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RESEARCH OF THE PROCESS OF PRODUCING ALCOHOLS BASED ON BY-PRODUCTS OBTAINED IN THE FISCHER-TROPSCH SYNTHESIS

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Abstract. *Today, in the world and in our country, the need for fuel for liquid internal combustion engines used in the transport sector is met by fuels produced in an alternative form (liquefied synthetic fuels) in addition to natural liquid hydrocarbon sources. Fischer-Tropish synthesis is one of the main processes in the production technology of liquid synthetic fuel. Fischer-Tropsch synthesis produces alkanes, alkenes, water of reaction and alcohols. This article examines the factors influencing the efficiency of the formation of main and by-products as a result of the reaction during the production of liquefied synthetic fuels. The results of studies on the analysis of the composition of by-products formed during the Fischer-Tropsch synthesis and the extraction of alcohols based on them are also presented.*

Keywords: *reactor, liquefied synthetic fuel, synthesis gas, alkane, alkene, alcohol, reaction water.*

FISHER-TROPSCH SINTEZIDA HOSIL BO‘LADIGAN QO‘SHIMCHA MAHSULOTLAR ASOSIDA SPIRTLAR OLISH JARAYONINI TADQIQ QILISH

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Annotatsiya. *Bugungi kunda dunyoda va mamlakatimizda transport sohasida qo‘llaniladigan suyuq ichki yonuv dvigatellari yonilg‘isini ehtiyoji tabiiy suyuq uglevodorod manbalaridan tashqari alternativ shaklda (suyultirilgan sintetik yoqilg‘ilar) ishlab chiqariladigan yoqilg‘ilar orqali qondirilmoqda. Bunda suyuq sintetik yoqilg‘i ishlab chiqarish texnologiyasida Fisher-Tropish sintezi asosiy jarayonlardan biri hisoblanadi. Fisher-Tropsh sintezida alkanlar, alkenlar, reaksiya suvlari va spirtlar hosil bo‘ladi. Ushbu maqolada suyultirilgan sintetik yoqilg‘i ishlab chiqarish jarayonda reaksiya natijasida asosiy va qo‘shimcha mahsulotlarni hosil bo‘lish samaradorligiga*

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ta'sir etuvchi omillar tadqiq qilingan. Hamda Fisher-Tropsh sintezida hosil bo'lgan qo'shimcha mahsulotlarni tarkibini tahlil qilish va ular asosida spirtlar ajiratib olish bo'yicha olingan tadqiqot natijalari keltirilgan.
Kalit so'zlar: *reaktor, suyultirilgan sintetik yoqilg'i, sintez gazi, alkan, alken, spirt, reaksiya suvlari.*

ИССЛЕДОВАНИЕ ПРОЦЕССА ПОЛУЧЕНИЯ СПИРТОВ НА ОСНОВЕ ПОБОЧНЫХ ПРОДУКТОВ, ПОЛУЧЕННЫХ В СИНТЕЗЕ ФИШЕРА-ТРОПША

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Аннотация. *Сегодня в мире и в нашей стране потребность в топливе для жидкостных двигателей внутреннего сгорания, используемых в транспортной сфере, удовлетворяется за счет топлив, получаемых в альтернативной форме (сжиженные синтетические топлива) помимо природных жидких углеводородных источников. Синтез Фишера-Тропиша является одним из основных процессов в технологии производства жидкого синтетического топлива. Синтез Фишера-Тропша дает алканы, алкены, реакционную воду и спирты. В данной статье изучены факторы, влияющие на эффективность образования основных и побочных продуктов в результате реакции в процессе производства сжиженного синтетического топлива. Также представлены результаты исследований по анализу состава побочных продуктов, образующихся при синтезе Фишера-Тропша, и экстракции спиртов на их основе.*
Ключевые слова: *реактор, сжиженное синтетическое топливо, синтез-газ, алкан, алкен, спирт, реакционная вода.*

Introduction. Today, worldwide, oil and gas are the main raw materials for the production of energy and motor fuel, and the products obtained based on their processing are widely used in transport, energy, agriculture and everyday life. The main share of the fuel-energy complex is made up of liquid hydrocarbon fuels of internal combustion engines. Today, vehicles with internal combustion engines are the main part of the existing transport systems. As the number of people increases, so does the number of vehicles that serve them. This, in turn, causes an increase in the need for internal combustion engine fuel. Our republic does not have enough oil reserves to fully cover this need with the help of liquid hydrocarbon fuel produced using natural oil raw materials. Therefore, this need is partially covered by the production of synthetic liquid fuel using alternative methods. The emergence of synthetic liquid fuel production technology dates back to the 40s of the 20th century. This period corresponds to the period of the Second World War, and it is important for the need for fuel in the war. The main raw materials for the production of synthetic liquid fuel are

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coal and natural gas. Currently, enterprises producing synthetic liquid fuel based on natural gas and hard coal are operating in the world [1].

