

Consequences Of Complete And Undercombustion Of Fuel

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Abstract

As a result of complete combustion of fuel, only carbon dioxide and water vapors are formed from it. In addition, nitrogen and residual oxygen are released into the atmosphere. Due to the lack of air, premature combustion of fuel occurs. It produces toxic gases carbon monoxide (CO), hydrocarbons (CN) and nitrogen oxides (NOx), which are dangerous for the environment and human life.

Keywords: Atmospheric air, environment, ecology, automobile engine, fuel, processed gas, oxygen, carbon oxide, nitrogen oxide, hydrocarbon.

Access.

A significant increase in the number of motor vehicles in the world day by day leads to the poisoning of the environment and ecology. In the modern world, toxic emissions from air, water and land vehicles are the main source of atmospheric air pollution today. Road transport is the first on this list. Hydrocarbon-based oil and gas products are used as the main fuel for vehicle engines. The increasing consumption of oil and gas products will cause their reserves to decrease sharply in the near future.

In Uzbekistan, like the rest of the world, the air of residential areas is the same one of the main sources of poisoning is motor transport means. The internal energy source of vehicles general toxic emissions from combustion engines into the atmosphere 60-80% of substances. All foreign countries, that's it measures are being taken to reduce the amount of toxic waste gases, including in Uzbekistan.

According to the Innovative Development Strategy of the Republic of Uzbekistan, it is planned to increase the volume of electricity production by more than 20% by 2025 using renewable and alternative energy sources. In the long-term perspective, the task of increasing the production of electricity to 120 billion kWh by 2030 has been set, and one of the main directions for the implementation of this task is the development of alternative energy and renewable resources.

In our republic, it is now alternative and reuse of renewable energy sources to the level of state policy raised. In this, the use of natural solar and wind energy, as well as wide to use electric, hydrogen, hybrid and bio-fuels opportunities are being created. However, these energy-producing sources hydrocarbon due to the complexity and cost of production the use of fuel continues on a large scale. Therefore, the technical and economic indicators of today's gasoline engines it is important to increase its effectiveness without reducing it. Reduction of fuel consumption and the amount of toxic gases analysis of technologies shows that a large number of hydrocarbon fuel to this day despite scientific research The lack of an effective way to turn on this problem is fundamentally solved shows that it has not been done [4].

In the Republic of Uzbekistan, human influence on atmospheric air is regulated by the Law of the Republic of Uzbekistan "On Protection of Atmospheric Air" dated December 27, 1996 No. 353-1 [5]. Basically, atmospheric air is a component of natural resources, it is a national wealth and is protected by the state.

In the period from 2019 to 2030, one of the main tasks of transitioning the economy to a "green" economy is to increase the energy efficiency of the economy and rational use of natural resources. This is achieved through

modernization of technology and development of financial mechanisms. Green economy is a system of conducting business, in which economic growth is achieved due to the rational use of fuel and energy and natural resources in all sectors of the economy, disposal of industrial and household waste, which ensures the reduction of pollutants and greenhouse gases.

As a result of the implementation of the strategy, the relative emissions of greenhouse gases per unit of GDP are expected to decrease by 10% from the level of 2010. It also allows residents and business entities to use modern, cheap and reliable energy supply. In addition, it is expected to expand the production and use of environmentally friendly engine fuel and cars, and the development of electric transport.

The main part.

The implementation of the strategy serves to improve management in the field of increasing the energy efficiency of the economy, rational use and conservation of natural resources, reducing greenhouse gas emissions, ensuring the use of green energy, creating green jobs and ensuring climate stability.

Currently, fossil fuels- coal, oil, natural gas and uranium- form the basis of the world energy complex, but their reserves are decreasing every year. In the last 40 years, the amount of fossil fuels produced in the world has exceeded the production in the entire previous history of mankind. In the conditions of current energy consumption, rapid industrialization and population growth in the republic, a significant increase in the demand for energy resources of the economy and an increase in the dependence of economic sectors on energy are expected. According to estimates, if current trends and reserve consumption volumes continue, by 2030 the deficit of energy resources may amount to 65.4 percent of total demand.

