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Study on Individual Hydrocarbon's Composition of Gasoline Fraction of Tamsagbulag Oil, Mongolia

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In order to conduct complex research on oil originated in Mongolia for further application of petroleum not only as fuel but also as raw material for organic synthesis, we need to study the physical, chemical characteristics and individual, group hydrocarbon's compositions of main petroleum fractions. A number of studies and surveys on the physical and chemical characteristics, group hydrocarbon's composition of petroleum deposits in *Zuun-Bayan*, *Sukhaibulag, Tsagaan Elst, Tamsagbulag* have been carried out earlier through *n-g-M*, aniline point and dispersimetric methods successfully. Yet a detailed chromatographical and NMR spectroscopic study for the individual hydrocarbon's composition of Tamsagbulag oil main fractions has not been conducted. In the present study the results of GC analyses of gasoline fractions of wells *19-3, 19-13* and *19-10*, *Tamsagbulag (Eastern Mongolia)* were presented. The gasoline fractions of given wells were characterized by the high concentration of paraffins and presence of trace amount of olefins. There were identified *69* paraffins, *45* naphthenes, *41* aromatics and *3* olefins in total *158* individual hydrocarbons from each samples of gasoline fraction. The first attempts to classify Tamsagbulag oil under the individual hydrocarbon's composition data were successfully conducted and the supposition of a genetic classification of given oil as *"sapropelic"* type was made.

Keywords: *sapropel, humus, olefins, Tamsabulag deposit*

Introduction

The Mongolian government developed a programme entitled Petroleum in order to launch comprehensive prospect and research of Mongolian petroleum. The program aimed at maintaining and advancing geological prospect, saving times spent on production of petroleum, establishing an oil-refining factory and supplying needs of domestic market. American experts made a survey on reserves of Mongolian oil and came up with 350 million barrels (95% probability) and 28×10^{12} barrels (10% probability). The analysis on the characteristics of Mongolian oil deposits of Zuun-Bayan and Tamsagbulag were more appealing than other deposits. Zuun-Bayan and Tamsagbulag deposits have rather larger resources in petroleum, which is a great contributor to petroleum needs of the country. Main part of R&D in this area includes the study on chemical structure of medium and heavy fractions, processing ways of various individual hydrocarbons from light[1], heavy[2,3] petroleum fractions, and their usage in organic synthesis[4].

Up to date, studies and surveys for physical and chemical properties, chemical compositions of oil fractions, chemical structure and high molecular and heterorganic individual hydrocarbons compositions of Mongolian rediscovered crude oil deposits are just beginning[5,6]. Generally, complex research on chemical composition of light, medium and heavy fractions, heteroatomic compounds, gums and asphalthenes has not been done. Meanwhile, a number of research works on physical and chemical characteristics[7], sulfur organic compounds[8] of the petroleum in deposits of Zuun-Bayan, Sukhai bulag, Tsagaan Elst, and Tamsagbulag have been carried out[9].

Structural and group composition of heavy oil fraction, Tamsagbulag was determined by empiric and nomogramm methods and both methods showed similar results[10]. The detailed chromatographical and ^{1}H, ^{13}C NMR spectroscopic studies of individual hydrocarbon composition of main fractions of Zuunbayan oil have not been done[1]. There were discussed the characteristics of individual paraffins, naphthenes, aromatics and olefins. All oils contain the same set of hydrocarbons and the oils differ by relative concentrations of normal alkanes, isoalkanes, five and hexatomic naphthenes. The distributions of hydrocarbons inside each of the hydrocarbon's groups as the first approximation are constant[11].

Generally the hydrocarbons of gasoline fraction play an important role for genetic classification of given crude oil. For the explanation of hydrocarbon's concentration of gasoline fractions the following factors basically are proposed, one of which can exert influence to a structure of oils in general, respectively; initial OR (oxidation-reduction), processes of a cracking (catalytic and thermal), isomerization, migration, biodegradation. The various writers estimate the possible contribution of each of these factors, however, majority removes a main role to processes of a catagenesis. The role of OR in automobile gasoline hydrocarbons, with rare exception, is recognized practically by all explorers. The genetic classification of crude oil on the basis of hydrocarbon's composition of gasoline fraction was carried out by I. V. Goncharov[11]. Through this classification the crude oils were divided into two groups, "sapropelic" and "humus". Each of these groups was divided into two groups: type A, which is characterized by the ratio of isoalkanes/normal alkanes < 1.5 and type B, whose ratio of *isoalkanes/normal alkanes* > 1.5[11].

