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INVESTIGATION OF THE EFFECT OF CATALYSTS ON THE DIMERIZATION OF HEXENE

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ABSTRACT

Nowadays, oligomers of high olefins play an important role. The reason is that high α-olefins are a raw material in the production of quality synthetic surkov materials. Dimerization of olefins is an important step in their processing. Because it is possible to obtain products for the basic organic synthesis industry from such dimerized substances. In our study, we studied the effect of catalysts on the dimerization of hexene 1. IR-spectroscopic analysis of the obtained substances was performed as a result of the experiment.

Introduction

Nowadays, oligomers of high olefins play an important role. The reason is that high α-olefins are a raw material in the production of quality synthetic surkov materials. Dimers of styrene and α-methyl styrene can be used as a means of controlling the molecular weight of polymers and rubbers, plasticizers, heat carriers resistant to high temperature radiation, solvents for paints and varnishes, monomers for the production of gas-separating polymer membranes. Will be used [1; 2;].

Dimerization of olefins is an important step in their processing. Because it is possible to obtain products for the basic organic synthesis industry from such dimerized substances.

Dimerization of olefins is the process of forming a dimer (a combination of two molecules) as a result of fusion reactions. In this process, in the presence of mineral acids (donor of the H + proton), a proton attaches to the doublet in the alkene molecule. The following carbation is formed:

This carbation binds to the next alken molecule to form dimer carbation:

R CH CH_3 + R—CH=CH_2

►R—CH—CH_2—CH—R

I 2

CH_3

As a result of the release of a proton from the dimer carbation, it stabilizes, and the dimerization product of the alkene forms a mixture of dialken isomers:

H

I +

R—CH—CH—CH—R

►R—CH—CH=CH—R

I^2-H+I^2

CH_3

CH_3

R—CH—CH_2—CH—R—H

►R—CH—CH_2—CH= R

I-H+I

CH_3

CH_3

Hexen-1 and its isomers are widely used in various fields. Such compounds are used as raw materials in the chemical industry and can be used to make chlorinated products (insect repellents), heterocyclic compounds, unsaturated alcohols and unsaturated carbonic acids. It is used as a monomer in the field of polymers and various rubber products are obtained from the polymer product obtained [6; 4;].

At present, the chemical industry of double-bonded organic compounds plays an important role in the national economy, in the production of basic products for the production of monomers. In particular, double-bonded substances based on olifens are mainly used in the production of polymers, which are special sorbents. It is known that the addition of other radicals to organic compounds containing an active hydrogen atom is easy and common. Such organic compounds include olefins, alcohols, phenols, amines, carbonic acids, and others [5;].

Basically, the corresponding high olefins are produced by the action of 1-hexene catalyst ferrous sulphate at a lower temperature. However, in this case, the dimerization yield of hexene is not very high. The reaction takes a long time and a small amount of sample is taken for testing every hour [6; 7;].

In recent years, it has been studied that in organic synthesis, mainly olefins are first halogenated and then double-bonded in a highly basic system. In this case, the formation of a complex and delocalized charge of the active anion of the system, as well as the metal cation, formed mainly by the interaction of the catalyst and the solvent, plays an important role.

In modern organic synthesis, the study of the dimerization process of olifens is important to study the conditions of the process, the effect of the catalyst, the nature of the solvents. The use of highly basic systems in this process is one of the current problems in the chemistry of organic compounds.

With this in mind, we aimed to study the structure and physicochemical properties of the products obtained by studying the effect of catalysts during the dimerization of hexene 1.

Materials and methods.

Hexene 1, alumina, sulfuric acid, ammonium sulfate, ferrous sulfate, and distilled water were used to study the dimerization process of 1-Hexene.

Hexen 1 is a colorless, slightly flammable, pungent-smelling liquid. Insoluble in water. Mixes well with many organic solvents. 1-Hexene has olefin-like properties. Hexene 1 is obtained by the following methods.

Aluminum oxide. Al_2O_3 is a binary substance composed of aluminum and oxygen. In nature, alumina occurs as a compound. Aluminum oxide is widely used in nature, mainly in the form of various compounds with the metals potassium, sodium, magnesium. A colorless crystalline substance under normal conditions. T kai- 2980 ° C T liquid-2072 ° C density a-Al_2O_3 - 3.99, g-Al_2O_3 -3.68 g / sm^3 is insoluble in water but forms various hydrates with water.

Sulfuric acid. H_2SO_4 is an odorless, colorless, heavy oily liquid under normal conditions. Density 1.83 g / sm^3, T select 296 ° C. Sulfuric acid absorbs water and releases large amounts of heat.