That's why scientists and researchers are doing a lot of work to protect the environment and ecology, to leave it clean for future generations. In particular, research on the optimal use of renewable (solar and wind) energy, alternative fuels (alcohol, biogas, hybrid, electricity, hydrogen, etc.) is included. But the technological difficulty and complexity of these devices created today prevents them from becoming popular in terms of price. Increasing the fuel efficiency of vehicles and reducing the amount of exhaust gas can be done by improving the design of engines, optimizing the supply system and the preparation of the fuel-air mixture, and using new types of composite materials.

Atmospheric pollution from motor vehicles occurs to a greater extent through exhaust gases from the exhaust system of the car engine and, to a lesser extent, through crankcase gases. Every year, a single car absorbs more than 4 tons of oxygen from the atmosphere, produces 800 kg of carbon monoxide, 40 kg of nitrogen oxide, and almost 200 kg of various hydrocarbons.

Improving the power, economic and environmental parameters of internal combustion engines is the main goal of engine designers and manufacturers. The basis of this improvement lies in the improvement of the working cycle of the engines.

Methodology.

The engine working cycle is a sequence of a set of processes that occur in the cylinder. The purpose of this work cycle is to ensure complete combustion of the fuel and convert it into working energy without producing toxic waste gases. A sufficient amount of air, as well as time and temperature, are required for complete and ecologically "clean" combustion of fuel. As we know, the exhaust gases of gasoline engines mainly consist of toxic carbon monoxide (CO), hydrocarbons (HC) and nitrogen oxides (NO_x). To ensure fuel economy and improve environmental performance, there must be sufficient oxygen for hydrocarbon combustion. At the same time, it is necessary to prevent the formation of nitrogen oxides. For the maximum performance of the working cycle, the energy generated by combustion must be delivered to the working body at the beginning of the working cycle.

Energy losses of different types of engines can be in the following ranges:

- losses due to incomplete combustion of fuel- 2-25%;
- losses in the cooling system- 15-30%;
- loss with processed gases- 20-55%;
- timely delivery of heat- 10-15%

The reason the fuel is not fully combusted is that in today's modern high-rpm engines, the combustion process takes place in a very short amount of time, i.e. within milliseconds. The next reason is related to the process of preparing the combustible mixture. Mainly the losses due to incomplete combustion of the fuel are due to the very short time it takes to burn the fuel in less than a millisecond for a modern high rpm engine. Air and fuel do not have time to mix due to lack of time and cause incomplete combustion. The second factor is that after the piston passes the upper end point, the combustion conditions deteriorate. The volume of the combustion area increases, which leads to

a decrease in the pressure and temperature of the gas, and the area of the cooling surfaces and, accordingly, heat losses increase. The third factor is related to the formation of the mixture- lack of oxygen in the right place of the fuel. Due to lack of time, fuel and air do not mix completely. Modern fuel systems equipped with electronic control units, multi-stage injection, high-efficiency combustion systems and other technical means are aimed at solving this problem.

Nowadays, the number of renewable and alternative fuel engines is increasing. However, it is questionable whether petroleum products, which are a common and common type of fuel, will be abandoned in the near future. Therefore, reducing the fuel consumption and at the same time the amount of toxic substances in the exhaust gases while maintaining the F.I.K., power, traction-economic characteristics of today's existing engine is one of the main issues to be solved.

It is known that nowadays the structure and working principle of the internal combustion engine has reached almost technical perfection. However, in practice, in order to comply with the basic parameters set by the engine manufacturers, it is required to fulfill the condition of the engine according to the results of the laboratory tests.

According to the conclusions of many researchers, the main reason for the decrease in power efficiency of internal combustion engines is the incomplete combustion of the fuel. The reasons for this may be fuel-air problems.

Of course, with today's modern electronic control systems, the composition and quality of the fuel-air mixture is controlled. The engine electronic control system analyzes the quality of fuel preparation, immediately corrects changes in its composition, and adequate adjustment of the joint operation of internal combustion engine mechanisms is achieved.

There are a number of ways to prepare the fuel-air mixture and increase its combustion efficiency [6,7,8]. These are the preparation of separate or combined fuel assembly components. The processing of the components of the combustible mixture has one goal- its qualitative oxidation.

Each method has its advantages and disadvantages. Which method to choose depends on the design of the internal combustion engine, for example, it is unreasonable to carry out air ionization before the air filter, etc.