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Alkanes

The contents of normal alkanes in oils of "sapropelic" group are a little bit lower than those in oils of the second group. The oils of "humus" group contain paraffins, in general, much more, while light hydrocarbons of alkanes are less than those in oils of the "sapropelic" group. The main difference in oils of these two groups is sharp increase in contents of hemi compounds for the second group. More oxidized OR will derivate gasoline hydrocarbons with the considerable contents of hemi compounds[12]. There is understandable regularity in a structure of alkanes at transition from oils of type A to type B. The stability decreases in the following series; n-octane > mono > di > tri octanes. In this sequence, there is an enrichment of oils by isomeric octanes at transition from group A to group B[13,14]. At the transition from oils of group A to B, is observed significant change of a ratio of 2-, 3-methylalkanes. The concentration of 3-methylalkanes increases. The similar characteristics were observed in oils of Tatarstan. Sharp reduction of this ratio in biodegraded oils of Balahan deposits also is determined[13,14]. The increase in concentration of 3-methylalkanes indicates their higher stability towards microbiological oxidation. This is explained in smaller length of a circuit portion in a molecule, free from the substituters[13]. Among compounds of an identical degree of substitution the hemi-substituted structures are the most difficultly acquired by microorganisms, which is confirmed by increase of concentrations of 2, 2- and 3, 3-dimethylhexanes among dimethylhexanes [11].

Naphthenes

Between given two groups of crude oils the essential differences in their individual composition are also observed. In spite of the fact that the oils of sapropelic group are heavier, they are richer by a light homologues (*cyclopentane and methylcyclopentane*). Oils of the second group are characterized by the high contents of threemethylcyclopentanes. The oils of these two groups well differ in the ratio of (*cyclopentane* + *methylcyclopentane*)/$\sum$ *trimethylcyclopentane*. Moreover, in oils of the second group the contents of hemi-isomers such as *1,1*-dimethylcyclopentanes and *1,1*-methylethylcyclopentanes is much higher. The oils enriched with hemi iso-alkanes contain a lot of hemi iso-naphthenes.

Among C_6 naphthenes in oils of both groups prevails the methyl cyclohexane. In oils of the sapropelic group, as well as among C_5 naphthenes, there is a lot of light homologue-cyclohexane and much less of *1,3*- and *1,4*-dimethylcyclohexanes. Therefore, the oils of miscellaneous groups with a structure of hexatomic naphthenes are conveniently distinguished by value of ratio of *cyclohexane/*($\sum$*1,3- and 1,4-dimethylcyclohexanes*). The transition from the group A to group B is characterized by increase of a concentration of C_5 and C_6 naphthenes, and the ratio of them varies unsignificantly. Therefore we consider that the ratio of 6/5 can be used in genetical constructions[11].

Arenes

The contents and structure of aromatic hydrocarbons of first and second groups essentially differ from each other. In gasolines of first group the contents of arenes and ratio of *m-xylene/o-xylene* are less, than those in second group. Most sharply oils of two groups are different in the value of ratio of $\sum$*xylene/ethyl benzene.* The xylenes and ethyl benzene are contained in some oils of the first group with equal concentrations, while in oils of the second group the contents of xylenes sometimes at 10～20 time exceeds those of ethyl benzene[11]. The conditions of fossilizing of initial organic material, and also depth of processes of biochemical transformation of oils in reservoir render the main influencing factor on formation of individual composition of hydrocarbons in a gasoline fraction[15-17]. Other factors, such as a catagenesis, condensate establishment and others can also influence on a structure of gasolines, but the effect of each of them manages is observed only at the compensation of others, therefore, in practice it is almost impossible to monitor. In that case, where all factors act in aggregate, the effects of OR and biodegradation are much stronger than those of all remaining factors[11].

However, until now a detailed chromatographical and spectroscopical studies on individual hydrocarbon compositions of main fractions of Tamsagbulag oil have not been done. In the present study some approaches with the GC analyses of gasoline fraction of Tamsagbulag deposit were attempted.