Ammonium sulfate is an inorganic complex compound, an ammonium salt of sulfuric acid. It is a colorless, transparent, odorless, crystalline (or white powder) substance. Density- - 1,766 g / sm.

Iron (II) sulfate. Inorganic compound, its formula is $FeSO_4$. Iron sulphate is an odorless colorless, crystalline transparent substance.

Catalyst preparation

In order to study the dimerization process of 1-hexene, the necessary catalysts are prepared. To do this, sulfuric aluminum oxide was used to study the dimerization process.

In the process, alumina was used in gamma mode. To do this, the alpha state oxidized to a gamma state when heated above 400 ° C in a drying oven. Aluminum oxide acts as a carrier.

Physical properties of gamma alumina: density 3.68 g / ml,

The liquidus temperature is 2044 ° C and the boiling point is about 3000 ° C.

Concentrated sulfuric acid was also used in the process.

Preparation of sulfate catalyst

For this, a concentrated sulfuric acid solution of 2M was first prepared. Take 100 ml of the prepared 2M solution, place it in a flat-bottomed flask and add 2 g of gamma alumina. The mixture was stirred in a magnetic stirrer for 1 h at room temperature. The resulting solution was filtered and dried in an oven at 120 ° C for 2 h. Then it turned into a dark black substance.

Preparation of ammonium sulfate catalyst

In the preparation of this catalyst, 100 ml of ammonium sulphate salt and 2 g of gamma alumina were added to a flat-bottomed flask. The mixture was stirred in a magnetic stirrer at room temperature for 1 h. The resulting mixture was filtered and then dried in a drying oven at 120 ° C for 2 h.

Preparation of ferrous sulfate catalyst

In the preparation of ferrous sulphate catalyst, 1.4 g of ferrous sulphate salt is dissolved in 6 ml of distilled water in a flat-bottomed flask. To the molten ferrous sulfate was added 10 g of sulfated gamma aluminum oxide catalyst. The solution was stirred in a magnetic stirrer until it was completely absorbed into the carrier. The mixture was then filtered and dried in an oven at 120 ° C for 2 h. The catalyst turned black.

The oligomerization of hexene-1 was studied on the basis of the formed catalysts.

The hexene fraction was brought from the saline gas chemical complex and separated by simple driving. The boiling point of the hexane and isomers was taken into account in the purification. The obtained substances were filtered. Filtration was performed on a simple vacuum filtration instrument.

Table 1
Physicochemical properties of the obtained olefins

№	The name of olefin	Quantitative content, %	$T_{bo.poin}$, °C	n_D^{20}	d_4^{20}
1.	hexene-1	21,5	63,5	1,3879	0,6731
2.	2-methyl-1-pentene	40,1	62,1	1,3920	0,6771
3.	3-methyl-1-pentene (trans)	2,5	54,2	1,3842	0,6675
4.	3-methyl-2-pentene (stis)	3,3	70,2	1,4045	0,6986
5.	2-ethyl-1-butene	21,0	64,7	1,3967	0,6896
6.	2-ethyl-1-pentene	4,7	72,7	1,4657	0,6997
7	Residue	6,9	t >100	1,485	
	That's all	100			

Results and discussion.

The structure of the obtained olefins was investigated by the IK-spectral method.

The C-H groups corresponded to 3082 sm^{-1} gravitational vibration in IK-hex-1 solution. assimilation density is observed and also includes an assimilation band of 1647 sm^{-1}. Approximately 909 and 993 sm^{-1} peaks are observed in the region 2924-2950 sm^{-1} in the 1-hexene IR spectrum due to the deformation vibration of the two-vector hydrogen atom, which has a vibration corresponding to the Cis C = C olefin group system, as well as Lies in the area of 1607 sm^{-1}. The negativity of the third carbon deformations is observed in the region of 1377 sm^{-1}. Deformation vibrations of CH_3 methyl groups are observed in the regions 1457-1460 sm^{-1}, valence vibrations of CH_3 groups in the region 1377 sm^{-1}.