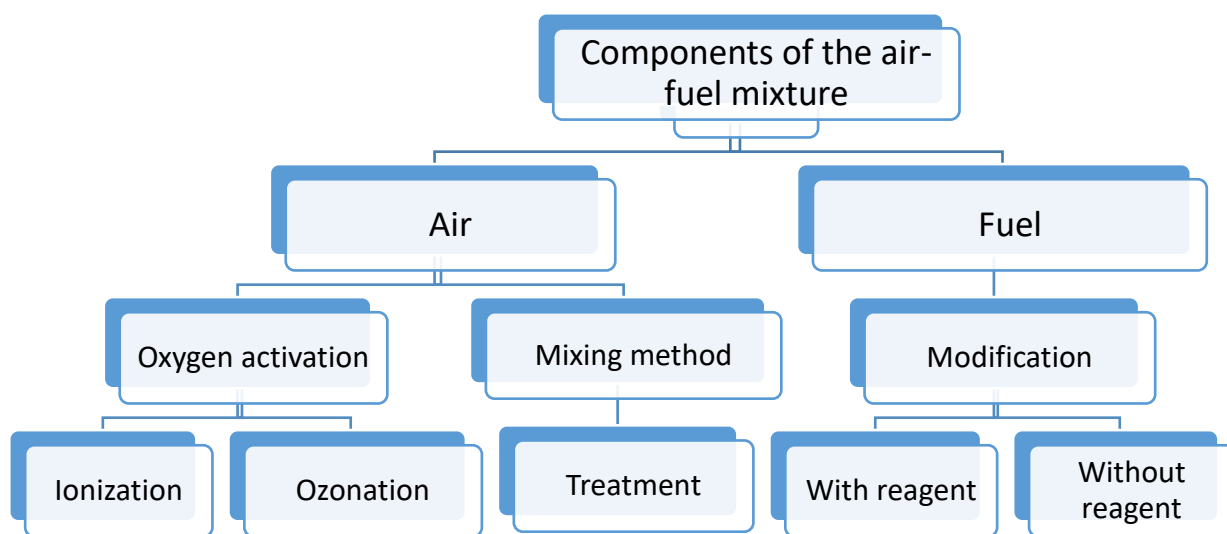


Fig. 1. Distribution diagram of fuel-air mixture processing and preparation processes.

The distribution of the areas of transition processes in the preparation of the fuel-air mixture and molecular processing is shown in Fig. 2. Recycling and some other processes may occur at various stages of the preparation of the fuel-air mixture. For example, stages 2 and 3 occupy an intermediate position (that is, they can occur simultaneously), this depends only on the structure of the internal combustion engine.mixture.

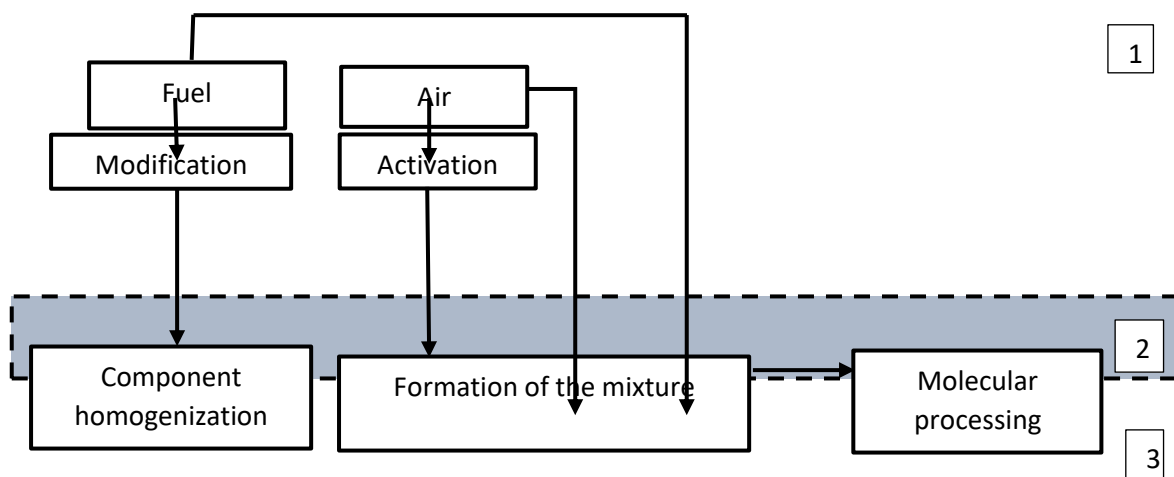


Fig. 2. Distribution of regions of transient processes in the preparation of the fuel-air mixture and molecular processing

