

CHEMISTRY

STUDY OF PETROLEUM OF GEORGIAN
MTSAREKHEVI DEPOSIT

PhD Teimuraz Uchaneishvili,

PhD Nino Nonikashvili,

PhD Nino Kavtaradze,

Phd Nana Tserodze,

Phd Maia Stephanishvili

Georgia, Tbilisi, Iv. Javakhishvili Tbilisi State University,
P. Melikishvili Institute of Physical and Organic Chemistry

ARTICLE INFO

Received 05 April 2018

Accepted 02 May 2018

Published 12 May 2018

KEYWORDS

mtsarekhevi petroleum,
light hydrocarbon fractions,
hydrocarbonic group
composition of the oil
fractions,
method of aniline,
GS-MS method

ABSTRACT

Physical and chemical operational parameters of petroleum from the Mtsarekhevi deposit on the territory of Georgia was studied. This petroleum belongs to the petroleum of heavy type (ρ_4^{20} -0.9505g/cm³), is characterized by the small exit of petrol and light hydrocarbon fractions, by the low content of general sulfur and low freezing point. Hydrocarbon composition of petroleum fractions was studied by gas-chromatography and mass spectrometry methods. It was established that in isomeric alkanes the content of the mono substituted isomers predominates over the disubstituted isomers. The amount of saturated hydrocarbons - paraffins and cycloalkanes in the total composition was 93 %, and the ratio of isoparaffins and n-paraffins was about 1:3.

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Introduction. Study of the physical, chemical and operational properties of petroleum of each individual deposit using modern instrumental method has great applied importance together with the scientific novelty. On the basis of this study it is possible to elaborate theoretical and practical backgrounds for their further rational processing. For this purpose, the petroleum of the Mtsarekhevi deposit, located in Dedoplistskaro on the territory of the Municipality of east Georgia has been studied.

Research results. Physicochemical properties of this petroleum are presented in Table 1.

Table 1. Physicochemical characteristics of petroleum of Mtsarekhevi deposit

Density $\rho_4^{20}/\rho_{15}^{15}$, g/cm ³	Kinematic viscosity ν^{20}/ν^{60} , mm ² /s	Temperature, °C		Total sulfur, % mass	Acid number, mg KOH/g	Paraffin content, % mass	Salts, mgNaCl/l	Ash content, % mass
		Freezing point	Blasting point					
0.9505/ 0.9512	19.96/ 10.77	- 4	- 1	0.24	2.08	3.3	12.7	0.01

Table 2. Composition of light fractions of petroleum of Mtsarekhevi deposit

Temperature ranges of the fractions, °C	Initial boiling point-65	65- 100	100- 150	150- 200	200- 250	250- 300	300- 350	350- 370	370- 475	475- 525	525- 565	565+
Yield on the petroleum, % mass	1.75	2.68	5.17	6.71	8.25	9.69	9.11	3.83	19.31	7.50	4.70	21.0
Yield on the petroleum, % volume	2.54	3.36	6.20	7.66	8.92	10.05	9.22	3.80	18.63	7.03	4.35	18.06
ρ_4^{20} g/cm ³	0.6438	0.7233	0.7572	0.7947	0.8395	0.8749	0.8964	0.9141	0.9026	0.9300	0.9435	1.0573

Data of the table 2 reveals that the mentioned petroleum is characterized by a low yield of petrol fraction (16 %) and of light fractions (initial boiling point - 350°C), respectively 16 and 43 %, and the content of total sulfur doesn't exceed 0,002 %.

The group composition of petrol fraction (initial boiling point - 200°C) has been studied by aniline method. It is established that this fraction is mainly presented by paraffin and naphthenic hydrocarbons (97 %), and the amount of aromatic hydrocarbons is small (Table 3).

Table 3. The group composition of petroleum fraction (initial boiling point-200°C) of Mtsarekhevi deposit

Hydrocarbons	Composition, % mass
Paraffin hydrocarbons	47.0
Among them	
N-paraffin hydrocarbons	25.5
Naphthenic hydrocarbons	45.9
Aromatic hydrocarbons	6.8

The amount of saturated hydrocarbons (paraffins and cycloalkanes) in the total composition of petroleum is about 93 %, and the ratio of isoparaffins to n-isoparaffins is about 3.

The table 4 presents distribution among isomers of separate paraffin hydrocarbons for petrol fraction. The data is obtained by means of chromato-mass spectrometry (GC-MS) HP 6890/5973. For short naming (encryption) of isomeric hydrocarbons the method presented in the works [1-2] is used.

