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INVESTIGATION OLIGOMERS OF HEXENE-1 WITH THE AROMATIC FRAGMENT AS SYNTHETIC COMPONENTS TO PETROLEUM OILS

Abstract: *The essence of the research is achieving of base oils having higher viscosity index. For this purpose, α-olefin hexene-1 with reserves cheap raw materials, aromatic hydrocarbon in composition – oligomerization in toluene decisive environment. The advantages of toluene in the presence of oligamerization is that the toluene by forming a complex with Aluminum Chloride plays the role of so catalyst and process (oligomerization and alkylation) is going fuzzy, toluene cyclic cheaper than monomers and finally the active center of oligomers in environment is alkalized of toluene as a result of obtained product having a smaller unsaturated and it allows to produce hydrogenation stage of the technological process. In order to increase the viscosity index of petroleum oils of received oligoalkiltoluene was used as a synthetic component.*

Key words: *Base oils; viscosity index; hexene-1; toluene; aluminum chloride; oligomerization; alkylation; oliqoalkyltoluolenes; synthetic component.*

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1. INTRODUCTION

Lubricating oil is the system with multicomponent; they are used in order to ensure the long-term exploitation of machine and mechanisms. One of the most important components in the content of the lubricating oil is viscosity additives. The viscosity of the lubricating oil is the most important exploitation parameter and its price determines the viscosity class of the lubricating oil. The simplest and faithful among the different ways of gaining the oil having the good viscosity-temperature property is considered the usage of the viscosity admixtures – from the polymer combinations. Some polymers – as well as, polyisobuthylene, polyalkylmethacrylates, polyvinylbutyle ether are used as the viscosity additives [1-6]. But the additives shown today are considered “classics” and they aren’t used, because they don’t meet the requirements of the modern technique

The copolymerization being as a method of Chemical modification, is used for giving necessary properties to the polymer compounds and it means it is considered as the simplest way of carrying out purposeful synthesis. For this purpose, α-olefins, (in particular case hexene-1) oligomerizated with vinyl aromatic or karbocyclic monomers. But there is a simple way to get aromatic fragmented hexene-1 oligomers. Studies carried out at the "Polymer Additives" laboratory of Chemistry of Additives Institute showed that in composition of α-olefins aromatic hydrocarbons for example when it is oligomerizated in solvent environment of toluene creates oligoalkiltoluene and they can be used as a initial raw material for getting synthetic oil or component as well as multifunctional additive

depending on the nature of the initial α-olefin. Oligomerization products of C_8-C_{12} α-olefins actually are used as synthetic oil [7-10].

The advantages of toluene in the presence of oligamerization is that the toluene by forming a complex with Aluminum Chloride plays the role of so catalyst and process (oligomerization and alkylation) is going fuzzy, toluene cyclic cheaper than monomers and finally the active center of oligomers in environment is alkalized of toluene as a result of obtained product having a smaller unsaturated and it allows to produce hydrogenation stage of the technological process.

On this basis, it has been studied oligomerization of hexene-1 in the presence of toluene.

2. EXPERIMENTAL

The composition of the solvent in the presence of toluene Hexene-1 oligomerization is carried out as follows: three-neck flask equipped with mechanical stirrer, thermometer and drops funel placed on a cooling bath. Amount of solvent in a flask (hexane or heptane) + is a mixture of toluene. The amount of the solvent stirrer should be in the same amount with α-olefin (i.e. the ratio of 1:1 by weight). Blending is putting into operation in flask solvent 1-1, 5% - given with the amount of AlCl3 (table 1).

Table 1

The characteristics of products of oligomerization of 1-hexene in the presence of toluene.

Oligomerization conditions			Oligomers indicators		
temperature, °C	amount of solvent, %		yield, %	molecular mass	bromine number, qBr/100q
	toluene	$AlCl_3$			
20	0	1	86,9	4000	17,5
20	10	1	91,5	2500	2,7
20	20	1	92,3	1600	1,5
20	30	1	94,8	1000	1,0
40	20	1	95,1	800	1,2
0	20	1	93,7	1200	1,2
20	20	0,5	74,9	1500	1,2
20	20	1,5	96,5	1500	1,2

Composition and structure of synthesized compounds IR- and NMR-spectroscopy methods, element analysis (for carbon content determination) were investigated with fractionation of their content. For Research 20% were obtained in the presence of toluene in 100°C kinematic viscosity 7.3 mm^2/s taken from the oligomer.

In IR-spectrum (Fig. 1). 720, 760, 780, 825, 860 and 880 sm^{-1} frequency half substitute benzene (825 sm^{-1}) is obtained and α-olefins fragments corresponding to absorption lines. It should be noted that, the absorption bands corresponding to the value of two-and three benzenes fall on each other and making an accurate analysis is not possible. However, it was possible to determine that oligomer composition of according to 1,2-, 1,4- and 1,2,4-substituted there benzene. However, it was possible to determine that there are 1,2-, 1,4- and 1,2,4-substituted benzene in composition of oligomers.

