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USE OF BIOGAS FOR VEHICLES

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Annotation. The development of measures to protect the environment from toxic components of exhaust gases of internal combustion engines (ICE) is one of the main tasks during the operation of motor vehicles. Biogas is one of the most environmentally friendly fuels for vehicles. It is used as motor fuel for transport, powering internal combustion engines of stationary installations.

Keywords. Biogas, motor vehicles, heat of combustion, cetane number, methane number, biogas mixture.

One of the main tasks during the operation of motor vehicles is the development of measures to protect the environment from toxic components of exhaust gases of internal combustion engines (ICE). Liquid fuel combustion engines emit much more aggressive emissions than gas combustion engines.

Thus, the use of gas fuel in internal combustion engines is a very urgent task. Biogas is one of the most environmentally friendly fuels for vehicles, as it produces minimal emissions of carbon dioxide and solid particles. The gas engine works more quietly, vibrations are reduced, which improves the working conditions of drivers. [2, 5]

The efficiency of biogas as a motor fuel depends on the content of methane and the absence of such harmful impurities as: hydrogen sulfide, ammonia, carbon dioxide and moisture. Their presence contributes to the formation of metal corrosion,

clogging and rapid wear of parts and components of the unit. It is for this reason that biogas should be thoroughly cleaned before it is used in a combustion engine. [1, 3]

It should be noted that the main component of biogas is methane, its biogas content can reach 80% by volume. The content of another significant component of biogas - carbon dioxide - usually reaches 35%. Other components are contained in small amounts (as a rule, no more than 1%). Some physicochemical properties of biogas in comparison with petroleum diesel fuel and natural gas (methane) are shown in Table 1 [4].

Table 1

Physico-chemical properties of diesel fuel, biogas and natural gas

Physico-chemical properties	Fuel		
	SE	Biogaz	Natural gas
Composition formula	$C_{16,2}H_{28,5}$ (conditional)	CH ₄ (60...80 % by volume) CO ₂ (15...35 %) H ₂ (до 1 %) H ₂ S (до 1 %) Impurities (3 %)	CH ₄ (95 % by volume) CO ₂ (1 %) N ₂ (до 1,5 %) Impurities (2,5 %)
Density at 20 ° C, kg/m ³	830	1,16*	0,809
Heat of combustion, MJ/kg	42,5	20,2*	48,4
Cetane number	45	1*	3
Self-ignition temperature, °C	250	700*	540
Amount of air required for burning 1 kg of substance, kg	14,3	12*	17,2
Methane number	–	123*	100

*Average values are given.

Biogas is used as a motor fuel for transport, powering internal combustion engines of stationary installations of various purposes, heating buildings and structures, as well as household gas.

It should be noted that both gasoline engines with forced ignition of the working mixture and diesel engines can be converted to biogas. However, combustion of biogas fuel in diesel engines at high compression ratios and increased excess air ratios is more efficient than in positive ignition engines. But it should be

noted that the combustion process of the biogas mixture in the cylinder volume of a diesel engine is affected by high self-ignition temperatures (as well as the working mixture of methane and air), which are 600...800 °C. These values significantly exceed the self-ignition temperature of the working mixture of drops of petroleum diesel fuel with air. Therefore, self-ignition of the biogas mixture only due to the heat of compression in the diesel combustion chamber is very problematic. It is possible to ignite the working mixture of biogas with air from a spark plug or an incendiary dose of diesel fuel. At the same time, it should be taken into account that for igniting biogas fuel, it is necessary to significantly increase the energy of spark formation compared to conventional gasoline engines, and the energy supplied with diesel fuel is 100-10,000 times greater than the energy of spark formation of a spark plug.

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