered method giving satisfactory results in the decision of a case in point.

Work proceeds with the purpose of specification of design data and the analysis of results of clarification of the processed gases depending on a mode and operating conditions of the automobile.

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