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RESEARCH OF THE ASSOCIATED PETROLEUM GAS CONVERSION INTO AROMATIC HYDROCARBONS ON A ZEOLITE CATALYST

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Oil production and refining processes have a strong impact on the environment due to the significant amount of associated petroleum gas that is flared [1].

The object of the study is the process of associated petroleum gas conversion into liquid hydrocarbons. This process makes it possible to efficiently utilize associated petroleum gas and obtain aromatic hydrocarbons – a valuable petrochemical feedstock. In addition, in the reactions of the process, a hydrogen-containing gas is formed, which is a high-energy fuel, which is increasingly being introduced into the structure of the world energy consumption. High activity and selectivity, as well as resistance to catalytic poisons characterize zeolite catalysts used in this process [2].

The aim of this work is to develop mathematical of associated petroleum gas conversion based on the approach presented in [3].

At the first stage of the work thermodynamic parameters of the reactions were calculated (Table 1) at the temperature of 520 °C and the pressure of 1.2 MPa.

Further, based on the literature and the thermodynamic parameters of the reactions, a formalized scheme was drawn up for the conversion of associated petroleum gas on zeolite.

The developed transformation scheme became the basis for a kinetic model of the process under study.

The system of equations of the kinetic model:

$$\begin{cases} \frac{dC_{paraffins\ C1–C2}}{dt} = -2W_1 + 2W_{-1} + W_3 + W_2 \\ \frac{dC_{paraffins\ C3–C5}}{dt} = -W_2 + W_{-2} - W_3 + W_{-3} \\ \frac{dC_{olefins}}{dt} = 4W_1 - 4W_{-1} - 4W_4 + 4W_{-4} + 4W_2 - 4W_{-2} \\ \frac{dC_{aromatic\ HC}}{dt} = -W_5 + W_4 + W_3 - W_{-3} - W_{-4} \\ \frac{dC_{H_2}}{dt} = W_1 + W_3 + W_4 \\ \frac{dC_{polyaromatic\ HC}}{dt} = -W_6 + W_5 - W_{-5} \\ \frac{dC_{coke}}{dt} = W_6 \end{cases}$$

The reaction rate equations are given in the table 2.

Table 1. Thermodynamic parameters of process reactions (at 520 °C, 1.2 MPa)

Reactions	ΔH, kJ/mol	ΔG, kJ/mol
2 Paraffins C_1–C_2 → Paraffins C_3–C_5 + $2H_2$	184.45	–28.0
Paraffins C_3–C_5 → Olefins + Paraffins C_1–C_2	69.52	–27.0
Paraffins C_3–C_5 → Aromatic HC (C_6–C_{12}) + $4H_2$ + Paraffins C_1–C_2	274.15	–65.0
6 Olefins → Aromatic HC + (2–3)H_2	–248.0	–101.0
Aromatic HC → Polyaromatic HC	–94.84	–291.6
Polyaromatic HC → Coronen + H_2	–87.3	–97.5

Table 2. Reaction rate equations

Direct reaction	Reverse reaction
$W_1 = k_1 \cdot C^2_{paraffins\ C1–C2}$	$W_{-1} = k_7 \cdot C^2_{H_2} \cdot C_{paraffins\ C3–C5}$
$W_2 = k_2 \cdot C_{paraffins\ C3–C5}$	$W_{-2} = k_8 \cdot C_{olefins} \cdot C_{paraffins\ C1–C2}$
$W_3 = k_3 \cdot C_{paraffins\ C3–C5}$	$W_{-3} = k_9 \cdot C_{polyaromatic\ HC} \cdot C_{H_2} \cdot C_{paraffins\ C1–C2}$
$W_4 = k_4 \cdot C^4_{olefins}$	$W_{-4} = k_{10} \cdot C_{aromatic\ HC} \cdot C_{H_2}$
$W_5 = k_5 \cdot C_{aromatic\ HC}$	$W_{-5} = k_{11} \cdot C_{polyaromatic\ HC}$
$W_6 = k_6 \cdot C_{polyaromatic\ HC}$	

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CHITOSAN-BASED FILMS FOR GRAMICIDIN S SUSTAINED RELEASE

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Due to permanent antibiotic resistance development, antimicrobial peptides became attractive candidates for drug development [1].

Among those, Soviet invention – Gramicidin S represents strong antibacterial properties, which reflects in low inhibitory and bactericidal concentrations, and a specific mechanism [2].

Since the peptide is toxic towards to the red blood cells, its application is limited to the topical level [3].

Gramicidin S is used in a complex therapy of eye infections as an active ingredient of eye drops which demand a periodical application of several drops 2–3 times per day [4].