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**Problems of commercial gasoline production during the process of zeoforming**

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Many researchers are engaged in problem of getting a motor fuels that meet the modern requirements from primary products, on the basis of GOST 51866 – 2002 [1]. This is due to the need for more rational use of available resources in the country, the lack of high –quality and affordable motor fuel, as well as the struggle for environmental improvement [2].

Currently, the European Union (EU) and the United States of America (USA) identifies the key requirements for motor gasoline until 2010, which are presented in Table 1. Major changes are associated with a decrease in the sulfur content, aromatic hydrocarbons (primarily benzene) and olefins in gasoline.

Table 1 – Requirements of EU countries to gasoline [4]

| Data  | Values in different periods of time, year |      |
|---|---|------|
|   | 2005 – 2009                               | 2010 |
| 1   | 2   | 3    |
| Sulfur content, ppm                           | 50,0                                      | 10,0 |
| Content, %:                                   |   |      |
| Aromatic hydrocarbons                         | 35,0                                      | 25,0 |
| Olefins                                       | 18,0                                      | 15,0 |
| Benzene                                       | 1,0                                       | 0,7  |
| Oxygen  | 2,7                                       | 2,7  |
| The volume fraction of vaporized gasoline, %: |   |      |
| at 100°C                                      | 46,0                                      | 46,0 |
| at 150°C                                      | 75,0                                      | 75,0 |

To preserve the traditional markets, domestic refineries should produce commercial gasoline, which satisfies its quality characteristics with international standards.

On July 1, 2002 enacted the State Standard of the Russian Federation GOST R 51866 – 2002 “Motor fuel. Unleaded petrol. Specifications”, which is adapted under taken in the EU environmental programs and standards for motor vehicle emissions. Table 2 presents the main indicators of the quality of gasoline in Russia.

Table 2 – Key indicators of the quality of gasoline in Russia [1]

| Data   | GOST R 51866 – 2002 |
|--|---------------------|
| 1  | 2                   |
| Octane number (ON) (Research Method (RM)) / Octane | 95/85               |

| Data  | GOST R 51866 – 2002 |
|---|---------------------|
| Number (Motor Method (MM))                    |                     |
| Sulfur content, ppm                           | 150                 |
| Content, %, not more:                         |                     |
| Aromatic hydrocarbons                         | 42                  |
| Olefins                                       | 18                  |
| 1   | 2                   |
| Benzene                                       | 1                   |
| Oxygen  | 2,7                 |
| Saturated vapor pressure, kPa                 | 45 ÷ 60             |
| The volume fraction of vaporized gasoline, %: |                     |
| at 100°C                                      | 46 ÷ 71             |
| at 150°C                                      | 75                  |

The importance of developing new catalysts and processes to obtain gasoline with high octane number is relevant in connection with a reduction in consumption of leaded gasoline and tighter requirements for the content of aromatic hydrocarbons, especially benzene.

Also very important to expand the resource base of this process by engaging in the production of motor gasoline standard custom of hydrocarbons, such as gas condensate, condensate associated gas and so on, which is especially important for the Russian regions remote from industrial centers of oil and hydrocarbon resources have their own materials [3].

Deactivation of catalyst coke is a reason for the decrease selectivity and drops octane number of produced gasoline is also a key aspect of the technology of catalytic processes, which determines the overall their efficiency.

The main perspective of Zeoforming process is that:

- Low operating costs and capital investments;
- Simplicity of the technology;
- Less explosive – and fire dangerous for lack of hydrogen;
- Low sensitivity to the catalyst composition and quality of raw materials.

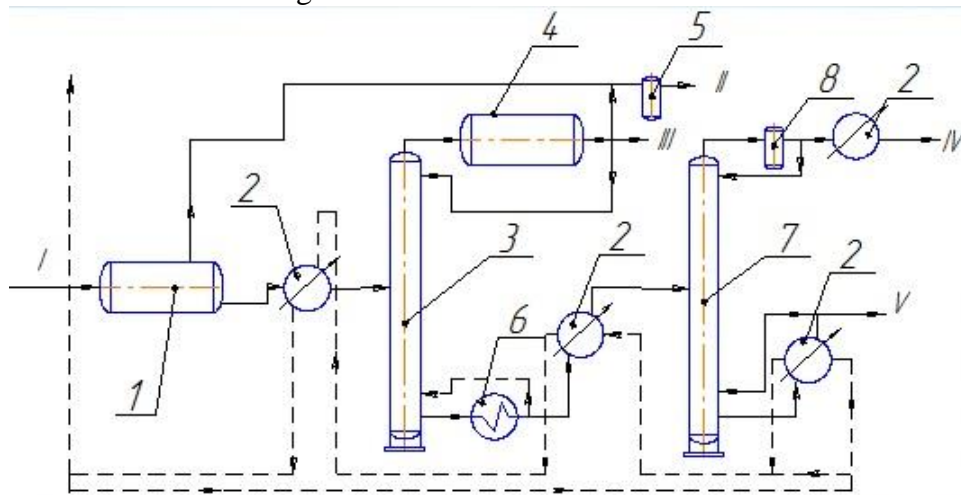
These reasons make the process more cost – effective to implement. The main reaction of this process can be present in the table 3.