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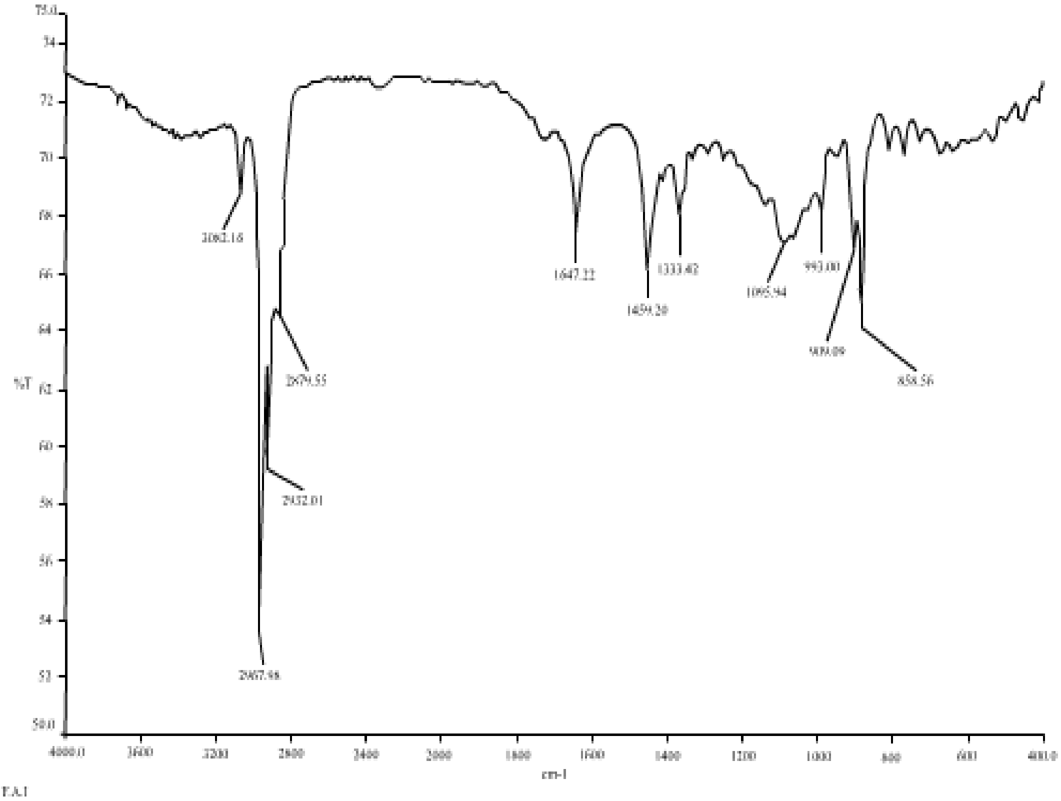

Figure 1. IK spectrum of 1-hexene

In this study, the effect of the nature of the catalyst on the dimerization process of hexene 1 was studied. $(NH_4)_2SO_4$ $\gamma A1_2O_3$, $FeS0_4 \bullet \gamma Al_20_3$, $H_2SO_4 \bullet \gamma A1_2O_3$ were selected as catalysts. The dimerization process of 1-hexene was carried out in the presence of catalysts at 60° C for 10 h. The process was as follows. 0.2 mol of 1-hexene and 5 g of prepared catalyst were placed in a flat-bottomed flask. The mixture was stirred in a magnetic stirrer and the temperature was maintained at 60° C. During the reaction, a sample was taken from the mixture every 2 hours.

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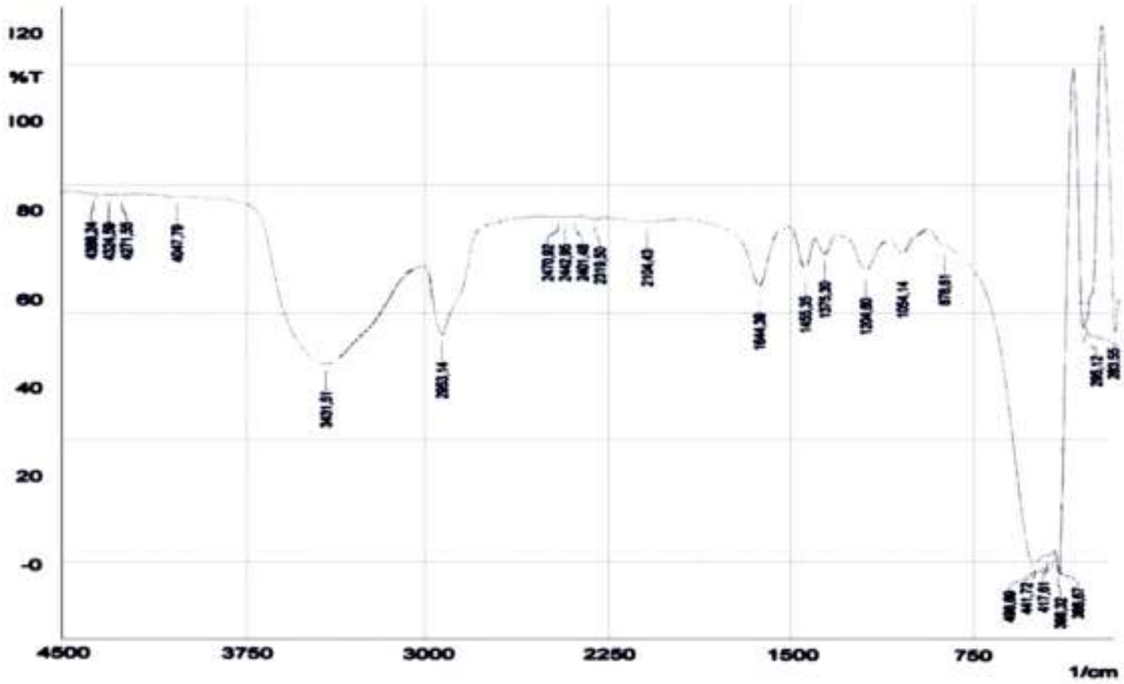

