

# Investigation Of Hydrocarbon Group Composition Of Hydraulic Liquid Amg-10 Prepared From Oil Rocks

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## Abstract:

In this paper the results of the physical-chemical indices of distillate prepared by compounding on the basis of the fraction (beginning of boiling point – 222°C, end of boiling point – 313°C), isolated from oil, extracted from “Neft Dashlary (Oil Rocks)” oil deposit and the investigation of hydrocarbon group composition have been presented. It has been determined that the distillate prepared by compounding on the basis of “Neft Dashlary” oil, and investigated on the basis of carried out investigations can be used as a suitable raw material in preparation of the hydraulic liquid AMG-10.

**Keywords:** Raffinate, Selective Purification, Oil Fraction, Dearomatization, Extract Solution

## 1. Introduction

In modern period along with the rapid development of technique, aircraft used in the various purposes, the requirement for fuels, lubricating oils and also for volume of production of the hydraulic liquids and indices of quality, exploitation properties becomes hard.

In aircraft in the hydraulic systems, in preparation of base products of the hydraulic liquids used as working liquid, it is used the non-paraffinic oils with unique properties, characterized by low freezing temperature. In choice of the base products for preparation of the hydraulic liquids it is firstly paid attention to its viscosity. Thus, this indice shows a determining influence on working ability of the hydraulic systems. Along with this, for preparation of the base products of the hydraulic liquids it is advisable to use the oils with non-paraffinic, riched by hydrocarbons of naphthene series, because one of the important conditions of the base products of the hydraulic liquids is a requirement not to be frozen at -72°C. Therefore, in the selection of the oil raw materials used in preparation of the hydraulic liquids, one of the important conditions, first of all, is that the

freezing temperatures of taken fractions of the oil fractions should be between -55 and -60°C.

In this regard, now, in preparation of the base product of hydraulic liquid oil-based AMG-10 successfully used in the aviation, a small quantity of the oils is useful and in recent years the base product of hydraulic liquid AMG-10 was mainly prepaing by aromatization and neutralization of the distllate isolated from Balakhani fatty oils with concentrated sulfuric acid [1]. With decrease of raw materials resources of these oils, the investigation of use of possibility of the oils extracted from other oil deposits is one of the important problems of petrochemistry, including oil-refining industry.

Taking into account the above-mentioned ones, there have been first of all investigated the freezing temperature and other physical-chemical parameters of the taken oil to check a possibility of investigation of hydraulic liquid AMG-10 extracted from “Neft Dashlary” oil deposit. The obtained results are presented in Table 1.

**Table 1.** Physical-chemical properties of “Neft Dashlary” oil

№	Indices	Factual indices of “Neft Dashlary” oil
1	2	3
1.	Density at 20°C, kg/m <sup>3</sup>	900,3
2.	Kinematic viscosity, mm <sup>2</sup> /sec.	
	+20°C – d <sub>4</sub>	55,611
	+50°C – d <sub>4</sub>	15,318
3.	Quantity of sulphur, %	0,3243
4.	Quantity of coke, %	2,11
5.	Flash tempertaure determined in closed crucible °C	Below -5°C
1	2	3
6.	Freezing temperature,	-58

	°C	
7.	Fraction composition , °C:	
	GOST 2177-99	
	ICO 3405-88	
	beginning of boiling	92°C
	distillation temperature of 5%	100°C
	8% -	120°C
	9,5% -	150°C
	11% -	160°C
	14% -	180°C
	18% -	200°C
	21% -	220°C
	31% -	240°C
	39% -	260°C
	45% -	280°C
	52% -	300°C
	64% -	330°C
8.	Residue	31%
9.	Loss	5%

