

PROSPECTS AND ADVANTAGES OF USING NATURAL GAS AS A MOTOR FUEL FOR DIESEL ENGINES

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Today, the piston engine is the most popular type of engine among others, it is widely used in all spheres of human activity. The main share of the world's consumption of petroleum fuels falls on piston engines. The consequence of such widespread use is the fact that piston engines are the main source of emissions into the atmosphere of such harmful substances as nitrogen oxides NO_x , carbon monoxide CO (carbon monoxide), unburned hydrocarbons C_nH_m and suspended particles.

Currently, the most commonly considered alternatives to gasoline and diesel fuel are such fuels as alcohols, esters, synthetic fuels, vegetable oil fuels, gaseous hydrocarbon fuels, synthesis gases and hydrogen [1].

A special place in this list is occupied by natural gas (the main component of which is methane CH_4 – mass fraction up to 98%). Natural gas has a number of advantages compared to other types of alternative fuels. Thus, the explored reserves of natural gas significantly exceed the reserves of oil fields.

Natural gas is used as a fuel in almost the same form in which it is extracted from the field, with the exception of the processes of drying and cleaning from foreign inclusions.

Using natural gas as a motor fuel reduces the carbon footprint due to the lower carbon content in its composition (74.9% by mass in natural gas versus 85.5% in gasoline and 87% in diesel fuel, respectively), which contributes to a reduction in the concentration of carbon dioxide in exhaust.

The use of gas allows to reduce emissions of suspended particles. The use of natural gas as a motor fuel has a positive effect on the engine resource and allows to increase the oil change interval, since during the combustion of gas no carbon deposits and deposits are formed on the parts of the cylinder-piston group and the oil film is not washed off due to fuel getting on the walls of the cylinder liner [2].

The single aggregate state of natural gas and air is an important advantage from the point of view of organizing an effective work process, since in this case a better mixing of fuel with incoming air and the formation of a homogeneous combustible mixture are ensured.

However, the use of natural gas as a motor fuel entails some disadvantages. One of the disadvantages is the low concentration of energy per unit volume, which at atmospheric pressure is 800-1000 times less than per unit volume of traditional liquid fuel of petroleum origin. Another disadvantage is the difficulty of storing fuel on board a vehicle.

Indeed, when using natural gas fuel, there is a problem in creating light, compact and reliable systems for storing it on board a vehicle.

The installation of heavy gas cylinders leads to a reduction in the mileage utilization factor, and also reduces the vehicle's carrying capacity.

Today, it has become possible to install gas cylinders made of light and durable composite materials, which have advantages compared to traditional cylinders [3].

Despite the fact that when methane is burned, the heat release per unit mass is higher compared to traditional fuels, the energy release during the combustion of a stoichiometric mixture of natural gas is somewhat lower than when gasoline and diesel are burned. In addition, when an engine with external formation of a combustible mixture is fed with natural gas, part of the air is replaced by gaseous fuel, which thus worsens the filling of the cylinder. At the same time, the fuel economy of the engine decreases by approximately 9-11% [4, 5].

To maintain power indicators at the level of basic values, an increase in the cyclic supply of gaseous fuel is resorted to. The use of natural gas as a fuel allows reducing the concentration of carbon dioxide in exhaust gases. When a homogeneous mixture of gaseous fuel with air is burned, there are practically no emissions of suspended particles from fuel combustion, except for those that occur in the combustion products of engine oil, if the fuel is burned in an engine with spark ignition.

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