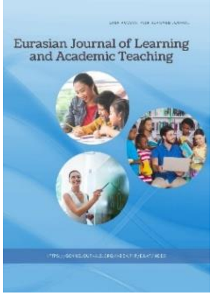

Adding Hydrogen to the Fuel-Air Mixture in Engines

Nasirov Ilham Zakirovich,	Andijan Institute of Mechanical Engineering Republic of Uzbekistan, Andijan
Rakhmonov Khurshidbek Nurmuhammad ugli	Andijan Institute of Mechanical Engineering Republic of Uzbekistan, Andijan
Abbasov Saidolimkhon Jaloliddin coals,	Andijan Institute of Mechanical Engineering Republic of Uzbekistan, Andijan

ABSTRACT

Adding 5% hydrogen to a conventional gasoline-air mixture in a gasoline engine reduced the effective fuel consumption by 14% and the amount of unburned hydrocarbons in the exhaust gases by 2-3 times, and carbon monoxide by 0.1%. The addition of hydrogen increased the octane number of gasolines to 8-10 units and completely eliminated the use of tetraethyl lead added to them.

Keywords: Hydrogen, internal combustion engine, exhaust gases, environment, hydrogen-air mixture, gasoline, octane number, detonation, fuel consumption, carbon monoxide, unburned hydrocarbon, gasoline-hydrogen-air mixture.

On November 22, 2021, the President of the Republic of Uzbekistan signed a decree on "Increase of renewable energy sources and development of the industry" [1]. It demanded the expansion of access to renewable energy sources and the creation of the necessary conditions for the sustainable development of hydrogen energy to strengthen the energy security of the Republic.

Along with the development of hydrogen energy, great attention is paid to reducing the toxicity of exhaust gases from internal combustion engines and reducing environmental pollution. For this purpose, a presidential decree was adopted to amend the Law of the Republic of Uzbekistan "On Atmospheric Air Protection" [2].

At the present stage, the main directions of improvement of the internal combustion engine are aimed at reducing fuel consumption and exhaust gas (IG) toxicity. Experiments have shown that due to these improvements, the economic performance of conventional fuel-powered engines is declining [3-5]. Therefore, in order to reduce the fuel consumption of engines and the toxicity of IG, it is necessary to replace the traditional mixture with another alternative, for example, hydrogen-air mixture.

Studies have shown that the hydrogen-air mixture has a high combustion rate, and due to the very short ignition period of such a mixture, abnormal combustion occurs in the engine cylinders: early, solid and detonated combustion. There are no methods or tools to determine the nature of such burns and their performance.

It is not possible to determine the properties of hydrogen in devices that determine the properties of conventional fuels, such as the octane number of gasoline and the degree of compression resistant to permissible detonation. The methane number is generally incorrect for estimating the detonation properties of hydrogen, since the combustion of hydrogen is taken as the lower limit of the methane number scale. For hydrogen, its resistance to detonation on the octane number scale is usually estimated at 45-70, but its higher values can also be found in the literature, for example, in V.Ancelotti it is 80 and above [6].

In recent years, along with the development and improvement of hydrogen-powered engine processes, the addition of hydrogen to the fuel-air mixture in other areas - hydrocarbon fuels and primarily gasoline-powered engines - is developing. This line is interesting in that with a slight improvement in the engine, it is possible to significantly reduce fuel consumption, the amount of carbon monoxide and unburned hydrocarbons in the exhaust gases.

