REGENERATION OF ZEOLITE CATALYSTS

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ABSTRACT The use of a zeolite catalyst in the alkylation of gasoline with styrene is a well-characterized fuel component for internal combustion engines with a content of 6.51% by mass of aromatic hydrocarbons released into the environment. Aromatic hydrocarbons are mainly represented by light kerosene-naphthenic hydrocarbons formed during combustion. Due to the increase in the minimum amount of harmful substances, the catalyst eventually loses its properties, so these catalysts need to be renewed periodically.

АННОТАЦИЯ Применение цеолитного катализатора при алкилировании бензина стиролом является хорошо изученным компонентом топлива для двигателей внутреннего сгорания с содержанием 6,51% по массе ароматических углеводородов, выделяющихся в окружающую среду. Ароматические углеводороды представлены в основном легкими керосин-нафтеновыми углеводородами, образующимися при горении. Из-за увеличения минимального количества вредных веществ катализатор со временем теряет свои свойства, поэтому такие катализаторы необходимо периодически обновлять.

KEY WORDS: gasoline, catalysts, zeolites, regeneration, hydrodearomatization, dearomatization, thermogravimetry, without recirculation.

КЛЮЧЕВЫЕ СЛОВА: бензин, катализаторы, цеолиты, регенерация, гидродеароматизация, деароматизация, термогравиметрия, без рециркуляции.

INTRODUCTION: The current and prospective environmental requirements for gasoline and kerosene limits are increasing year by year, especially the western European countries have met the emission standards since 2000. Euro-3 motor gasoline, which regulates the maximum amount of benzene to no more than 1.0% (ARC not higher than 42%). Since 2005, the Euro-4 standard has started to work, which limits the amount of ArU more strictly (up to 30%). In the future, the content of ArG in the composition of motor gasoline should be reduced to 20-25% (including benzene to 0.8%, and then to zero), and Euro-5 will allow to obtain higher standards**.** [1].

The catalytic hydrodearomatization process is carried out at high pressures. Although extraction processes dearomatizations proceed at relatively low temperatures and pressures, the extractors used are often not environmentally safe. [2,3].

Development of technology for dearomatization of gasoline and kerosene fractions by alkylation, selection of effective heterogeneous zeolite catalysts is of urgent and practical importance. [4].

Alkylation to effective zeolite catalysts, industrial process development, dearomatization of motor fuels by alkylation on heterogeneous catalysts is an urgent problem, taking into account the trend of transferring processes in the world oil refining and petrochemical industry. [5].

DISCUSSION: The hydrogen structure of ZSM5 zeolite structure catalyst by alkylation with dearomatization and aromatic hydrocarbons (ArH) with gasoline-kerosene fractions included in their composition turned out to be the most effective [6,7]. thus, when gasoline is aromatized by styrene alkylation, the highest conversion of aromatic hydrocarbons is observed in the mass ratio. Aromatic hydrocarbons: olefin equal to 1:1 (76.1%), with complete conversion of styrene, the amount of aromatic hydrocarbons in the gasoline fraction was 6.51% by mass. The amount of aromatic hydrocarbons in gasoline after alkylation of benzene with styrene was determined, as well as ArU: styrene ratio 1:0.2 and 1:0.5.[8].

RESULT: The conversion rate of aromatic hydrocarbons under these conditions was 17.35 and 38.0%, respectively. The octane numbers of given dearomatized gasoline samples are listed in the table below.

Table 1. Octane numbers of dearomatized gasoline samples

№	Gasoline samples	residual Amount of ArU, mass%	Octane number, IM
1.	real	22.58	86
2.	It is relatively unflavored ArU: styrene =1:0,2	19.42	84
3.	It is relatively unflavored ArU: styrene =1:0,5	15.31	79
4.	ArU dearomatized in: styrene =1:1	6.51	72

As can be seen from the table, the reduction of ArU content contributes to the reduction of OC in dearomatized gasoline samples. One of the most effective methods of regeneration of used catalysts and adsorbents is thermal desorption, the main characteristic of which is the dependence on energy. Thermogravimetry method is usually used to determine this relationship. [12,13]. Differential thermal composition of regeneration modes for coked samples of catalysts containing zeolite was studied, samples of catalysts with different coke contents were analyzed. [9].

It is known that the supply of air for regeneration in industrial processes contains a large amount of incomplete combustion products, including oxygen, which definitely worsens the environment. [10].Therefore, it is necessary to achieve a reduction in the regeneration time, so that the energy costs and the environmental situation in production will be much better.

Derivatographic studies of coked catalysts were carried out in a branded device Paulik-Paulik-Erdey in the temperature range of 20-1000°C and a heating rate of 10 °C/min (Fig. 1-2). Usually TG, DTG and DTA curves are shown in fig. 1 and 2. Research conditions:

- the mass of the catalyst - 500 mg; - TG sensitivity - 100 mg
- DTG sensitivity 1:10; - DTA sensitivity 1:5;
- heating rate 10 °C / min.