As is seen from Table 1 the investigated oil freezing temperature indice –minus 58°C confirms that the oil is non-paraffinic naphene-based one. This oil sample has been isolated to 10°C fractions in APH-2 laboratory apparatus under atmospheric and vacuum conditions for preparation of the base product of the hydraulic liquid AMG-10 and for preparation of the hydraulic liquid AMG-10 on the basis of these fraction the useful base distillate has been compounded and according to TU 38-10111286-89 the corresponding indices have been determined. The obtained results are presented in Table 2. As is seen, the compounded distillate: beginning of boiling point is 222°C, end of boiling point – 313°C, density at 20°C – 849,3 kg/m<sup>3</sup>, kinematic viscosity at +50°C – 2.13 mm<sup>2</sup>/sec. At -50°C – 133,612 mm<sup>2</sup>/sec. flash temperature, in open crucible – 104°C, the freezing temperature – -73°C, quantity of the aromatic hydrocarbons – 12%, quantity of the sulfur – 884 ppm is characterized by such indices and meets all the requirements of TU 38-10111286-89. Based on this, the new distillate prepared from the oil extracted from “Neft Dashlary” oil deposit can be used as the raw material for preparation of the base product of the hydraulic liquid AMG-10.

One of the main indices of the base product of the hydraulic liquid AMG-10 – there is not requirement

about that a quantity of the aromatic hydrocarbons in its composition should be no more than 0.5%. The process of selective purification of the investigated distillate from aromatic hydrocarbons with harmless ion-liquid extragent using the extraction method has been carried out [2, 3]. Unlike dearomatization of the distillate with known acidic-contact method, its purification with use of ionic liquids as a selective solvent using the extraction method is considered more suitable from ecological point of view. So, in purification of the distillate with concentrated acetic acid a yield of the main product is low and it arises an utilization problem of the prepared acidic hydrone and the acidic waters cause the environment, pollution. Using the ionic liquid of neutral nature prepared on the basis of acetic acid and N-methylpyrrolidone as an extragent the base product TU 38301-29-21-92 prepared from selective purification has been analyzed with corresponding test methods.

The hydraulic liquid distillate AMG-10 prepared from “Neft Dashlary” oil and the physical-chemical parameters of the base product prepared from dearomatization of this distillate with ionic liquids have been determined by the standard methods and modern physical methods of hydrocarbon group composition. The obtained results are presented in Table 2.

**Table 2.** Physical-chemical properties of the base product of the hydraulic liquid AMG-10 prepared on the basis of “Neft dashlary” oil after purification by ionic liquid

№	Indi-ces	Stan- dard TU 383 01-29- 21-92	Base product of AMG-10	Test methods
1	2	3	4	5
1.	Density at 20 <sup>0</sup> C, kg/m <sup>3</sup> , no more	850	839	GOST 3900- 85

1	2	3	4	5
2.	Kinematic viscosity,m m <sup>2</sup> /sec:			GOST – 33-2000

	+50°C, no more -50°C, no more	2,45 220	2,25 180	
3.	Fraction composition, °C beginning of boiling, no low end of boiling, no higher	210 315	225 305	GOST 2177-99
4.	Flash temperature determined in open crucible, °C, no low	93,0	114	GOST 4333-87
5.	Aniline point, °C, no low	78,0	79	GOST 12329-77
6.	Freezing temperature, °C, no higher	-72	-73	GOST 20287-91
7.	Corrosion test on the copper board	resistant	resistant	GOST 2917-76
8.	Sulfation, % no more	1,5	0	GOST 6994-74
9.	Acidic number, mg/KOH per gr product, no more	0,03	0,006	GOST 5485-90
10.	Total quantity of sulphur, %	–	0,025 7	ASTMD 4294

As can be seen from Table, the base product of hydraulic liquid AMG-10 prepared with compounding on the basis of “Nefit dashlary” oil meets all requirements specified by TC.

The distillate prepared from compounding of fractions differing by boiling degree 10°C, isolated from oil prepared from “Nefit Dashlary” oil deposit on the basis of fraction with beginning of boiling point – 222°C, end of boiling point – 313 °C, used for preparation of the hydraulic liquid as a raw material and hydrocarbon group composition of the base

product of the hydraulic liquid AMG-10 obtained with selective purification of ionic liquid extractant prepared on the basis of acetic acid and N-methylpyrrolidone of this distillate has been determined using “Clarus SG. 8T” mass spectral chromatography manufactured by “Perkin Elmer”, “Clarus-680” firm.