Experimental

Materials

After the removal of water by separol deemulgator from crude oil up to 0.2% and suspended solids petroleum was distilled under the atmospheric pressure according to the standard method GOST 11011-85 in Tomsk Institute of Petroleum Chemistry, Russia. The gasoline fraction IBP-180 ℃ was selected and individual hydrocarbon's composition was analysed by GC chromatographic method.

Methods

Gas Cromatograph	: GC "Tsvet-100M"
Detector	: FID
Coloumn	: quartz capillary coloumn 100 m
Sample	: 0.0005 mL
Temperature range	: 25～250 ℃
Speed	: 3 ℃/min
Carrier gas	: Nitrogen gas
Stationary phase	: OV-101

Results and Discussion

We have obtained totally 158 individual hydrocarbons (69 paraffins, 45 naphthenes, 41 aromatics and 3 olefins) from each samples of gasoline fraction (IBP-180 ℃) of wells 19-3, 19-13 and 19-10, Tamsagbulag deposit, Mongolia.

The calculated hydrocarbon's group composition of Tamsagbulag gasoline fractions from each samples of wells are as follows in each of following hydrocarbon groups: paraffins 54.69%, 65.04% and 54.58%, naphthenes 40.13%, 28.17%, and 37.29%, aromatics 4.85%, 4.06% and 5.59%; trace content of olefins: 0.05%, 0.19% and 0.27% where the order of figures represent the wells 19-3, 19-13 and 19-10, Tamsagbulag, respectively. It is interesting, that in comparison with gasoline fraction of Zuunbayan oil (53.2%)[1], Tamsagbulag wells 19-3, 19-10 the paraffin's concentration in gasoline fraction of Tamsagbulag well 19-13 was relatively high, but the naphthene's concentration was low (Table 1, 2). However, the arene's concentrations of Tamsagbulag wells 19-3, 19-13 and 19-10 were only half of the Zuunbayan gasoline fraction [1]. In the Table 3 is shown the olefin's concentration of Tamsagbulag gasoline fractions of given three wells, which is lower than that in the Zuunbayan well 329 (3.7%)[1]. The calculated octane numbers of given three samples of wells 19-3, 19-13 and 19-10 were

Table 1. Concentration (wt%) of Individual Paraffins in Gasoline Fractions of Wells 19-3, 19-13, 19-10 Tamsagbulag Oil

