INFLUENCE OF THE QUANTITY OF BENZENE ON THE PERFORMANCE CHARACTERISTICS OF GASOLINE

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Annotation.

The article shows the influence of the amount of benzene in gasoline on the octane number and performance characteristics of the fuel, as well as toxic substances formed during the combustion and partial combustion of benzene. Described are hydrocarbons that determine the toxicity of commercial gasolines and products of their combustion. The article describes the effect of changes in the benzene content in the composition of gasoline on the octane number of the fuel. Suggestions for simplification of the technological system for standardizing the amount of benzene in gasoline are presented.

Keywords:

Gasoline, amounts of benzene, benz-α-pyrene, aromatic hydrocarbons, the effect of benzene, performance, Octane number.

The increasing consumption of natural fuels in response to the growing needs of mankind poses a risk of depletion of energy resources, which requires the rational use of energy resources, as well as the search for and use of alternative energy sources that do not harm the environment. increases the relevance of the main tasks to be performed. Therefore, research on reducing anthropogenic impact on the environment and the production of high quality fuel and the use of environmentally friendly energy resources in the preparation of commercial fuels for the transport sector in our country is one of today's priorities [1]. The policy of deep modernization of production facilities and technical and technological re-equipment is aimed at increasing the production of export-oriented finished products based on deep processing of hydrocarbons and increasing their competitiveness [2]. The legal basis of this policy is to accelerate socio-economic development, increase the living standards and incomes of the population, ensure the comprehensive and effective use of natural, mineral, industrial, agricultural, tourism and labor potential of each region. Section III of the Action Strategy for the five priority areas of development is reflected in the "Priorities for Economic Development and Liberalization" [3].

As the increase in the number of vehicles has led to an increase in the amount of toxic waste in the environment, it has led to a sharp tightening of emission standards and quality requirements for motor fuels.

Modern automotive and aviation gasoline is a complex mixture of basic components such as direct driving, cracking, catalytic reforming, polymer gasoline, as well as iso-paraffins and various additives [4], the chemical composition of which is quite diverse. has a decisive effect on the detonation properties of [5].

The properties of the motor fuel used play an important role in the analysis of the environmental characteristics of vehicles.

The gasoline fraction consists of three groups of hydrocarbons, mainly alkanes, cyclanes and benzene, as well as aromatic hydrocarbons [6].

Methane, ethane, propane and butane have high octane levels (around 100). The unbranched structure of alkanes indicates a very strong detonation stability, even in rich mixtures.

However, the branched structure of saturated hydrocarbons significantly reduces their detonation stability. The normal structure of lyctane is 20, while that of 2,2,4-trimethylpentane is +100 This is a good example. Higher octane number and variety are characteristic of isomers (neohexene, tryptane, standard isooctane) with double methyl groups per carbon atom, and other tripartite isomers of octane.

The formation of a double bond in a normal hydrocarbon molecule ensures that its detonation resistance is significantly higher than that of the corresponding saturated hydrocarbons [7]. The size of the octane is also affected by the position of the doublet. The closer the double molecule is to the center of the molecule, the higher its octane. The first representatives of the cyclopentane and cyclohexane series (especially cyclohexane) have good detonation resistance. the presence of normally structured side chains in hydrocarbon molecules also leads to a decrease in their octane properties. Almost all simple aromatic hydrocarbons, such as benzene, have a high resistance to detonation. Their Octane is around 100 and above. The presence of side chains, especially the branched ones, increases the resistance to detonation. The only exception is O-ksilol.

Comparing the octane numbers of hydrocarbon mixtures with the true octane number of individual hydrocarbons, large deviations between them can be observed in unsaturated and aromatic hydrocarbons. At the same time, we see that the octane number of unsaturated hydrocarbons is lower than the true value, and in aromatic hydrocarbons it is higher. Their difference can reach 5-10 units of octane number. Aromatic hydrocarbons artificially increase the octane number of the fuel and increase the detonation stability. Although benzene exhibits high detonation stability among aromatic hydrocarbons, the negative effects of benzene increase the dry layer on the engine piston and cylinder walls as its content increases. , aromatic hydrocarbons, which are characterized by high density and high refractive index, are limited in gasoline, despite their high octane number, due to the deformation of rubber seals, plastic tubes and other plastic parts and their decomposition due to melting and corrosion.Euro-5 the maximum concentration of aromatic hydrocarbons according to the requirements of the environmental standard is 35%.