Literature analysis and methods.

I. The production process of synthetic liquid fuel is carried out mainly on the basis of raw materials of methane, and this process consists of the following technologies [2; p. 314-319].

1.1. Preparation of methane raw materials: (natural gas preparation, drying, purification, fractionation).

1.2. Methods of obtaining synthesis gas from methane:

II. $CH_4 + O_2 \rightarrow 2CO + 4H_2$ Partial oxidation.

III. $CH_4 + H_2O \rightarrow CO + 3H_2$ water vapor conversion.

IV. $CH_4 + CO_2 \rightarrow 2CO + 2H_2$ carbonic anhydride conversion.

1.3. Synthesis gas is mainly produced

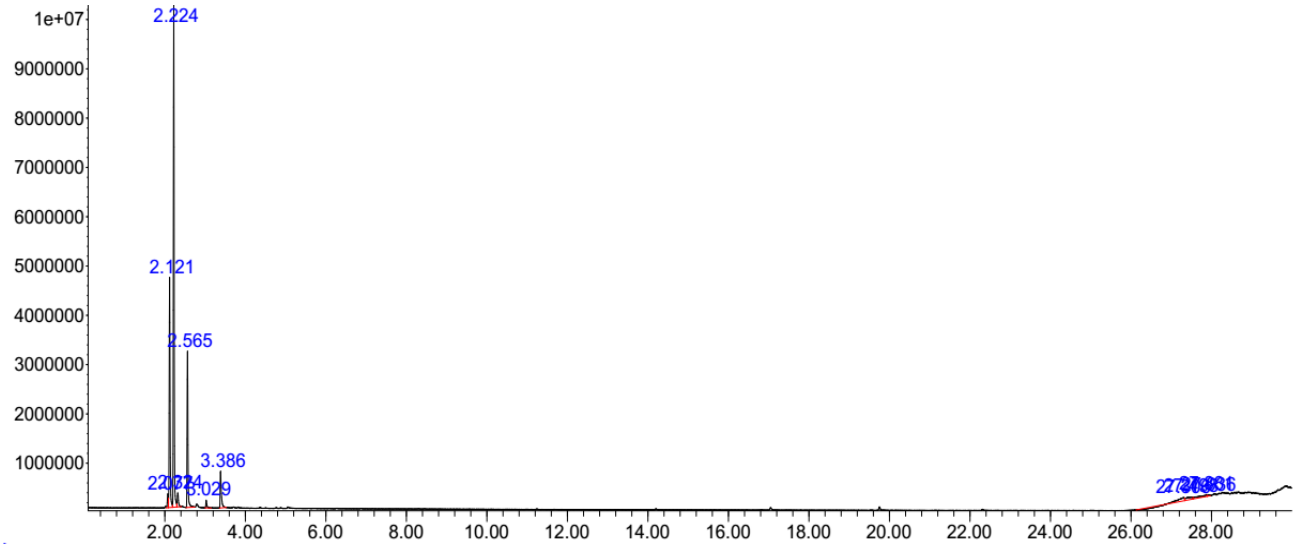

Figure 1. Chromatographic analysis of alcohols contained in organic matter extracted from reaction waters.

Table 1

Chemical composition and concentration of organic liquids separated from the composition of reaction waters by the rectification method

№	Library/ID	RT	area%
1.	Ammonia	2.077	1.56
2.	Ethyl format	2.121	20.00
3.	Ethanol	2.224	45.91
4.	Hydroperoxide, 1-methylethyl	2.324	1.95
5.	1-propanol	2.565	16.03
6.	1-propanol, 2-methyl-	3.029	0.94
7.	1-butanol	3.386	5.08
8.	4,4 -dimethyl-, acetate	27.306	0.71
9.	1,3-dimethyl-4-vinylhexadehydrocyclopenta [α]phenanthren-3-ol	27.498	1.86
10.	Cholestan-16-ene	27.881	1.69
11.	Cholestan-3-one, 4,4-dimethyl-, alpha.	27.936	0.27

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in industry using partial oxidation and water vapor conversion methods.

Fisher Tropish Synthesis. In this process, the process of synthetic extraction from synthesis gas is considered, in which CO and H_2 react in the reactor to produce the main product synthetic oil (Wax) and intermediate products (aldehydes, ketones, alcohols, reaction waters, etc.). The following reactions take place in the process [3; p. 375].