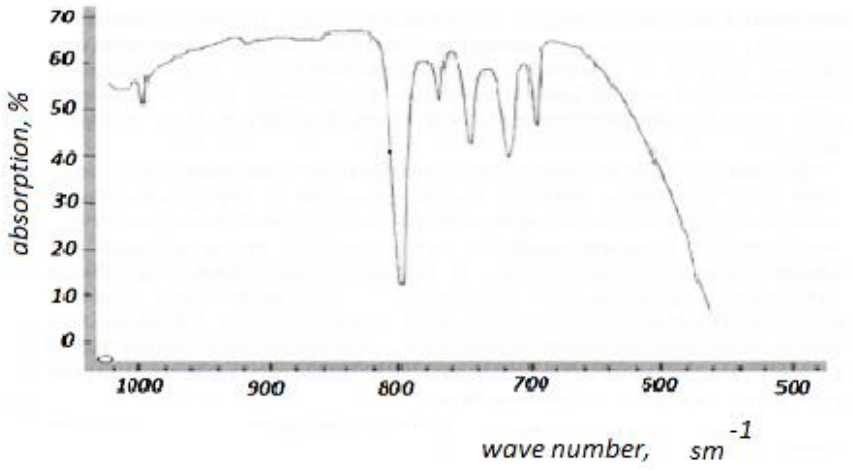
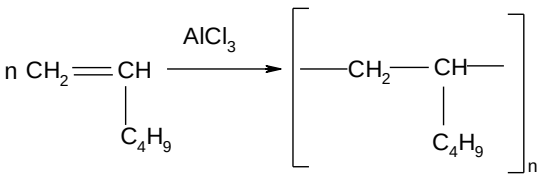


Figure 1 - IR- spectrum of oligoalkyltoluene.

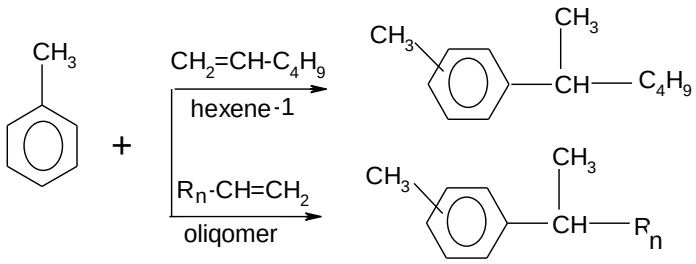
The results of NMR-spectroscopic analyzes confirmed the results of IR-spectroscopy. Suitable fragments of the methyl group CH_3-Ar, which is integral intensity of the hydrogen (2,1 mln^{-1}), suitable factor of benzene less than integral intensity of hydrogen (6.6 mln^{-1}). This means that in addition to three substitute formed benzene two substitute benzene. If only three substitute benzene were formed the intensity of the signals corresponding to the methyl group to hydrogen in that case three substitutes would be equal to the intensity of benzene protons. In the presence of toluene summarizing the results of the oligomerization process of hexene-1 it is possible to come such a conclusion, during the oligomerization of hexene-1 alkyl derivatives with a mixture of toluene are formed oligohexene alkyl derivatives.

Alkyl derivatives are formed from alkylation and oligomerization of toluene with hexene-1 and its oligomers. Thus, the process schematically can be shown as follows:

1. Oligomerization of hexene-1



2. Alkylation and oligoalkylation of toluene



3. Results and discussion

Viscosity-temperature properties of synthesized oilgoalkyltoluene as a synthetic component in composition of petroleum oils (И- 12А and М-6) have been investigated (table 2).

The results indicate that using from oligohexeniltoluene according to the viscosity index price it is possible to get a concentrated base oils meet modern standards (according to the modern requirements, kinematic viscosity at 100°C 8 mm^2/s viscosity index of the oil price should not be less than 93).

Table 2

Influence of concentration of Oligohexeniltoluene to viscosity-temperature properties of И-12А and М-6 oils.

Consentration of oligomers, %	Viscosity-temperature properties of condensed oil	
	viscosity, mm^2/s, in 100°C	Viscosity-index
И-12А oil + oligomer		
0	4,05	82
10	5,20	88
20	6,40	96
30	7,50	104
40	8,50	106
М- 6 oil + oligomer		
0	5,80	76
10	6,20	82
20	7,00	88
30	7,50	94
40	8,00	96
50	8,90	96

Synthesized oilgoalkyltoluene by the addition to M-6 oil oxidation stability and the freezing temperature of the oil has been studied (Table 3).

Table 3

Influence of oilgoalkyltoluene of the oxidation stability and of the freeze temperature of М-6 oil.

Oligomer concentration, %	Oxidation stability		T_{freeze}, °C
	settling, %	viscosity reduction, %	
0 (mineral oil)	4,32	117	-5
10	2,94	25,46	-12
20	1,30	21,93	-18
30	1,33	20,15	-21

4. Conclusions

Changing reaction conditions and the amount of toluene in decisive composition in the range of 2000-6000 molecular weight of oligoalkiltoluene was obtained. When obtained oligomer compounds are used in the amount of 20-30% in the composition of petroleum oils, their price of the viscosity index is increased to 96-104

The results indicate that using from oligohexenyltoluene according to the viscosity index price it is possible to get a concentrated base oils meet modern standards (according to the modern requirements, kinematic viscosity at 100°C 8 mm^2/s viscosity index of the oil price should not be less than 93).

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