	Paraffins	TB 19-3	TB 19-13	TB-10		Paraffins	TB 19-3	TB 19-13	TB-10
C_3	*propane*	0.076	0.326	0.317		*2,6-dimethylheptane*	0.074	0.0578	
C_4	*i-butane*	0.207	0.881	0.431		*2,3-dimethylheptane*	0.811	0.4792	
	n-butane	1.020	2.574	1.666		*4-methyloctane*	0.701	0.8234	0.714
	subtotal	**1.226**	**3.455**	**2.097**		*2-methyloctane*	0.410	0.1752	0.239
C_5	*2,2-dimethylpropane*	0.035	0.043	0.012		*3-ethylheptane*	0.513	0.614	0.601
	i-pentane	1.64	2.834	1.922		*3-methyloctane*	0.0668	0.046	0.028
	n-pentane	3.154	5.135	3.472		*3,3-diethylpentane*	0.238	0.012	0.251
	subtotal	**4.829**	**8.012**	**5.406**		*I8*		0.25	0.327
C_6	*2,2-dimethylbutane*	0.045	0.08	0.053		*I9*		0.031	
	2,3-dimethylbutane	0.388	0.352	0.346		*n-nonane*	4.50	5.583	4.958
	3-methylpentane	1.113	1.301	1.077		***subtotal***	**8.579**	**9.251**	**8.752**
	2-methylpentane	2.159	2.424	2.105		***mono:di***	**1.32**	**1.03**	**1.24**
	n-hexane	5.071	6.529	4.731	C_{10}				
	Subtotal	**8.776**	**10.687**	**8.312**		*2,2-dimethylocatne*	0.062	0.084	0.106
	mono:di	**6.900**	**7.800**	**7.700**		*2,4-dimethyloctane*	0.511	0.196	
C_7	*2,2-dimethylpentane*	0.045	0.0582	0.045		*2,3-dimethyloctane*			0.175
	2,4-dimethylpentane	0.362	0.138	0.125		*2,6-dimethyloctane*	0.008		0.004
	2,2,3-trimethylbutane	0.032	0.025	0.028		*2,5-dimethyloctane*	0.054	0.052	0.065
	3,3-dimethylpentane	0.044	0.042	0.032		*3,3-dimethyloctane*	0.146	0.2	0.031
	2-methylhexane	0.929	1.054	0.855		*3,6-dimethyloctane*	1.422	1.429	1.687
	2,3-dimethylpentane	0.811	0.624	0.624		*4-methylnonane*	0.187	0.133	
	3-ethylpentane	0	0.79	0.961		*4-ethyloctane*	0.276		
	3-methylhexane	1.441				*I17*	0.450	0.539	
	2-methyl hexane					*2-methylnonane*	0.031		
	n-heptane	6.80	7.924	6.258		*3-ethyloctane*	0.179	0.221	0.191
	subtotal	**10.47**	**10.655**	**8.928**		*3-methylnonane*	0	0.11	0.189
	mono:di	**1.90**	**2.90**	**2.20**		*I18*	0.143	0	0
C_8	*2,2,4-trimethylpentane*	1.999	1.388	1.663		*n-decane*	2.634	3.714	3.60
	2,5-dimethylhexane					*3-methyl-5-ethylheptane*	0	0.014	0
	2,4-dimethylhexane	0.812	0.592	0.765		*I23*			0.562
	3,3-dimethylhexane	0.02	0.232	0.143		*I10*			
	2,3,4-trimethylpentane	0.118	0.117	0.084		***subtotal***	**6.120**	**6.693**	**6.790**
	2,3-dimethylhexane	0.188	0.196	0.175		***mono:di***	**0.126**	**0.235**	**0.341**
	2-methyl-3-ethylpentane	0.512	0.43	0.495	C_{11}				
	2-methylheptane	2.221	2.469	2.165		*3-methyldecane*			
	4-methylheptane	0.433	0.495	0.33		*2-methyldecane*			
	3,4-dimethylhexane	0.259	0.295	0.745		*2,4-dimethylnonane*		0.445	
	3-methyl-3-ethylhexane					*I33*		0.233	
	3-ethylhexane					*3,3-dimethylnonane*		0.163	0.189
	3-methylheptane	0.675	0.864	0.563		*I35*		0.101	
	n-octane	6.657	7.671	6.35		*2,3-dimethylnonane*		0.077	
	subtotal	**13.890**	**14.751**	**12.914**		*2-methyldecane*	0	0	0
	mono:di	**2.6**	**2.9**	**2.2**		*3,3-dimethylnonane*	0.136		
C_9	*2,2,5-trimethylhexane*	0.018	0			*I36*	0.087		0.153
	2,2,3,4-tetramethylpentane					*2,3-dimethylnonane*	0.052		0.071
	2,3,5-trimethylhexane	0.075	0.0628			*I38*	0.189		0.294
	2,2-dimethylheptane	0.078	0.0047	0.077		*I40*	0.119		0.178
	2,2,3-trimethylhexane	0.058	0.0578	0.054		*3-ethylnonane*	0.031	0.019	0.032
	2,4-dimethylheptane	0.685	0.6781	0.706		*3-methyldecane*	0.066	0.046	0.155
	4,4-dimethylheptane					*I42*	0.044		0.077
	3,3-dimethylheptane	0.21	0.2384	0.128		***subtotal***	**0.724**	**1.212**	**1.149**
	3,4-dimethylheptane					***mono:di***	**0.539**	**0.095**	**0.719**
	2,5-dimethylheptane	0.142	0.1369	0.104		***Total***	**54.689**	**65.043**	**54.585**

Table 2. Individual Naphtenes of Gasoline Fraction of Wells 19-3, 19-10, 19-13, Tamsagbulag