Many researchers mainly believe in the self-selected method of molecular processing of the fuel or air fraction and overestimate the potential of this method. However, using these methods together can produce unexpected results. Often, the results of scientists' research are contradictory. The reason for this is the method and tools of the experiment, the low accuracy of its conduct. The success or failure of research results is also understood by the extreme complexity of the processes during physical exposure to organic substances. For example, when a fuel (gasoline, kerosene, diesel fuel) is affected by magnetic or electric power, its structure undergoes reconstruction. Changes occur in the physical and chemical properties of the fuel [9].

It is known that today's main fuels are composed of hydrocarbon compounds. Here, the number of carbon atoms in a fuel molecule is on average 7-8, and the number of hydrogen atoms is 10-11.

Table 1 Characteristics of traditional fuels

| Properties of fuel products | Unit | Petrol | Natural gas | Biogas | Ethanol | Methanol |
|---|-------------------|-------------|-------------|-------------|-----------|-----------|
| Lower calorific value | kJ/m ³ | 44000 | 33802 | 29850 | 41900 | 21500 |
| Upper calorific value | kJ/m ³ | 34500-35600 | 32186 | 32300 | - | 26230 |
| Limits of transition in a mixture with air according to the coefficient of excess air | - | 0,29...1,18 | - | 0,65...1,88 | 0,9...1,1 | 0,7...2,0 |
| Auto ignition temperature | °C | 467...527 | 640... 680 | 685... 747 | 423 | 464 |
| Theoretically, the amount of air required to burn fuel is | m/kg °C | 12,35 | 9,52 | - | 6,53 | 6,45 |
| Boiling temperature | °C | 33... 168 | - | -161.3 | 365 | 338 |
| Density under normal conditions | kg/m ³ | 700...760 | 0,717 | 0,71-0,74 | 0,75 | 0,791 |
| Octane number | - | 76...98 | 110 | 126 | 125 | 125 |

Hydrocarbons have a "closed cell" structure, so the internal atoms of carbon do not participate in the process of oxidation and combustion. When a hydrocarbon fuel burns, the hydrogen atom is oxidized first, and only then the carbon atoms burn. Due to the extremely high speed of the internal combustion process in the engine cylinder, it takes a long time to oxidize all the hydrogen atoms, so only a fraction of the carbon atoms are oxidized. In addition, oxygen cannot reach all groups of carbon atoms in the chain.

Incompletely burned fuel molecules form exhaust gases. In order to achieve complete combustion of fuel molecules, it is necessary to supply a complete supply of oxygen to the chain, or it is necessary to divide the chain into separate molecules. It is also called the process of changing the fractional composition, because relatively light

carbon molecules and isolated free radicals are formed in it, which later recombine with each other and serve as "combustion initiators".

Table 2 shows changes in molecular liquid fuel (gasoline) with the same atomic composition according to chemical formulas [10].

When the fuel passes through the magnetic field, it is separated into charged radicals, and they also move to the dielectric element, where they accumulate and create parts with a volume electric charge and strong electrostatic fields.

At certain values of the parameters of these fields in the fuel path, processes occur that can change the state of the fuel molecules.

Table 2 Basic molecular changes of liquid fuel (gasoline) while keeping the atomic composition

| Initial | | Transformed | | The difference in heat of combustion, % |
|-------------------|--|--|---|---|
| Original molecule | Heat of combustion ΔQ , kJ/mol | Fraction Composition | Total calorific value ΔQ , kJ/mol | |
| C_8H_{18} | 5470 | $C_8H_{18} + 2C_2H_{12}$ C_4H_{10} | 5607 | 7 |
| C_8H_{18} | | C_2H_2 $2C_2H_4$ $2CH_4$ | 5900 | 15 |
| C_8H_{18} | | $C_5H_6 \rightarrow 0,5C_2H_4$ $\searrow 2C_2H_2$ $\xrightarrow{3CH_4}$ | 5975 | 18 |
| C_8H_{18} | | $2C_2H_2 \rightarrow 2C_2H_4$ $\searrow 2H$ $0,5C_2H_4 \rightarrow 0,5C_2H_4$ $\searrow 0,5H$ $3CH_4 \rightarrow 3CH_4$ $\searrow 3H$ | 8367 | 28 |

Graphically, these changes are shown in Fig. 1.3, a. shown in fig. An important point is the occurrence of isomers, that is, molecules with the same chemical formula, but different spatial arrangement of radicals (Fig. 1.3, b). Isomers cause a decrease in the combustion temperature of the fuel and ensure its uniform combustion.

