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Interaction of gasoline volatility and ecological characteristic

Estimation and study the relationship between evaporation and quality score, which determines the level of environmental safety of motor gasoline is the aim of work. Methods of research include analytical method which involves analysis and synthesis of information to determine the general trend of ecological aspects of motor gasoline, statistical analysis of data.

Intensive development of the transport sector and the fuel filling station, and the associated increase in environmental pollution endangering the ecological balance and human health.. One of the most effective ways to reduce the negative impact of the fuel filling station on environment is improving the ecological safety of modern motor gasoline,

The main sources of pollution during the operation of vehicles are emissions of exhaust gases and emissions of the fuel-air mixture during transportations and filling. Particular attention should be paid to this problem at fuel filling stations located within major cities.

Basically, losses through evaporation include:

1) losses from saturation of the gas space of new or reconstructed gasoline storage tanks;

2) losses caused by the displacement of vapor-air mixture during filling and pumping ;

3) losses caused by daily fluctuations in temperature and atmospheric pressure;

The principal amount of gasoline sold directly through a filling station with capacity of 25 m^3 . In the course of technological operations of filling and issuing fuel released fuel-air mixture into the atmosphere, which is about 1.5-2 kg per 1 m^3 of sold gasoline. Generally at filling stations with a total capacity of 40 m^3 emitted into the atmosphere 4-4,5 tons per year of volatile hydrocarbons.

Due to the rapid evaporation of light fractions what significantly effects on the quantitative and qualitative indicators of gasoline and change chemical composition of gasoline represented on chromatogram.

Established that the by evaporation of fuel is an increase concentration of heavy aromatic hydrocarbons by evaporation of light fractions that affects and degrades the starting properties, increases the duration of heating of the engine and reduces the efficiency of the engine.

Changing of the quality characteristics of gasoline during the evaporation losses are presented in table 1.

Changes of hydrocarbon composition lead to deterioration completeness combustion of fuel, reducing its efficiency and increased the amount of exhaust emissions.

Table 1

№	Name of indicator	Initial gasoline	Gasoline after evaporation	Absolute difference
1	Fractional composition: -start of boiling temperature, C^o -10 % distilled at a temperature, C^o -50 % distilled at a temperature, C^o -90 % distilled at a temperature, C^o - end of boiling temperature, C^o	 38,0 60,0 112,0 166,0 192,0	 43,0 71,0 117,0 168,0 202,0	 5,0 11,0 5,0 2,0 10,0
2	Flash point temperature, C^o	-29,0	-22,0	7,0
3	Surface tension, mH/m	22,9	23,5	0,6
4	Saturated vapor pressure, kPa	57,9	49,0	8,9
5	Octane number by motor method,	85,0	79,0	6,0
6	The total content of aromatic hydrocarbons, %	36,0	49,5	13,5
7	Mass fraction of benzene, %	2,9	1,6	1,3
8	Density, kg/m^3	750,0	760,0	10,0
9	Diffusion coefficient, 10^{-6} m^2/s	8,3	7,9	0,4
10	Physical stability, %	1,1	1,0	0,1

The main parameters that determine the level of environmental safety of modern motor gasoline are:

1) value of octane number;
2) sulfur content;
3) the total content of aromatic hydrocarbons;
4) content of benzene.

One of the most important indicator for modern gasoline is octane number. The octane number of gasoline – is a measure that characterizes efficiency, economic and ecological compatibility of usage gasoline in vehicles. This number indicates anti-knocking characteristic of a fuel and strongly depends on the hydrocarbon type.

Given the above results of previous studies, the next stage of my work was to determine the effect of evaporation loss of one of the most important indexes - the

octane number. For the investigation was chosen gasoline grade A-95 (100 ml), which evaporated in static conditions. A measurement of amount of evaporative fuel and octane number was conducted every day during the week. The results of experimental work we can see at the table 2, which presents all the measured parameters and their changes occurred during the experiment, such as: losses from evaporation, research octane number, motor octane number and anti-knock index.

Table 2

Type of fuel	Losses from evaporation,%	Octane numbers		
		RON	MON	AKI
Gasoline A-95	0	100	90	95
	10	100,4	90,3	95,4
	20	101,0	90,7	95,9
	30	101,2	90,9	96,1

As a result of evaporation losses gasoline characterized by high toxicity, increased tendency to carbonization, so while increasing the octane number leads to reducing its environmental properties.

Conclusion

In result of analysis of literature data established that the main characteristics of gasoline that determine the level of environmental safety are: value of octane number; mass fraction of sulfur; the total content of aromatic hydrocarbons; mass fraction of benzene. As a result of evaporation losses gasoline characterized by high toxicity, increased tendency to carbonization, so while increasing the octane number leads to reducing its environmental properties.

References

1. Motor Gasoline [Electronic resource] // Cambridge, U.K.: Royal Society of Chemistry. – 1995. – Access mode: http://www.chemistryexplained.com/FeGe/Gasoline.html (last access: 15. 05. 2017).
2. Gasoline [Electronic resource] // KazKontrakt Group. – 2015. – Access mode: http://www.kazkontrakt.kz/index.php?page=en_kkt_products_and_services-petrol (last access: 15. 05. 2017).