Naphthenes		Concentration, wt%			Naphthenes		Concentration, wt%		
		19-3	19-13	19-10			19-3	19-13	19-10
C_5	*cyclopentane*	0.816	0.571	0.883		*1c,2t,4c-trimethylcyclohexane*	0.024	0.022	
	methylcyclopentane	3.739	2.669	3.744		*1,1,2-trimethylcyclohexane*	0.052	0.259	0.062
C_6	*cyclohexane*	6.069	2.767	5.784		*I8*	0.206	0.066	
	Subtotal	9.809	5.436	9.528		*N20*	0.079		
	1,1-dimehylcyclopentane	0.315	0.305	0.281		*i-butylcyclopentane*	0.371	0.444	0.437
	1c,3-dimethylcyclopentane	0.891	0.672	0.885		*N21*	0.191	0.215	0.237
	1t,3-dimethylcyclopentane	1.006				*I9*	0.032		
	1t,2-dimethylcyclopentane	0.028				*N22*	0.116	0.11	0.134
		0.493				*N24*	0.118	0.132	0.076
C_7	*1c,2-dimethylcyclopentane*	0.02				*1,1-methylethylcyclohexane*	0.091	0.34	
		0.004			C_9	*N26*	0.096	0.268	
		0.018				*N27*		0.368	
	methylcyclohexane	11.119	6.403	10.702		*i-propylcyclohexane*	0.096	0.083	0.105
	ethylcyclopentane	0.086	0.024			*n-butylcyclopentane*	0.576	0.605	0.652
	subtotal	**13.981**	**7.404**	**11.868**		*N29*	0.454	0.506	0.53
	1c,2c,4-trimethylcyclopentane	0.218	0.464	0.158		*N30*	0.059	0.082	0.046
	1c,2t,4-trimethylcyclopentane	0.519	0.045	0.492		*N31*	0.164	0.131	0.129
	1t,2c,3-trimethylcyclopentane	0.604	0.426	0.601		*N32*	0.217	0.127	0.33
	1c,2t,3-trimetylcyclopentane	0.122	0.132			*N33*	0.151	0.339	
	1t,4-dimethylcyclohexane	2.32	2.331	2.297		*1c,3c,5-trimethylcyclohexane*			0.274
	1,1-dimethylcyclohexane	0.878	0.927	0.703		***subtotal***	**4.489**	**5.012**	**5.301**
	3c-ethylmethylcyclopentane	0.194	0.185	0.18		*N34*	0.171	0.138	0.62
	3t-ethylmethylcyclopentane	0.235	0.187	0.224		*i-butylcyclohexane*	0.026	0.024	0.038
	2t-ethylmethylcyclopentane	0.205	0.163			*1,4c-dimethylcyclooctane*	0.014	0.015	
C_8	*1,1-methylethylcyclopentane*	0.543	0.331	0.176		*1,3-dimethylcyclooctane*	0.444	0.45	
	1t,2-dimethylcyclohexane	0.268	0.179	0.238		*1t-methyl-2n-propylcyclohexane*	0.298	0.146	0.224
	1c,2c,3-trimethylcyclopentane	1.24	0.928	1.1559		*N37*	0.038	0.11	0.146
	i-propycyclopentane	0.71	0.788	0.522		*1,5-dimethylcyclooctane*	0.03	0.027	0.024
	1c,2-dimethylcyclohexane	0.103	0.092	0.072	C_{10}	*sec-buthylcyclohexane*	0.091	0.095	0.337
	1,1,2-trimethylcyclopentane	0.052	0.014	0.098		*1,2-methyl-i-propylcyclohexane*		0.007	0.02
	ethylcyclohexane	0.025	0.028	0.0236		*I42*		0.028	
	n-propylcyclopentane	1.688	1.481	1.767		*I43*		0.006	
	subtotal	**9.927**	**8.7**	**8.709**		*1,1-dimethylcyclooctane*			0.092
	1c,2c,5-trimethylcyclohexane	0.291	0.229			***subtotal***	**1.111**	**1.047**	**1.501**
	1,1,3-trimethylcyclohexane	0.754	0.722	0.748					
C_9	*1c,2t,4t-trimethylcyclohexane*	0.114	0.05	0.304					
	N12	0.288	0.217						
	Total						**40.134**	**28.170**	**36.289**

49, 47 and 49. The results are low and the further study on the increase of octane number is proposed. The Naphthehes/Paraffins ratios were 0.73, 0.43 and 0.68 for the wells 19-3, 19-13 and 19-10, which describes the paraffinic and "sapropelic" character of Tamsagbulag oil[11].

Lowest Paraffins

For the ratio of *iso-paraffins/n-paraffins*, 0.83, 0.65 and 0.84 were determined for the wells 19-3, 19-13 and 19-10, respectively and this shows the similarity to data of paraffinic oil of type A of "sapropel" group [11].

