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Opinion
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Activation of Motor Fuels Under Operating Conditions

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Opinion

The increase in the intensity of the motor-tractor internal combustion engines (ICE), the high cost of motor fuel cause innovation in the operation of self-propelled and stationary equipment. One of the directions in operational innovation is the modification of motor fuels by the activator under the patent of the Russian Federation № 2411074. Activator (Figure 1) – a cylinder 150 mm long, diameter 30-50 mm, consists of three chambers, does not contain chemicals, is integrated into the fuel system of the internal combustion engine with a capacity of 300 HP. It contains: 1 – housing, 2 and 3 – twisted elements, 4 – rod, 5 – disk with microchannels, 6 – rod cone, 7 – microchannels, 8 – intermediate chamber, 9 – mixer of crisscrossing gratings. Three times in it the impact causes irreversibility and continued modification of fuels – a special advantage of the asset.

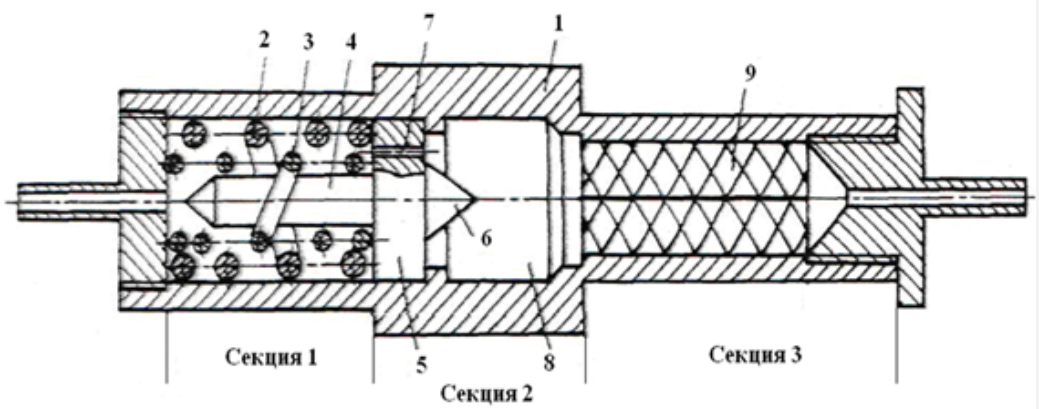

Figure 1: The scheme of the activator according to the patent of Russian Federation № 2411074.

Bench tests of the activator on ICE of KamAZ-740, ZMZ-406 (three times) and YaMZ-236 were carried out. It is tested on a dozen cars and one diesel car. In the petroleum testing on single cylinder installations, the internal combustion engine, the control methods described in the documentation for petroleum products in institute VNIITiN (siti Tambov) tested 8 brands of gasoline and three brands of diesel fuel. The Rochester Institute of Technology (USA) carried out control of harmful substances in the exhaust gases of engines working with the activator: the sulfur content in the fuel is reduced to 50 %, resins 7-9 times, NO – up to 17 %, NO_2 – up to 14 %, and CO – up to 49 %. The volume of activated fuel with a decrease in its density increased by 2.49 %. Dozens of diesel fuels and gasoline, jet fuel, rapeseed oil before and after activation were studied on the crystallux-4000M chromatograph. Diesel fuel was tested in the cold chamber of KHTV-0.08, and the smoke control of KamAZ-740 diesel was carried out on the NefAZ-5299 bus.

Bench tests showed a decrease in diesel fuel consumption by 26.5, 28.6%, and gasoline by 21.3, 27.7 and 31.9 % with a noticeable decrease in the gas content of CHx. Chromatograms of diesel fuel and gasoline showed: reducing the content of molecules with the number of carbon atoms more than 10; the formation of light hexane, heptane, 3rd pentane to 37%, and in the diesel fuel – new octane to 30%; reducing the sulfur content from 0.032 to 0.015%, resins – from 7.4 to 0.8 mg/100 ml. In gasoline, the toluene content increased to 16 %, in aviation kerosene – nonan and decan to 21%. A test on a domestic diesel passenger car showed a reduction in fuel consumption to 31.9%. Evidence of activation of fuels and explanation of the reasons for reduction of their consumption in ICE are, for example, the results of the modification of petrol in the Institute of Mechanical Engineering Russian Academy of Sciences, where in five receptions gradually increases its calorific value by 28%.

The change in the composition of ten brands of diesel fuel from 7 companies was studied: a decrease in the content of molecules C_{10}-C_{14}, C_{11}-C_{18}, a decrease in molecules C_{19}-C_{25}, and in the fuel of the company LIQVI MOLY molecules C_{11}-C_{13} disappeared altogether. (Figure 2) shows a modification of some diesel fuels: chart "a" - modification of the fuel company «LUKOIL», which sharply decreased the content of fractions $C_{11}H_{24}$–$C_{14}H_{30}$, but formed 23% of the factions C_6H_{14}, C_7H_{16}; on chart b – modification of fuel from VNIITiN: all upper curve is the initial fuel, the lower is destroyed the heavy and light fraction formed.

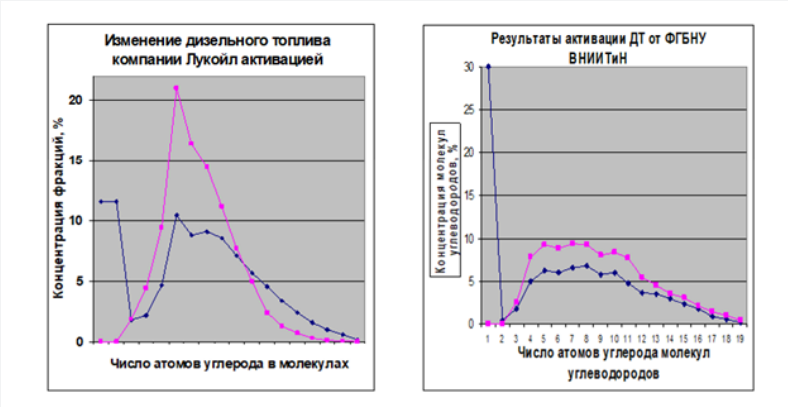

Figure 2: Change in the composition of diesel fuel according to the chromatograms of fuel samples No. 1169 and No. 1171.

Conversion fuels continue beyond the activator, and the proportion of the activated diesel fuel, introduced in the not activated, increasing the proportion of activated fuel up to 35%. Check the freezing point of diesel fuel brand L 0,05-62 showed that the commercial fuel at the temperature of minus 30°C was completely frozen and remained activated at minus 45ºC.

Conclusion

Simple in design, mastered in layouts, and in pilot production at two plants, the activator is effective in tests. But for a variety of applications require its extensive tests of life, on different engines, in the cold periods of the year. Not clear physico-chemical mechanisms of transformation of molecules of fuel in the activator, as affected by temperature, flow rate of fuel, size of chambers, number and diameter of microchannels in the activators for low and high-power piston, turbine, rocket engines? There are continents here for intellectual exploration.

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