Basic reactions

I. $nCO + (2n+1)H_2 \rightarrow C_nH_{2n+2} + nH_2O$ alkanes

II. $nCO + 2nH_2 \rightarrow C_nH_{2n} + nH_2O$ alkenes

III. $CO + H_2O \leftrightarrow CO_2 + H_2$ reaction waters

Additional reactions

I. $nCO + 2nH_2 \rightarrow H(-CH_2-)_nOH + (n+1)H_2O$ spirtlar

4. The artificial oil obtained as a result of Fischer-Tropish synthesis is refined and separated into fractions and brought to the state of finished products.

Research methodology. In this process, reaction waters + alcohols, aldehydes, ketones are formed as a by-product of Fischer-Tropish synthesis. Water is removed from this liquid mixture by the rectification method, and the resulting organic compounds (alcohols, aldehydes, ketones) are used as fuel for furnaces (boilers) in technology. Analysis of the content of organic liquid separated from the content of technical water is given in Fig. 1 [4].

Results. Ethanol (45.91%), Ethyl formate (20.00%) and 1-Propanol (16.03%) constitute the main share of organic liquids extracted from the composition of reaction waters. The physical properties of organic liquids extracted from the composition of reaction waters are presented in Table 2 [5; p. 604-607].

The composition of the reaction water is mainly salts. This mixture was divided into fractions in an experimental device by driving alcohol and ethers from its composition. The laboratory device of the fractional driving process is presented in Fig. 1. A 100 ml sample of organic matter was taken and separated into fractions by heating it at 20, 60 and 80°C using 7 heating furnaces in 1 driving flask [7; p. 109].

As a result of driving at 20°C, methanol was extracted as a gas. In this case, the total mixture content decreased by 1.3%. Ethyl formate began to evaporate when the

Table 2

Basic physical properties of organic liquids separated from reaction waters

№	The name of an organic liquid	Molar mass, gr/mol	Density, kg/m^3	Boiling temperature ℃
1.	Ammiak	17,031	0,73	-33,34
2.	Etil formati	74,08	917	54
3.	Etanol	46,069	789,45	78,39
4.	Gidroperoksid, 1-metiletil	76.0944	***924***	84
5.	1-propanol	60,0952	803	97
6.	1-propanol, 2-metil-	74.1216	803	108
7.	1-butanol	74,12	810	117,7
8.	4,4 -dimetil-, asetat	***59.04***	***902***	***137***

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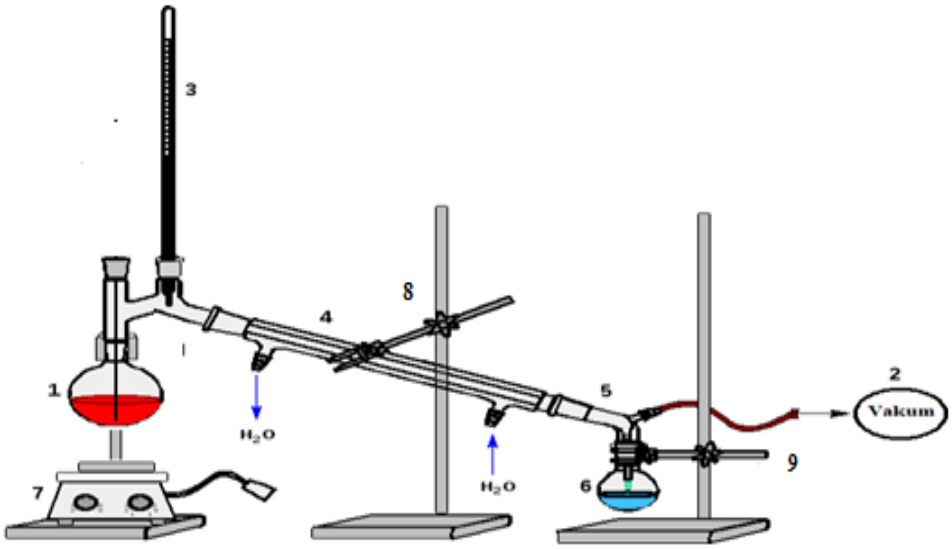

Figure 1. A simple driving laboratory device.
1 - driving flask, 2 - vacuum, 3 - thermometer, 4 - refrigerator, 5 - flask, 6 - collecting flask, 7 - heating furnace, 8,9 - tripod.

temperature was increased to 60°C, which also decreased by 18 mL in the process.

Conclusions. It can be concluded that the technology of production of technical alcohols can be established by driving the mixture of reaction waters + organic liquids formed in the Fischer-Tropsch technology and separating the separated light phase into separate fractions.

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