Figure 2 shows that the most active catalyst in the dimerization process is $FeS0_4 \bullet \gamma Al_20_3$. From the obtained IK spectrum it can be seen that in the area of 2953.14 sm^{-1} there are areas of absorption of $-CH_3$, in the area of 1644.39 sm^{-1} - HRC = CR'H stis, in the area of 1455.35 sm^{-1} - CH_2-.

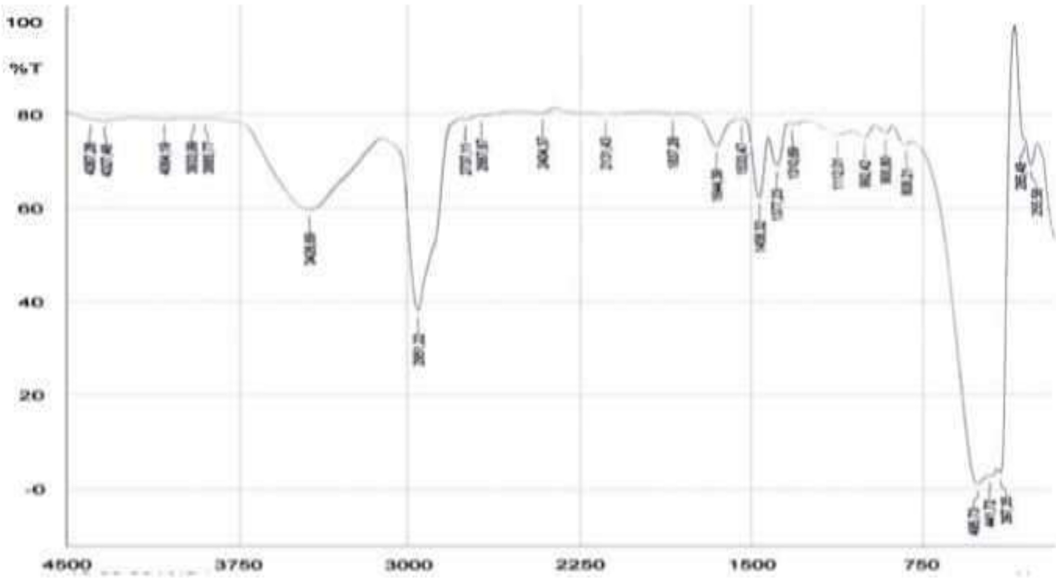

Figure 3. $H_2S0_4 \bullet \gamma A1_20_3$ - IK spectrum of hexene dimerization product 7-methyl 5-undecene based on catalyst. Based on the data in this IK spectrum, the presence of an absorption area of 2951.22 sm^{-1} indicates the presence of $-CH_3$ group, the presence of an absorption area of 1644.39 sm^{-1} indicates the presence of -S = S-group, the presence of an absorption area of 1456.32 sm^{-1} $-CH_2$ indicates the presence of a group.

