ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 5 , May 2021

Features of Operation of Internal Combustion Engines of Gas-Cylinder Cars on Biogas

Bazarov Baxtiyor Imamovich , Suvankulov Sherali Abdumannonovich

Doctor of technical sciences, Tashkent state transport university
Senior lecturer, Department of Vehicle Engineering, Jizzak Polytechnic Institute

ABSTRACT:

Objective. Generalization of experience of operation of gas - balloon cars operating on biogas.

Methods. Analysis of faults and failures of internal combustion engines in connection with conversion of internal combustion engines to gas fuels is given.

Results. Positive and negative aspects of gas fuel influence on technical and economic parameters of its operation in comparison with fuels of oil origin are considered.

Conclusions. The presence of a significant energy saving potential in the field of piston engine building in the case of using gas - engine fuel in internal combustion engines is shown.

KEYWORDS: Operation, gas-balloon cars, reliability, biogas, engine, economy, ecology

I. INTRODUCTION

Today, gas hydrocarbon fuels are the most significant alternative to fuels of oil origin. In the global and domestic market, the range of gas fuels used as motor fuel of automotive vehicles has expanded significantly. In addition to traditional fuels - natural (methane) and liquefied petroleum (LPG - a mixture with the main components of propane, butane and isobutane) gases - associated petroleum gas, biogas (from agricultural products and wastes), synthesis gas obtained from the generator by partial oxidation of methane, hydrogen and others are proposed for use.

The total number of cars owned by individuals with installed gas balloon equipment in Uzbekistan as of January 1, 2021 exceeded 2.5 million units. In many countries, there are legislative measures to encourage the use of gas as a motor fuel: the provision of benefits, postponements or tax exemptions. Uzbekistan, Argentina, Brazil and Pakistan are world leaders in the use of gas - balloon cars (GBA). It is considered that the advantages of gas fuels over fuels of petroleum origin are due to economic, resource, technical and environmental factors [1, 2, 3, 4,], for example:

- low price (1.5... 3 times cheaper than gasoline and diesel fuel);
- large natural reserves and independence of gas properties from climatic conditions;
- Increase of engine life by 50%, service life of engine oil and spark plugs by 1.2... 1.5 times;
- Reduction of ICE noise and vibration, toxic emissions to the atmosphere (Fig.1).

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 5 , May 2021

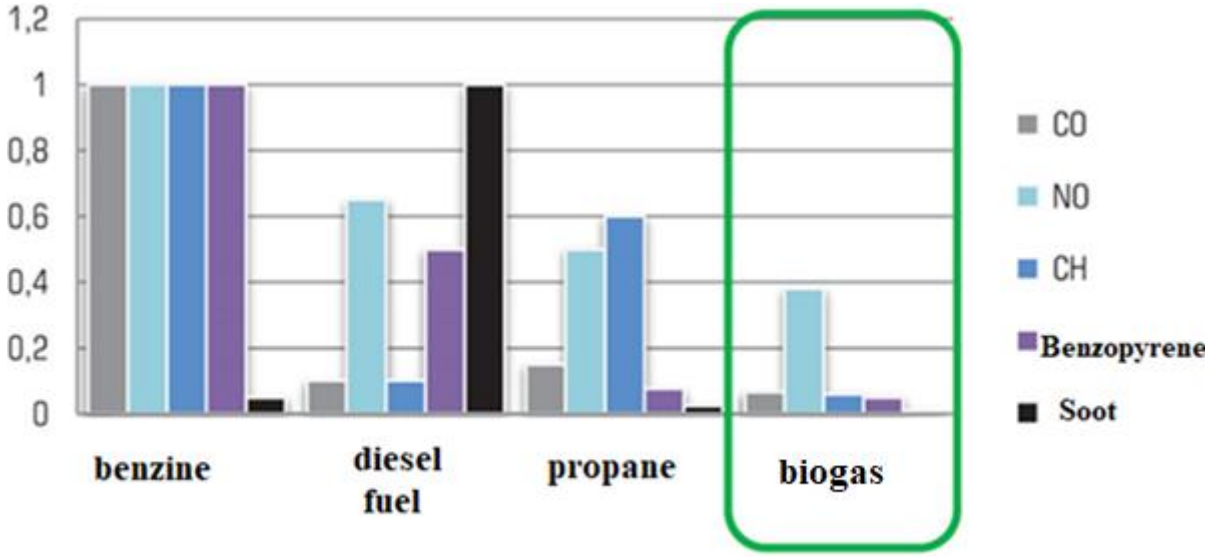

Fig.1 Relative content of toxic components in waste gases

The appearance on the market of gas fuels with significantly different compositions dictates the need to create engines adapted for these fuels (with a gas supply system). Two trends are now most prevalent:

- Transformation of existing petrol ICE to dual - fuel (gasoline or gas) or spark gas;

- conversion of diesel ICE - rework of the fuel system operating according to the gas-diesel method of mixing with the initial dose of diesel fuel, or installation of the ignition system with simultaneous reduction of the compression ratio in the combustion chamber to 12... 13 units (gas - spark version).