Table 3 – The main reactions on zeolite catalysts

| Reactions  |  |
|--|--|
| $C_8H_{18}$  | $\begin{array}{l} \nearrow C_5H_{12} + C_3H_6. \\ \searrow C_5H_{10} + C_3H_8 \end{array}$   |
| $C_6H_{12}$  | $\longrightarrow C_6H_{12}$  |
| $\begin{array}{l} 5 C_3H_6 \\ 3,75 C_4H_8 \\ \cdot \\ 2,5 C_6H_{12} \end{array}$ | $\begin{array}{l} \nearrow C_6H_5CH_3 + 2 C_3H_8 + C_2H_8. \\ \longrightarrow C_6H_5CH_3 + C_6H_{14} + 2 CH_4. \\ \searrow C_6H_5CH_3 + C_5H_{12} + C_2H_6 + CH_4 \end{array}$ |
| $C_4H_8 + C_4H_{10}$   | $\longrightarrow C_8H_{18}$  |
| $C_6H_6 + C_2H_4$  | $\longrightarrow C_6H_5C_2H_5$   |
| $2 C_8H_{10}$  | $\longrightarrow C_7H_8 + C_9H_{12}$   |
| $C_6H_6 + C_6H_4(CH_3)_2$  | $\longrightarrow 2C_6H_5CH_3$  |
| $(CH_3)_2 S$   | $\longrightarrow C_2H_4 + H_2S$  |

At moderate temperatures occur deep conversion of n – paraffin and naphthenes into high – octane gasoline components iso – paraffin and aromatic hydrocarbons. On this type of catalyst takes part and other reactions such as aromatisation, disproportionation, and so on.

The aim of this work is determined the optimal parameters of the fractionation unit with a varying composition of catalysate. The main limitation: the fractional composition of the gasoline product should be close to the requirements of GOST 51105 – 97 [1]. To achieve this aim mathematical model of fractionation unit was designed with help of the program HYSIS. Schematic diagram of a fractionation is shown in Picture 1.



Picture – Schematic diagram of a fractionation unit: 1 – separator; 2,9,10 – heat exchanger; 3 – stabilization column; 4 – condenser; 5 – unit for collecting hydrocarbon gas; 6 – heating

furnace; 7 – distillation column; 8 – reflux tank of gasoline vapors; I – warmed feedstock; II – hydrocarbon gas; III – liquefied gas; IV – petrol; V – bottom product.

Pressure had the most significant effect on the composition of the desired product in the columns of the fractionation unit. For example, varying the parameters of the stabilization column leads to changes in the temperature of the beginning and end of the boiling mixture and in the rectification column the boiling temperature of 10 %, 50 %, 90 % fractions is changed. The optimal parameters equipment of the fractionation unit are shown in table 4.

Table 4 – Characteristics parameters of equipment and their products

| Technological parameter | Temperature of reaction |         |         |         |
|-------------------------|-------------------------|---------|---------|---------|
|                         | 395                     | 425     | 445     | 465     |
| Stabilization column    |                         |         |         |         |
| Top pressure, MPa       | 2,67                    | 2,42    | 2,74    | 2,18    |
| Distillation column     |                         |         |         |         |
| Top pressure, MPa       | 0,92                    | 1,18    | 1,40    | 1,36    |
| Gasoline fraction       |                         |         |         |         |
| Yield, kg/h             | 611,20                  | 785,60  | 936,30  | 904,60  |
| Diesel fraction         |                         |         |         |         |
| Yield, kg/h             | 1755,80                 | 1683,10 | 1588,10 | 1589,60 |

With increasing pressure, the temperature in the column is also increased. Parameters, such as a minimum irrigation and / or the temperature on the trays, should be changed when the error occurred. Table 5 shows the fractional distillation catalysts obtained at different catalyst activity, and compositions of the desired product, corresponding optimal parameters of fractionation unit.

Table 5 – Comparison of the fractional composition of the catalyst before and after fractionation

| Boiling range        | GOST 51105 –97 | Temperature of reaction |        |          |        |          |        |          |        |
|----------------------|----------------|-------------------------|--------|----------|--------|----------|--------|----------|--------|
|                      |                | 395                     |        | 425      |        | 445      |        | 465      |        |
|                      |                | Catalyst                | Petrol | Catalyst | Petrol | Catalyst | Petrol | Catalyst | Petrol |
| T <sub>sb</sub> , °C | ≤30            | 36                      | 26,2   | 37       | 27,7   | 37       | 26,8   | 38       | 23,3   |
| 10%                  | ≤70            | 64                      | 27,8   | 65       | 33,6   | 76       | 30,5   | 68       | 25,3   |
| 50%                  | ≤120           | 112                     | 129,0  | 116      | 115,4  | 119      | 115,8  | 109      | 120,4  |
| 90%                  | ≤180           | 187                     | 144,3  | 171      | 140,6  | 167      | 139,7  | 145      | 136,0  |
| T <sub>eb</sub> , °C | ≤205           | 261                     | 155,7  | 261      | 152,7  | 271      | 152,1  | 242      | 145,1  |

The following conclusions may be made:

1. When the temperature increases, the output of commercial gasoline grows, the yield of the heavy residue and gases falling;
2. Significant changes of the process will produce a commercial gasoline, regulated by the state standard;
3. As for fractional composition that meets the requirements [1] it is not sufficient to change only one parameter, and we need to research all the factors that complicate the task.

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#### TREATMENT AND DISPOSAL METHODS.

The bulk of waste falls into the category of general waste, much of which can be recycled or reused. With correct segregation, less than 5 per cent of the waste is likely to be classified as clinical waste.

Clinical waste must be managed by approved treatment methods. Once treated by a process acceptable to the relevant State or Territory authorities, it may be reclassified accordingly before recycling or disposal.

The waste treatment options currently available have various capabilities and limitations. As technology changes, health care establishments should evaluate treatment alternatives for their safety, effectiveness, environmental impact, costs, and compliance with relevant State or Territory licensing requirements. Large volumes of liquids (such as 24-hour urine collections) should generally be disposed of into an appropriate sluice. Precautions must be taken