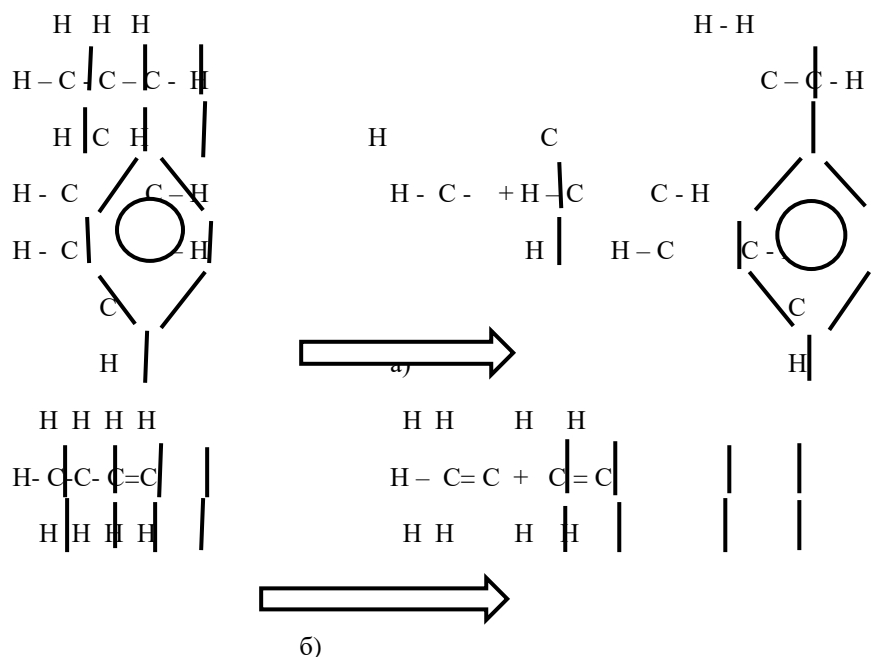


Fig. 3. a), b) Scheme of changing the fractional composition of the fuel:

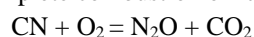
a) - the formation of molecules of light hydrocarbons; b) - formation of isomers

Discussions.

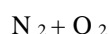
Gasoline and gas fuels are mainly used in gasoline engines of today's cars. For quality combustion of gasoline and gas fuels, it is necessary to provide the combustion zone with the required amount of air. At this time, it is important to mix fuel and air sufficiently to prepare a combustible mixture. As we know, the ratio of gasoline-air mixture 1:14.7 is optimal. For gas fuel, this ratio is 1:10.

The main conditions of the combustion process are the complete combustion of the fuel and the absence of combustible products in the gases released into the atmosphere.

As a result of complete combustion of fuel, only carbon dioxide and water vapors are formed;



In addition, nitrogen and residual oxygen are released into the atmosphere:



A lack of air leads to incomplete combustion of fuel. In this, toxic gases carbon monoxide (CO), hydrocarbons (CN) and nitrogen oxides (NOx) are formed, which are dangerous for the environment and human life. At the same time, incomplete combustion of fuel will certainly lead to an increase in fuel consumption.

Exhaust gases emitted by car engines contain more than 200 different toxic substances. The main toxic gases and substances that pollute the atmosphere in waste gases:

Conclusions.

Carbon monoxide (CO), nitrogen oxides (NOx), sulfur oxides (CO₂), hydrocarbons (CH_x), lead compounds (when engines run on leaded gasoline), soot. In the process of burning 1 ton of gasoline in a car engine, 180-300 kg of carbon monoxide, 20-40 kg of hydrocarbons and 25-45 kg of nitrogen oxides are formed.

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