The analysis has been carried out in the temperature conditions shown below: initial temperature – 50°C, this temperature is kept constant for 5 min.; the temperature rise to 170°C is 10°C per minute, this temperature is kept constant for 10 min; temperature rise to 290°C is 5°C per minute, this temperature is kept constant for 9 min., in all – 60 min. Injector temperature – 300°C. Capillary column belongs to “Restek” Rtx 35 Delete MS company, length of column – 30m, diameter – 0.25 mm, thickness of the lower liquid phase – 0.25 mcm.

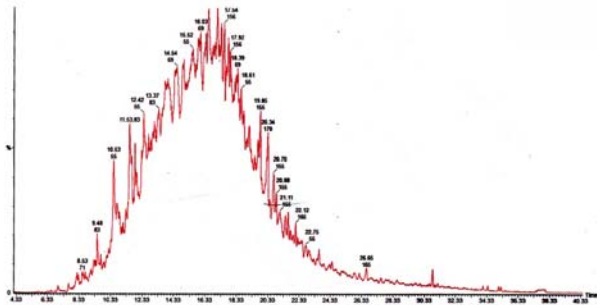
The rate of carrier gas, helium movement – 1 ml/min. Mass scan limit is in 60-500 interval.

The chromatographic images of the investigated samples are shown in Figs.1 and 2. According to the results of the chromatographic analysis, a total quantity of the aromatic hydrocarbons in the composition of the distillate (Fig.1) prepared with compounding on the basis of “Nefit dashlary” was 27,75%, a quantity of disubstituted aromatic hydrocarbons – 25,52%, a quantity of mono- and trisubstituted aromatic hydrocarbons were 0,62% and 1,61% mass, respectively teşkil edir. A total amount of the cyclic hydrocarbons is 64.93%, including quantity of mono-cyclic hydrocarbons – 64,31%, bicyclic – 0,61%, and a quantity of tetracyclic hydrocarbons – 0.01. The sample contains 7,14 % mass of alkanes.

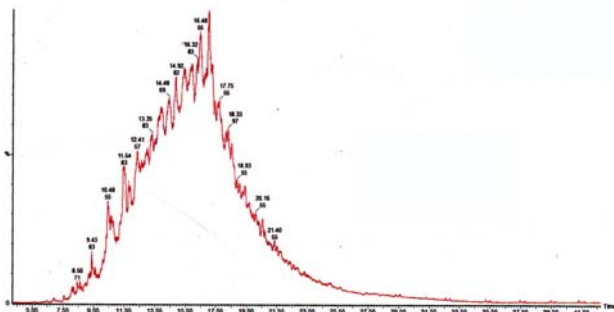
The investigation of taken distillate – base product of hydraulic liquid (sample II) – prepared by selective purification of ionic liquid extractant, synthesized on the basis of N-methylpyrrolidone and acetic acid on the modern chromatographic mass-septrometer shows that in the investigated sample the aromatic hydrocarbons are practically absent. In the composition of sample a quantity of alkanes is 12,04%, a quantity of cyclic hydrocarbons – 87,96%. It has been determined that in the compounded sample used on the basis of investigation of the distillate samples with sulfation a quantity of the aromatic hydrocarbons is 12%, and in the composition of the base product of hydraulic liquid

(sample II) purified selectively by ionic liquid extragent the aromatic hydrocarbons (0%) are absent.

[3] M.D.Ibragimova, V.M.Abbasov, S.G.Aliyeva et al., “Preparation of base of hydraulic oil AMG from Balakhany oily petroleum by a method of selective purification of ionic liquids”, IX Baku International Mamedaliyev Conference on Petrochemistry, 2016, p.145.



**Fig 1.** Chromatogram of the distillate prepared with compounding from oil extracted from “Neft Dashlary” oil deposit



**Fig 2.** Chromatogram of raffinate obtained by purification of IL of the distillate prepared with compounding from oil extracted from “Neft Dashlary” oil deposit

Thus, it has been determined as a result of the carried out investigations that the distillate prepared with compounding of 10°C fractions isolated from oil, extracted from “Neft Dashlary” oil deposit is the useful base product for preparation of the hydraulic liquid AMG-10.

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