When converting a specific ICE model to gas motor fuels, operational studies of the quantitative and qualitative characteristics of gas - balloon cars and their comparison with indicators when operating on traditional fuel are still relevant.

Depending on the type of gaseous fuels used and the type of engines, cars are manufactured or converted into gas - balloon cars: single - fuel, dual - fuel with independent engine feed by one of the fuels and dual - fuel with the simultaneous supply of two fuels

Gaseous automotive fuels include:

- compressed natural gas (CNG), as well as compressed natural gas (LNG) - methane;

- Biogas (biomethane)

- liquefied petroleum gas (LPG) - propane - butane mixture.

Depending on the gas fuel used, the schematic diagrams of the power supply systems have their own specific features and at the same time common elements. The term "generations" is used to classify GBO systems. Although, at the moment, there is no officially approved international classification of automobile GBO, a certain gradation has developed in professional circles.

II. METHODS

The purpose of the article is to summarize the experience of operating gas-balloon cars operating in Uzbekistan. The completed studies on the example of the GBA operation of GM cars (average annual mileage 90... 150 thousand km) with Chevrolet B15D2 engines in Jizzak allowed you to make the following waters:

ISSN: 2350-0328
International Journal of Advanced Research in Science, Engineering and Technology
Vol. 8, Issue 5 , May 2021

- frequency of replacement of engine oil of GBA engines less often than during engine operation with gasoline. When using semisynthetic oil, the optimal periodicity of its replacement is 10 thousand km; when operating in synthetic oil - 12 thousand km;

- air - gas mixtures burn at a lower speed, but when they burn, a greater amount of heat is released than that of an air - gasoline or air - diesel mixture. Due to the increased thermal conditions in the ICE combustion chamber and the "dryness" of the gas at the mileage of 150... 200 thousand km, noticeable wear of the guide bushings and valve seats occurs, which leads to the removal of the unit head and the replacement of the valves. Exhaust valves have wear on 10... 20% higher than intake valves. On the valve seats, their ovality in cross section to the engine axis is noticeable, which requires operations to restore the correct geometry of the valve seats.

Despite the fact that high octane numbers (105... 110 units according to the motor method) of gas fuels require a corresponding increase in the ignition timing, this must be done carefully - increase the angle no more than 1...3 degrees, relative to the optimal for gasoline. Early ignition increases thermal loading, which leads to ICE overheating. Taking into account the considerable operating time of ICE on depleted gas-air mixtures, in case of early ignition in operation practice, there are cases of burning of piston bottoms and valve trays;

- injectors operating on gasoline and gas are "coked" more often than gasoline ICE; the periodicity of maintenance of electromagnetic nozzles at the established labor intensity is 15...20 thousand km;

- the service life of the elements of the cylinder - piston group when using gas fuel is increased by 50...100%, spark plugs no more than 25%;

- the need for adjustment works of the gas supply system arises after 50 thousand km (carried out during seasonal maintenance). Maintenance is mainly carried out after 100...150 thousand km and consists in the replacement of the diaphragm and sealing gaskets of the valves of the low pressure reduction gear box;

- a new generation of Chevrolet B15D2 engines with an improved crankshaft when operating on gas fuel have a resource of about 500 thousand km, which is 15... 20% higher than when operating ICE on gasoline;

- values of power and specific fuel consumption during ICE operation on LNG deteriorate with respect to gasoline not more than 15%;

- the payback period of converted cars for the use of a gas type of fuel (with an average annual mileage of about 100 thousand km) does not exceed 1.5 years.

The table 1 shows an example of calculating the efficiency of using the Chevrolet B15D2 gas engine compared to the Euro - 4 base engine.