The toxicity of gasoline and combustion products is mainly assessed by the amount of aromatic and olefinic hydrocarbons and sulfur in it. Aromatic hydrocarbons, especially benzene paraffin, are toxic to hydrocarbons. Benzene is the lightest boiling hydrocarbon among aromatic compounds and has been identified as the most dangerous carcinogen among all toxins in the air. The mutagenic and teratogenic effects of benzene on the development of leukemia have been demonstrated. It is a component that causes leukemia, poses a serious threat to human health, and increases the toxicity of fuel and flue gases. The higher the content of aromatic hydrocarbons in gasoline, the higher its heat of combustion and the amount of nitrous oxide in the exhaust gases [8].

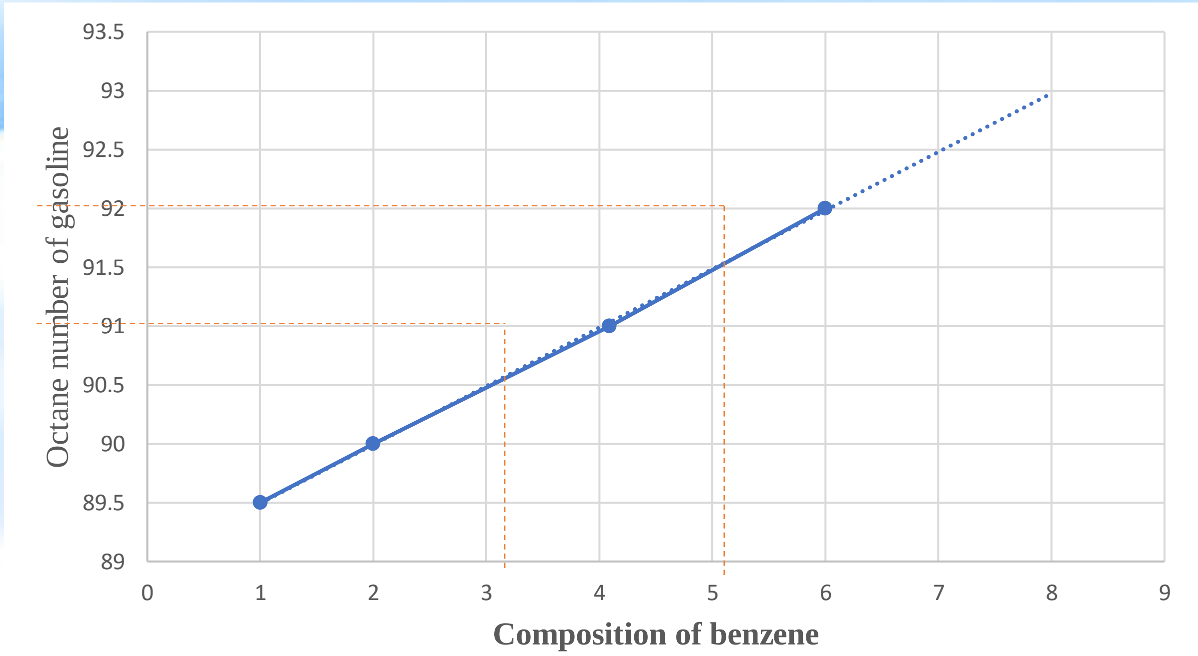
In addition, the benzene in gasoline increases the formation of soot in the engine and increases the concentration of saccharose and polycyclic aromatic hydrocarbons in the exhaust gases. As a result of the formation of the structure, the heat dissipation through the engine walls deteriorates and the temperature at the flame front rises, leading to an increase in the amount of highly toxic nitrogen oxides in the exhaust gases [9].

An increase in the amount of aromatic hydrocarbons in gasoline leads to an increase in the amount of partially burned hydrocarbons in the exhaust gases. This correlation has little to do with the concentration of polycarbonate hydrocarbons with carcinogenic effects.