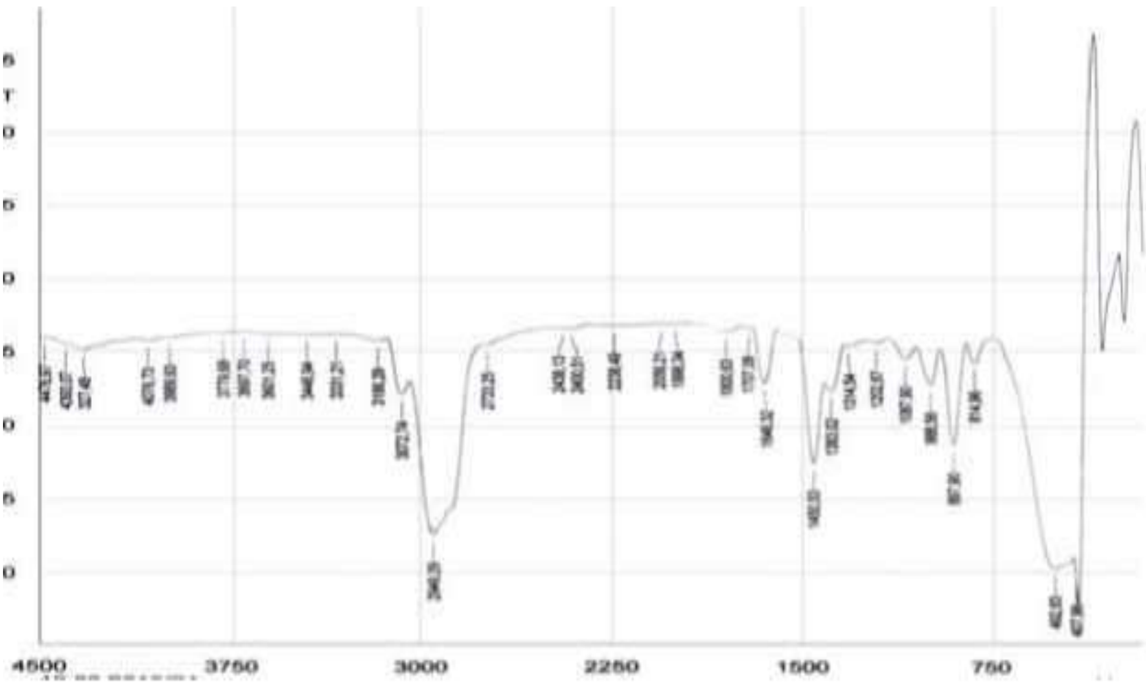

Figure 4. $(NH_4)_2SO_4 \bullet \gamma Al_2O_3$ - hexene dimerization product based on catalyst IK spectrum of 7-methyl 5-undecene Absorption lines belonging to -S = S-bonds in the area of 1647 sm^{-1} in the IK spectrum of 7-methyl 5-undecene, in the area of 2949 sm^{-1} It was found that there are valence oscillations specific to the CH_3 group.

Thus, it was found that different catalysts affect the dimerization of hexene 1.

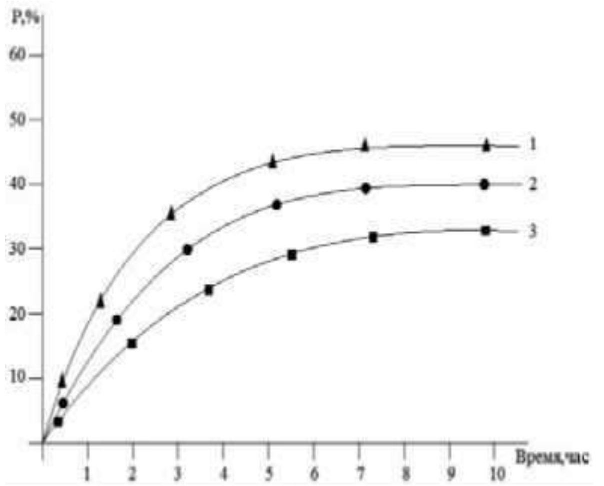

Figure 5 Influence of catalysts on dimerization of hexene 1.

1-$FeSO_4 \bullet \gamma Al_2O_3$;

2- $(NH_4)_2SO_4 \bullet \gamma Al_2O_3$;

3- $H_2SO_4 \bullet \gamma Al_2O_3$.

1-geksen =0,16 mol, t=60°C

As can be seen from the graph, the role of the catalyst $FeSO_4 \bullet \gamma Al_2O_3$in the dimerization of Hexen-1 is significant. The catalyst has a good effect on the dimerization process. The yield of the reactant is much higher than that of other catalysts.

Conclusions.

Our study found that when the dimerization process of 1-Hexen was continued at an average of 60° C and for 10 hours, the yield of the product was much higher. During the process, the temperature, the amount of raw materials and the duration of the reaction were studied and the optimal conditions were determined. In addition, hexene-1 was dimerized using catalysts of iron sulfate + alumina, ammonium sulfate + alumina, sulfuric acid + alumina. When the molar ratios of the catalyst and hexene 1 are

1: 0.5, the yield of the substance formed is high. The resulting substance was studied by IK spectroscopic method. The olefins formed during the experiments can be used in various fields of the chemical industry.

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