Economic efficiency of the Chevrolet engine B15D2
The table 1

Comparative characteristics	Benzine engine	Gas engine	Economy
Type of energy carrier	benzine	biogas	
Fuel cost per unit., sum.	5500	1500	
Fuel consumption per 100 km. run	8	8 m^3	
Costs per 100 km of mileage, s/km.	44 000	12000	36000
Oil changes frequency, km	6 000	10 000	
Oil consumption per one replacement, litet	3.5	3.5	

III. DISCUSSION

Methane gas equipment has both advantages and disadvantages

In terms of cost - in the future, after the installation of HBO pays off, biogas gives a high saving on fuel;

Power reduction - methane "weakens the machine" to 20%. But it should be borne in mind that this circumstance was almost leveled in modern specialized installations;

Ecological purity - biomethane is the cleanest fuel on the planet, which is on the same level as alcohol plants;

ISSN: 2350-0328

International Journal of Advanced Research in Science, Engineering and Technology

Vol. 8, Issue 5 , May 2021

Cylinder weight and fuel volume - the weight of the cylinders gives an additional load on the load - bearing part of the body and undercarriage;

Explosion hazard - biomethane is twice as explosive as propane and, taking into account dispersion, is considered as safe as possible relative to almost all other fuels;

IV. CONCLUSION

Based on the study, the following conclusions can be drawn:

1. The quantitative economic effect of converting five engines to biomethane is calculated. Thus, the study showed the presence of significant energy saving potential in the field of piston engine building in the case of using gas engine fuel in internal combustion engines.

REFERENCES

[1]. Panov Yu.V. Installation and operation of gas equipment for cars / Yu.V. Panov. Moscow: Ed. Center "Academy" 2006.160 p.
[2]. Pevnev N.G. Improvement of the operation process of gas-cylinder vehicles with a dual-fuel power supply system: dis. Dr. tech. sciences. Omsk: SibADI. 2004.360 p.
[3]. Pronin E.N. Natural gas as a motor fuel of the XXI century // Natural gas in a motor? Questions and Answers / E.N. Pronin. M .: Alkor-4, 2006. 60 p.
[4]. Saveliev G.S. Technical and economic indicators of gas-diesel and gas-spark engines operating on CNG / G.S. Saveliev, D. V. Degtyarev // Transport on alternative fuel. 2012. No. 2 (26). S. 74-75.
[5]. Likhanov V.A., Devetyarov R.R. Application and operation of gas equipment: a tutorial. - Kirov: Vyatka State Agricultural Academy, 2006 .-- 183 p. - ISBN 978-966-2930-47-4.
[6]. Llotko V., Lukanin V.N., Khachiyan A.S. The use of alternative fuels in internal combustion engines. - M .: MADI (TU), 2000 .-- 311s.
[7]. Korostashevsky M.S. Transfer of cars to alternative fuels in the USA // Truck. - 2002. - No. 9 - S. 40-41
[8]. Bondar V.A. Environmental safety of using gas fuel // AutoGas Refueling Complex + Alternative Fuel
(AGZK + AT). - 2003. - No. 2 (8) - S. 64-69.
[9]. Vodeiko V., Kuznetsov V., Khachiyan A, Shishlov I. Results of the development of gas engines MADI (GTU) // AGZK + AT. - 2005. - No. 3 (21) - P. 37-41
[10].GOST R 52033-2003. Cars with gasoline engines. Emissions of pollutants with exhaust gases. Norms and methods of control when assessing technical condition.
[11]. Emelyanov V.E. Alternative environmentally friendly fuels for cars: Properties, varieties, application / V.E. Emelyanov,
[12]. N.F. Krylov. - M .: OOO "Astrel Publishing House": OOO "ACT Publishing House", 2004. - 128 p.
[13]. Erokhov V.I., Karunin A.L. Gas-diesel vehicles (design, calculation, operation). Tutorial. M .: Graf - Press, 2005.- 560p.
[14].Zolotnitsky V.A. Automotive gas fuel systems. M .: ACT: Astrel, 2007 .-- 127 p.
[15]. Kapustin A.A., Ponomarev A.V., Sokolov M.G. On the design features of the internal combustion engine when operating on natural gas // NTS OJSC ≪Gazprom≫ -M., 2006. - pp. 22-32.
[16]. Kirillov N.G. Oil, natural gas and alternative motor fuels // Oil and Gas Technologies. - 2002. - No. 4 - S. 15-20.
[17]. Korostashevsky MS .. Transfer of cars to alternative fuels in the USA // Truck. - 2002. - No. 9 - S. 40-41.
[18]. Petrushev V.A., Moskovia V.V., Efgrafov A.N. Power balance of cars - M.: 1984. - 160 p.Odilov, N. (2020). The analysis of the development of gas cylinder supply system. Academic research in educational sciences, (3).
[19]. Odilova, S. S. Q., & Odilov, N. E. O. (2021). MUQOBIL YONILG'ILARDAN MOTOR YONILG'ISI SIFATIDA FOYDALANISH ISTIQBOLLARI. Academic research in educational sciences, 2(1).
[20]. Nurullaev, U., Otaqulov, Z., & Egamnazarov, N. (2021). REQUIREMENTS FOR THE LEVEL OF TRANSPORTATION OF ROADS IN WINTER. Academic research in educational sciences, 2 (2).