The prevailing weight concentration of isoparaffins C_6-C_{11} of given wells is taken by monomethyl isomers, where was observed the strong domination of *2-, 3-* and *4*-monomethyl isomers. Also the given wells were characterized by the domination of *3*-methyl isomers among isoalkanes C_7 and C_{11}, *2*-methyl isomers among isoalkanes C_6 and C_8, *4*-methyl isomers among C_9 and C_{10}. Among the dimethyl alkenes dominate the isomers in position *2,3*-among C_6,C_7,C_9 and *2,4*-among C_9 (in case of well 19-10); *2,4*-among C_8; *3,6*-among C_{10}; *3,3*-among C_{11} (wells 19-3,19-10) and *2,4*-among C_{11} (well 19-13).

The concentrations of hemidimethyl isomers in position *2,2*-among the isomers of C_6, in position *2,2-, 3,3*-among the C_7, C_9, C_{10}; *3,3*-among the C_8, C_{11} were unsignificant. As the previous isoprenoid hydrocarbon's trace compounds there were found out among isoalkanes C_8 the *2*-methyl-*3*-ethylpentane and among the C_{10} the *3*-methyl-*5*-ethylheptane. A ratio $\sum mono:\sum di$ makes for the hexanes 6.9, 7.8 and 7.7, heptanes 1.9, 2.9 and 2.2, octanes 2.6, 2.9 and 2.2, nonanes 1.32, 1.03 and 1.24 and by comparison with the Zuunbayan's data[1] was more close to the characteristics of paraffinic oils of Surguut, Romashkin and Grosnen deposits of type A[14].

Lowest Naphthenes

The lowest naphthenes of gasoline fraction of wells 19-3, 19-13 and 19-10 of Tamsagbulag contain 38%, 39.3% and 34.7% of akcylclopentanes; 42%, 47.2% and 47.1% of alkylcyclohexanes; 1.7%, 1.65% and 0.3% of bycyclanes; 2%, 2% and 2.3% of cyclopentane; 15.1%, 9.8% and 15.5% of cyclohexane accordingly. In comparison with Zuunbayan's data[1] in case of Tamsagbulag the alkylcyclopentane's concentration was slightly high for all wells, alkylcyclohexane's concentration also slightly high excepting the well 19-3 and concentration of bicyclanes low for all given wells (Table 2).

The ratio 6/5 for given three wells was 1.1, 1.2 and 1.4, that is considered as paraffinic crude oil of type A of "sapropel" group according to I.V.Goncharov's[11] genetic classification for crude oils.

The strong domination of alkylcyclopentane's concentration among the naphthenes C_8 was observed. A ratio $\frac{methylcyclopentane}{cyclohexane}$ was < 1 (0.61, 0.96 and 0.64 accordingly for the wells 19-3, 19-13 and 19-10) and in comparison with the Zuunbayan's data[1] slightly low. (Table 2).

The dimethylisomers among the isocyclopentanes C_7, isocyclohexanes C_8 and isocyclooctanes C_{10} (excepting well 19-10, in which case the alkylcyclohexanes dominate), threemethylisomers among the isocyclohexanes C_9 make the basic concentration weight of the lowest petroleum monocyclanes. The monocyclanes make a rather small part of each isomer's set. Among the iso-dimethylcyclohexanes the greatest part make *1t, 4*-dimethylisomers and *1,1*-dimethylisomers. The following dependence *1,1,3*-threemethylcyclanes > *1,1,2*-threemethylcyclanes was determined. The threemethylcyclopentanes, not containing forth carbon atoms were presented by comparable total amounts of *1,2,4* and *1,2,3* stereo isomers, and much more the second dominate. There was traced following dependence *1c, 2t, 3* < *1t, 2c, 3* < *1c, 2c, 3* and *1c, 2c, 4* < *1c, 2t, 4*.

The threemethylcyclohexanes were presented by isomer's ratio as*1c, 2t, 4c* < *1c, 2t, 4t* < *1c, 2c, 5* and in case of well 19-10 by 1c, *2t, 4t* < *1c, 3c, 5*. The concentrations of hemi *1,1*-dialkylcyclopentanes and *1,1*-dialkylcyclohexanes dominated, that describes the similarity to characteristics of oil of type B according to the Petrov Al.A[13,14], (Table 2). And besides were found out *i*-butyl, *sec*-butyl, *1t*-methyl-*2n*-propyl-, *1,2*-methyl-*i*-propyl-cyclohexanes. In comparison with the Tamsagbulag the Zuunbayan C_{10} naphtenes were presented by the additional concentrations of *n*-butyl-, methyl-*4*-*i*-propyl-, *1*-methyl-*3n*-butyl-cyclohexanes, that may was influenced by differences on the method[1].