When 5% hydrogen was added to a conventional gasoline-air mixture, the throttle valve was fully opened, and the engine power was the same, the specific fuel consumption was reduced by 11.5% to 217 g / kW. In the same case, when using a conventional gasoline-air mixture, the fuel consumption was 260 g / kW. A similar pattern was observed when working on partial openings of the throttle valve. For example, when the throttle valve is opened to the position where the engine corresponds to 66% of maximum power, the effective fuel consumption in all speed modes is reduced by 14%. When the engine crankshaft was operating at all speeds above 2000 rpm, the amount of unburned hydrocarbons in the exhaust gases decreased by 2-3 times and the carbon monoxide content did not exceed 0.1%. However, the concentration of nitrogen oxides increased, which was caused by the presence of free oxygen in the combustion zone (a = 1.05 ... 1.4) and the high temperature of the cycle, as the combustion rate of the gasoline-hydrogen-air mixture was much higher than usual. To reduce the emission of nitrogen oxides, it is necessary to further deplete the combustible mixture, for example, at a = 2 nitrogen oxide is almost not released, but at the same time the engine power is reduced by 15-20% [7-10].

Studies have been conducted to increase the combustion efficiency and detonation resistance of the gasoline-hydrogen-air mixture. According to the results of tests conducted by IT-9/2, the addition of 5% hydrogen increased the detonation resistance of gasoline by 8-10 units on the octane scale, and with the addition of 10% hydrogen - 13-15 units. Also, the addition of hydrogen to a conventional gasoline-air mixture completely eliminates the use of tetraethyl lead, which is added to increase the octane number of gasoline, and consequently reduces the release of lead compounds in IGs.

Literature

1. Mirziyoev Sh.M. Issues of "Increasing renewable energy sources and development of the industry" // People's speech was heard November 23, 2021, Tashkent-2021, 1,3 p.
2. Amendments and additions to the Law of the Republic of Uzbekistan "On protection of atmospheric air" // National Database of Legislation, 14.03.2019, No. 03/19/529/2765, 6 p.
3. Nasirov I.Z., Rakhmonov X.N., Abbosov S.J. Resultyou test the electrolyzer// U55 Universum: technical sciences: scientific journal. - No. 6(87). Part 2. M. Ed. "MTsNO", 2021.– 108 p. 34.http://7universum.com/ru/tech/archive/category/687. DOI: 10.32743/UniTech.2021.68.7-2. with. 31-33.
4. Nasirov, I. Z., & Teshaboev, U. M. (2022). Highly efficient reactor with an electrolyzer for an internal combustion engine. Enlightenment and knowledge, (1 (8)), 24-32. doi.org/10.24412/2782-2613-2022-18-24-32.
5. Nasirov, I. Z., & Abbaov, S. Zh. (2022). HYDROGEN ISHLAB CHIKHARISH USULLARI VA ISTIĶBOLLAR. International Journal of Philosophical Studies and Social Sciences, 99–103. Retrieved from http://ijpsss.iscience.uz/index.php/ijpsss/article/view/237.
6. Anzelotti W. F. Combustion of Hydrogen as Related to Knock.—Ind. and Eng. Chem., 1954, 46, No. 6.
7. Nasirov I.Z., Rakhmonov Kh.N. The results of laboratory tests of the electrolyzer // Natural Science Journal

"Exact Science" 2021 / Issue No. 120, www.t-nauka.ru. Kemerovo: Technocongress - 2021 p. 11-14.

8. Nasirov, I. Z., & Abbaov, S. Zh. (2022). HYDROGEN ISHLAB CHIKHARISH USULLARI VA ISTIҚBOLLAR. International Journal of Philosophical Studies and Social Sciences, 99–103. Retrieved from http://ijpsss.iscience.uz/index.php/ijpsss/article/view/237.
9. Nasirov I, Abbasov S, Rakhmonov H. Influence of hydrogen on the performance of an internal combustion engine // International Scientific and Practical conference "Topical Issues of Science". Part 4, 10.04.2022-p. 284-289. https://doi .org/10.5281/zenodo.6439206.
10. Nasirov, I. Z., Urinov, D. O., & Rakhmonov, H. N. (2021). Plasma electrolysis sinash. In INNOVATION IN THE MODERN EDUCATION SYSTEM: a collection of scientific works of the International scientific conference (25th March, 2021)–Washington, USA:" CESS (pp. 323-327).