Table 4. Isomeric distribution of separate alkanes, % mass

Hydrocarbons	Cipher	Composition, % mass
C ₅	n-C ₅	52.2
	i-C ₅	47.8
C ₆	n-C ₆	44.0
	2.2- DMC ₄	1.2
	2.3- DMC ₄	5.9
	2- MC ₅	28.6
	3-MC ₅	20.5
	Ratio: $\frac{\sum \text{monosubstituted}}{\sum \text{disubstituted}}$	6.8
C ₇	n-C ₇	46
	2.2- DMC ₅	1.1
	2.3- DMC ₅	10.3
	3.3- DMC ₅	1.1
	2.4- DMC ₅	4.6
	2- MC ₆	15.0
	3- MC ₆	21.8
	3- \mathcal{C} C ₆	-0.0
Ratio: $\frac{\sum \text{monosubstituted}}{\sum \text{disubstituted}}$	2.2	

It has been established that methyl-substituted structures predominate (2-6 times) among alkanes, while gem-substituted structures are present in insignificant concentration. Various distillation oil products have been received by rectification of researched petroleum. The characteristics of this petroleum are presented in the table 5.

Table 5. Characteristics of directly distilled jet and diesel fuels

Temperature ranges of distillation, °C	Yield on the petroleum, % mass	ν_{20} , cSt	ρ_{4-20}^{20} , g/cm ³	Total sulfur*, % mass	Temperature, °C		aromatic hydrocarbon s, % mass	Cetane number
					crystallization	Freezing		
120-230	17	1.264	0.7971	0.034	< -60	-		-
120-240	18.4	1.345	0.7836	0.038	< -58	-		-
180-350	29.9	4.072	0.8587	0.041	-	- 49	40	41
240-350	21.1	5.84	0.8730	0.042	-	- 34	41	43

*Amount of total sulfur was determined according to [3].

As it seems from the table 5, distillates with the temperature range of distillation 120-230°C and 120-240°C, with the total amount of sulfur and starting temperature of crystallization as well as other characteristics are matching requirements for the jet fuels TC-1 and TC-2 (GOST 10227-62).

Operational characteristics of fractions 180-350°C and 240-350°C are matching winter diesel fuel (GOST 4749-49) for high turnover engines with the potential content 21-30 %.

Simulated distillation curve of Mtsarekhevi petroleum is presented on the figure.1 [4].

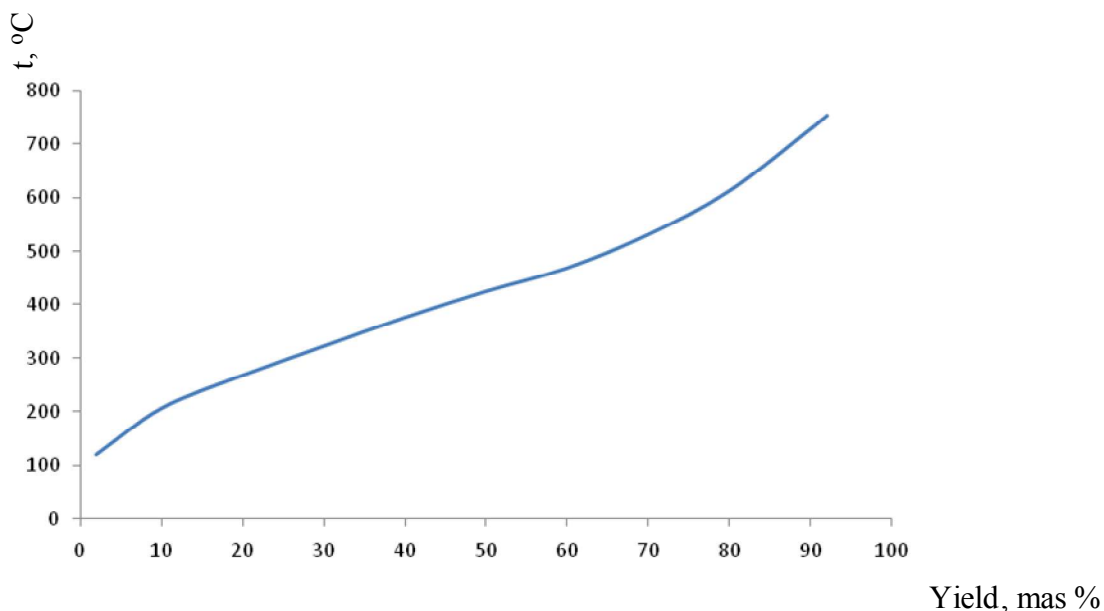


Fig. 1. Curve of Mtsarekhevi petroleum

Considering the data of the simulated distillation curve and tables 1 and 2 it is established that studied petroleum belongs to the heavy petroleum, with the low yield of petrol and light distillates. The technological classification of the petroleum is defined by the following encryption: 1T₂ M₂И₁П₂ (technological classification in the post-Soviet countries) [5].

Conclusions.

1. Physico-chemical operational parameters of petroleum of the Mtsarekhevi deposit on the territory of Georgia are studied.

2. Mtsarekhevi petroleum belongs to the petroleum of heavy type (ρ_4^{20} -0.9505g/cm³), is characterized by the small exit of petrol and light hydrocarbon fractions, by the low content of general sulfur and low freezing point.

3. It has been established that in isomeric alkanes the content of the mono substituted isomers predominates over the disubstituted isomers.

4. The amount of saturated hydrocarbons - paraffins and cycloalkanes in the total composition is 93 %, and the ratio of isoparaffins and n-paraffins is about 1:3.

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