There is a linear relationship between the amount of benzene in gasoline and its concentration in the emissions - exhaust gases, when refueling a car. For vehicles not equipped with a catalytic converter, the main source of benzene released into the atmosphere is almost 70% due to exhaust gases, about 20% due to evaporation, and less than 10% due to losses during refueling. The total emission of benzene increases by about 2 *mg / km* with each percentage increase in the volume of benzene in gasoline [10].

Production of high-octane gasoline is carried out mainly in two directions: 1) the production of high fractions and 2) the addition of additives and additives that increase the octane. In plants where the petrochemical industry is not well developed, high-octane gasoline is often produced by the formation of large amounts of benzene by aromatization of the catalyst due to the reforming.

In order to study the effect of the amount of benzene in gasoline on its octane properties, 23% was hydrotreated naphtha with an octane number of 61, containing 2.4% benzene, and the remainder was an octane number of 100, containing 4, A mixture consisting of a reformate containing 6% benzene was analyzed. The volume fraction of benzene in the mixture prepared from hydrotreated naphtha and rhizomat for the test is 4.08%. Its octane is 84 in the motor method and 91 in the research method.To determine the effect of benzene content, the volume fraction of benzene in gasoline was 9.2%, the narrow fraction in the range of 70-85 0S and the volume fraction of benzene in the range of 6.9%, in the range of 85-100 0S narrow fraction was separated. The separated narrow fractions were degassed under different conditions and the octane properties of the fuel were analyzed (the effect of the amount of benzene in the fuel on the octane number of the fuel is shown in Figure 1).



1-figure. **Gasoline Octane index depends on the amount of benzene in the composition**

The results of the study show that the amount of benzene in motor gasoline produced in the oil refineries in our country is reduced to 1% with a copy in accordance with European Environmental Standards, which significantly reduces the octane status of gasoline. The addition of alkylation and isomerization services to oil refining schemes has created the conditions for the implementation of the results of reducing the amount of benzene in fuel. The alkylated extractable main isotope consists of high-octane saturated hydrocarbons, the alkylate containing no aromatic hydrocarbons (Octane level 92-94) is used in the manufacture of rhyme with low performance, while the increase in fuel volume leads to the increase of benzene in it. with the ability to use a high-octane (Octane level 82-84) base component, the brand allows the benzene content in gasoline to work up to the norm. The change in octane number in the fuel is compensated by the addition of high-octane oxygen-retaining components, as well as the normalization of the benzene content, as well as the improvement of the environmental characteristics of the gasoline.

The composition of the fuel composition,%	Octane number of basic components	The amount of benzene in the base component	Research results	
			The value of the experimental parameters is the amount of benzene	The amount of benzene
Light naphtha, 22 %, Reform, 73 %, Oxygenate, 5 %	61 100 115	2,4 4,6 -	92,17	3,8
Gasoline Ai-80, 90 % MTBE, 5 % Isopropanol, 5 %	80 120 118	3,5 - -	84	3,15

Table 1.

Changes in the octane number and benzene content of the fuel composition

In order to improve the operational quality of the fuel, the dynamics of change of its octane number when using high-octane compounds used in the preparation of gasoline is analyzed. we propose the formula.

$$OS_b \cdot x + OS_q \cdot (1 - x) = OS_{y.k} \quad (1)$$

Here: OS_b — Octane number of base gasolines;

OS_q — octane number of a high-octane compound;

$OS_{y.k}$ — octane number of the fuel composition consisting of the base component and the compound;

x — volume fraction of base gasoline in the fuel composition.

This calculation formula allows to determine the octane number of the compound to be added, as well as to determine the volume component (2) of the base component and compound with a certain octane number in the preparation of branded gasoline (3).

$$x = \frac{OS_q - OS_{y.k}}{OS_q - OS_b} \quad (2),$$

$$OS_q = \frac{OS_{y.k} - OS_b \cdot x}{1 - x} \quad (3)$$

The results of the study on the composition of fuels based on basic components and various additives are given in Table 1.

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