The relatively high concentration of methylisopropylcyclohexanes *1t*-methyl-*2n*-propyl-, *1,2*-methyl-*i*-propyl-cyclohexanes in a fraction C_{10} agrees the data of Zuunbayan[1] describes the obvious genetic connection with terpenes (Table 2).

The ratio $\sum trimethylcyclohexanes/(cyclopentane+methylcyclopentane)$ was 0.59, 0.60 and 0.52 and the ratio $\sum dimethylcyclohexanes/cyclohexane$ was 0.59, 1.28 and 0.57 for the wells 19-3, 19-13 and 19-10 accordingly and describe the similarity to the "sapropelic" oil of type A according to the Goncharov I.V. genetic classification[9]. By the comparison with the Zuunbayan's data the concentrations of hemi *1,1*-dimethyl- and *1,1*-methylethylcyclopentanes, *1,1*-dimethyl- and *1,1*-methylethylcyclohexanes were relatively high, which is describes the characteristic of oil as of type B[14] or "humus" oil of type A[11].

Table 3. Individual Aromatics of Gasoline Fraction of Wells 19-3, 19-10, 19-13, Tamsagbulag

	Aromatics	Concentration of aromatics, wt%		
		19-3	19-13	19-10
C_6	*benzene*	0.072	0.009	0.070
C_7	*toluene*	0.548	0.083	0.545
C_8	*ethylbenzene*	0.120	0.111	0.126
	m-xylene	0.404	0.477	0.414
	p-xylene	0.725	0.872	0.762
	o-xylene	0.384	0.127	0.399
	Subtotal	**1.634**	**1.587**	**1.701**
C_9	*i-propylbenzene*	0.339	0.365	0.374
	1-methyl-3-ethylbenzene	0.078	0.072	0.048
	1-methyl-4-ethylbenzene	0.045	0.038	0.029
	1,3,5-trimethylbenzene	0.167	0.569	0.570
	1-methyl-2-ethylbenzene	0.067	0.105	0.057
	1,2,4-trimethylbenzene	0.050	0.049	0.058
	1,2,3-trimethylbenzene	0.071	0.071	0.062
	2,3-dihydroindane		0.126	
	1,3-diethylbenzene		0.030	
	1,3-diethylbenzene		0.028	
	Subtotal	**0.818**	**1.454**	**1.200**
C_{10}	*t-butylbenzene*	0.045	0.048	0.056
	sec-buthylbenzene	0.014		
	1-methyl-3-i-propylbenzene	0.072	0.052	0.052
	1-methyl-4-i-propylbenzene	0.177	0.144	0.140
	2,3-dihydroindane	0.149		0.079
	1-methyl-2-i-propylbenzene	0.354		0.488
	1-methyl-3n-propylbenzene	0.026	0.056	
	1,3-diethylbenzene	0.023		0.007
	1-methyl-3-n-propylbenzene	0.079		0.111
	Non identified	0.034		0.043
	Non identified	0.158		
	n-butylbenzene	0.041	0.049	0.059
	1,3-dimethyl-5-ethylbenzene	0.068		0.089
	1,2-diethylbenzene	0.051	0.039	0.064
	decalene	0.125	0.133	0.185
	1-methyl-2-n-propylbenzene	0.020	0.024	
	1,3-dimethyl-4-ethylbenzene	0.156	0.134	0.250
	1,3-dimethyl-2-ethylbenzene	0.020	0.006	0.027
	1,2-dimethyl-4-ethylbenzene	0.032		
	1,4-dimethyl-2-ethylbenzene		0.230	
	1,2-dimethyl-3-ethylbenzene		0.010	0.257
	Subtotal	**1.648**	**0.926**	**1.911**
C_{11}	*1-methyl-4-t-buthylbenzene*	0.097	0.097	0.153
	1,2-dimehtyl-3-ethylbenzene	0.016	0.007	
	1,2 dimethyl-3-ethylbenzene	0.011		
	1-ethyl-2-i-propylbenzene	0.010	0.005	0.016
	Subtotal	**0.037**	**0.109**	**0.169**
Total		**4.853**	**4.060**	**5.5959**