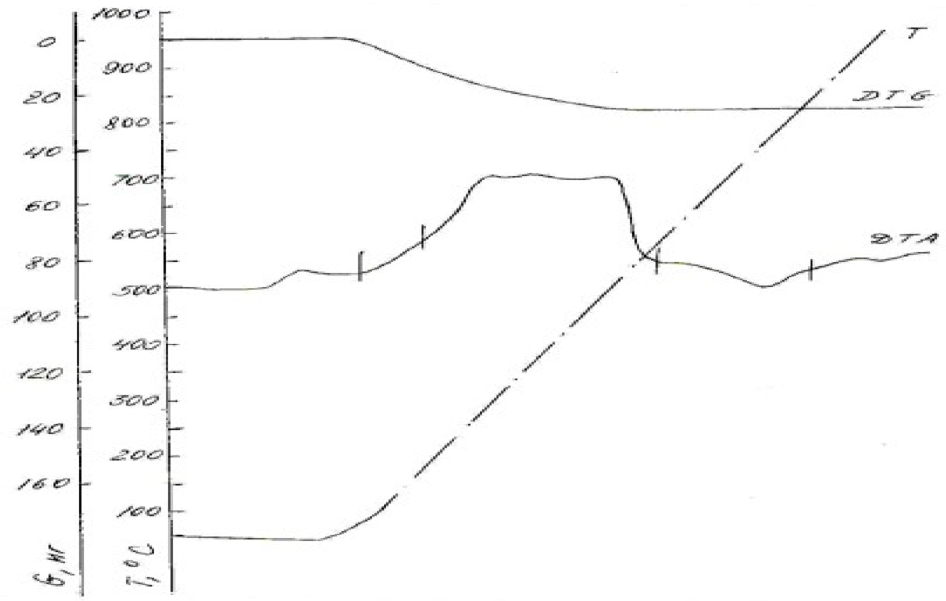

Figure 1. Derivatogram of the original sample HZSM-5.

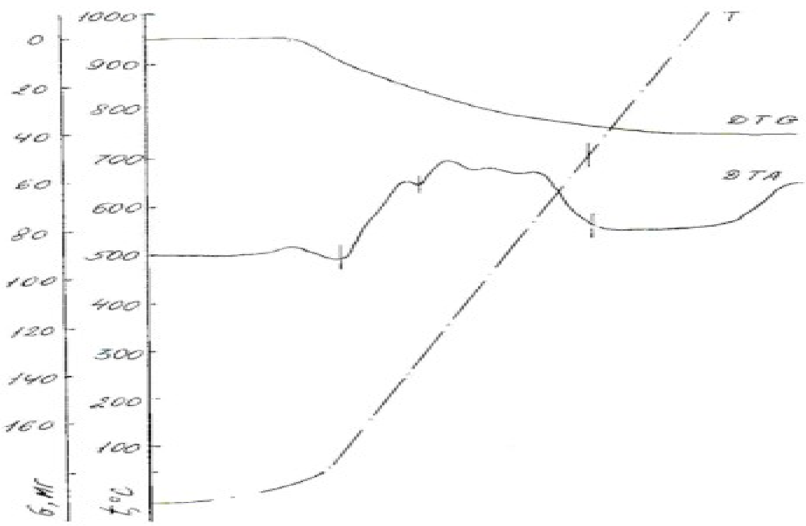

Figure 2. Derivatogram of the coked sample HZSM-5 (3.4 mt of coke in the catalyst). As can be seen from the figures, weight loss for the catalyst with heating of catalysts without coke deposits. [10]. Here, an endothermic effect is observed in

the temperature range 30-210ºC, which can be explained by the removal of adsorbed water from the internal structure. catalyst. [12,13].

An increase in temperature up to 900 °C is accompanied by a rather smooth decrease in the mass of the catalyst, apparently due to the dehydroxylation of its surface. A slight endothermic effect is observed along with weight loss in the interval temperature 680-850 °C. This effect can be explained by the destruction of the crystalline pore.

Derivatographic studies have shown that coked catalysts also lose moisture. The amount that increases in the temperature range of 30-210 °C is most likely the composition of tar coke deposits.

It was found that the components of diesel gasoline are obtained with the help of catalysts. Oxidation products are regenerated with the help of circulation, the octane number of components of motor gasoline obtained in catalysts is not small in size, and the nitrogen-oxygen mixture is regenerated without recirculation. Therefore, it is possible to reduce the consumption of technical nitrogen used for the regeneration process, and it is proved that it is possible to increase the octane number of gas emissions while maintaining the quality characteristics of the resulting component. [14].

Thus, the optimal temperature range for regeneration was determined. The samples of the studied catalysts in the lower range than the initial temperature are structural changes of the catalyst, i.e. 680 °C (apparently the maximum regeneration temperature should not exceed 550-600 °C). [15].The technique of regeneration of catalysts for nitrogen-oxygen has been improved. Also, the activity of the catalyst in the process of dearomatization of gasoline was studied.

CONCLUSION: One of the most effective methods of regeneration of spent catalysts is thermal desorption of adsorbents, which is its main characteristic. The dependence of the desorption energy of the adsorbed substance on the degree of adsorption filling is considered as surfaces. To determine this relationship, the thermogravimetry method is usually used. We studied methods of recovery of coked samples containing zeolite. Catalysts samples of catalysts with different coke contents were dearomatized gasoline using differential thermal analysis.

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