Lowest Arenes

The concentration of toluene in gasoline fraction of wells 19-3, 19-13, 19-10 was in 7.6, 8.8 and 7.7 times high in comparison of benzene concentration (Table 3), whereas in case of Zuunbayan the ratio *toluene/benzene* was only 3.2. And the concentration of methylcyclohexane in 1.8, 2.3 and 1.9 times was higher than the concentration of cyclohexane, that was close to the Zuunbayan's data

Table 4. Composition of Olefins in Gasoline Fraction of Wells 19-3, 19-10 and 19-13, Tamsagbulag

Well 19-3		Well 19-10		Well 19-13	
Olefins	**Wt%**	**Olefins**	**Wt%**	**Olefins**	**Wt%**
cyclohexene	0.005	*t-heptene-2*	0.024	*2,2,3,4-tetramethylpentene*	0.064
t-heptene-2	0.027	*2-methyloctene*	0.036	*3-ethyl-2-methylheptene-2*	0.152
undecene-1	0.016	*3-ethyl-2-methylheptene-2*	0.123	*Undecene-1*	0.055
Total	**0.048**	undecene-1	0.011	**Total**	**0.270**
		Total	**0.195**		

[1]. The concentration distribution of isomeric arenes, depending on the number and character of an arrangement of substituters, as a rule was similar with distribution of cyclohexanes about the same number of hydrocarbon atoms in a molecule. The ratio m-xylene/o-xylene was 1.1, 3.8 and 4.3. it is clear, that according I.V.Goncharov the ratio m-xylene/o-xylene of well 19-3 was similar to the type A of "sapropelic" group, however for the wells 19-13 and 19-10 these ratios were similar to the type A of "humus" group. And the ratio $\sum$*xylenes/ethylbenzene* was 12.58, 13.18 and 12.50 for the given wells, that was closely to the type A of the "humus" group[11].

Olefins

The most interesting result was the detection of trace concentration of unsaturated hydrocarbons in gasoline fraction of both oils. Generally, the crude oil doesn't contain the unsaturated hydrocarbons. However, such hydrocarbons were detected for the 15 samples by the scientists and the quantitative analysis had been carried out[18]. The presence of trace amount of unsaturated hydrocarbons indixes on the geochemical perculiarity of origins of the given oils.

We have found the trace amount of olefins (0.05%, 0.19%, 0.27%) in gasoline fractions of wells 19-3, 19-13 and 19-10, which were low in comparison with the Zuunbayan's data[1]. The olefins presented by cyclohexene, *t*-heptene-*2*, undecene-*1*, *2*-methyloctene, *3*-ethyl-*2*-methylheptene-*2* and *2,2,3,4*-tetramethylpentene (Table 4). The trace amount of olefins, detected in all oil fractions should be studied furthermore in the near future.

Conclusions

(1) The most perspective Tamsagbulag oil's gasoline fractions of wells 19-3, 19-13 and 19-10 were characterized by the high concentration of paraffins and presence of trace amount of olefins. 158 individual hydrocarbons (69 paraffins, 45 naphthenes, 41 aromatics and 3 olefins) were identified from each samples of gasoline fraction.

(2) The first attempt to classify Tamsagbulag oil under the individual hydrocarbon's data was successfully conducted and the supposition of a fitting of given oil to "sapropelic" oils is made. The ratios of *naphthehes/paraffins* were *0.73, 0.43 and 0.68*; *i-paraffins/n-paraffins 0.83, 0.65 and 0.84*; **6/5** *1.1, 1.2 and 1.4*, $\frac{methylcyclopentene}{cyclohexane} < 1$; $\sum$*trimethylcyclohexanes/(cyclopentane+methylcyclopentane) 0.59,0.60 and 0.52* and the ratio $\sum$*dimethylcyclohexanes/cyclohexane* were 0.59, 1.28 and 0.57 for the wells 19-3, 19-13 and 19-10 accordingly.

(3) For future usage of Tamsagbulag gasoline fractions as fuel product it is necessary to conduct a detailed study the increase of octane number.

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