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About properties of hydrocarbonic substance – the oil source

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Sources of modern representations about an oil origin have arisen in XVIII – the XIX-th century beginning. Attempt of the decision of this problem on the basis of the analysis of physical and chemical properties of oil and its derivatives on the basis of the literary data during 1940 1960 is more low made

Communication of physical sizes

I. It consists available between the physical sizes characterizing properties of oil, established for a dawn of «a foggy youth» oilchemistry of communication of a kind

$$n_D^{20} = Ad_4^{20} + B \qquad (1)$$

On modern representations [*Kitaigorodsky,* 1973] size $\boldsymbol{n}$ is defined by equality $n^2 \approx \boldsymbol{\varepsilon\mu}$, where $\boldsymbol{\varepsilon}$ – dielectric, and $\boldsymbol{\mu}$ - magnetic permeability of substance. Great attention S.S. Kurtts [*Brooks,* 1958] gave to the similar analysis, but this approach has a little given for understanding of properties (1). There is also more interesting dependence $n = c/v$, where c is velocity of light in vacuum, v – in substance [*Kitaigorodsky,* 1973].

II. Experiments by definition of influence T on change d and n are known. For them this dependence looks like $(d, n) = -aT + L$.The density is connected with temperature through the equation $d = d_o - \gamma_d T$, in which $\gamma_d = d_o\, \boldsymbol{\alpha}_d$; d_o - initial value of density at T = 0°C, $\boldsymbol{\alpha}_d$ - the factor of thermal expansion (compression) identical to those in the equation $\mathbf{v}_T = \mathbf{v}_o\, (1 + \boldsymbol{\alpha} T)$ [*Kitaigorodsky,* 1973].

On natural objects at increase T of size d and n decrease, as constancy mass of substance growth T conducts to increase in its volume, so also to density reduction. For sheeted oils on the average $\boldsymbol{\alpha}_d \approx 0{,}0008$. In experiment for row hydrocarbons (HC) $\Delta n / \Delta d$ = 0.603–0.454 which are equal to values A for concrete sublimates.

In work [*The major oil deposits developed capitalist and developing countries,* 1973] results of definition dynamic and kinetic viscosity on an interval 10–50°**C** are resulted. On them the oil size $\boldsymbol{\alpha}_d$ of some the deposits, equal 0.0007 is defined.

In too time the volume increase conducts to reduction of quantity of molecules in volume unit. As wave resistance there is a growth of speed of movement of light in substance, so also reduction of an indicator of refraction thus decreases. According to experiences its behavior is similar to behavior of density. Therefore it is possible to write $n = n_o - \gamma_n T$. Deleting parameter T and spending transformations for the equation (1), we receive $A = \gamma_n / \gamma_d = n_o \alpha_n / d_o \alpha_d$. That reflects physical sense of the equation (1) for oils. All it explains features of natural distribution of oil: simplification (reduction of its density) with the depth, caused accurate communication with $\boldsymbol{T}$ oil a layer, agreeing with A.F.Dobrjansky's position (1961) and other researchers. On P.F.Andreev [*Andreev et al.,* 1958] – the basic type of distribution of oil in space (it is characteristic for ~70 % of oil fields).

Mechanisms were offered different, but hypotheses remained not proved. Therefore the main reason of change of volume of oil is thermal influence at a weight constancy metamorphic oil, and the specified mechanisms are imposed, additional.

B). Warming up and reception sublimate was carried out in behavior T. Dinamika of behavior of interval sublimate of oils from adjournment of different age is reflected on fig. 1: objects share on groups rather low-temperature ($T \approx$ 40–400°C) and high-temperature ($T \approx$ 350–600°C) sublimates. Both curves have the interval of overlapping marked for $T \approx$ 350-400°C. Researchers are conducted in other works for shorter intervals, but always the described excess is marked practically in the same point – T = 350–400°C. In the nature sheeted T can reach 250°C, without holding out to a point of phase transition. For some natural concentration of oil growth of density with depth (the second type on [*Andreev, et al.,* 1958]) is marked. Here it is possible baric compression of substances which conducts to volume reduction, so also to growth of oil density. But the made experiments are carried out only at the pressure which are not exceeding standard value, therefore the pressure role isn't clear.

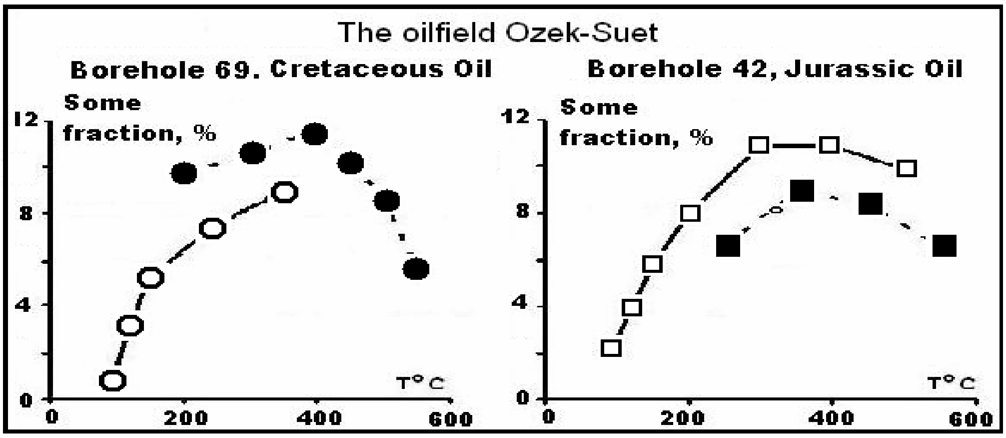

Fig. 1. Dynamics of reception возгонов on Ozek-Suat deposit [*Kotina, Chihacheva*, 1961]

III. For studying of influence *T* distribution isotherms (fig. 2A) for intervals *T* = 250–300 and 350–400°C are constructed. Are allocated on two groups of parameters *A* and *B*. Foundation of allocation of groups proves to be true also that on diagrams in coordinates (*M-d*) and (*M-X*) (*X*- fraction portion) on fig.2B these samples also are allocated in separate sets of points. All straight lines are crossed in a point d_o = 0.904; n_o = 1.495.

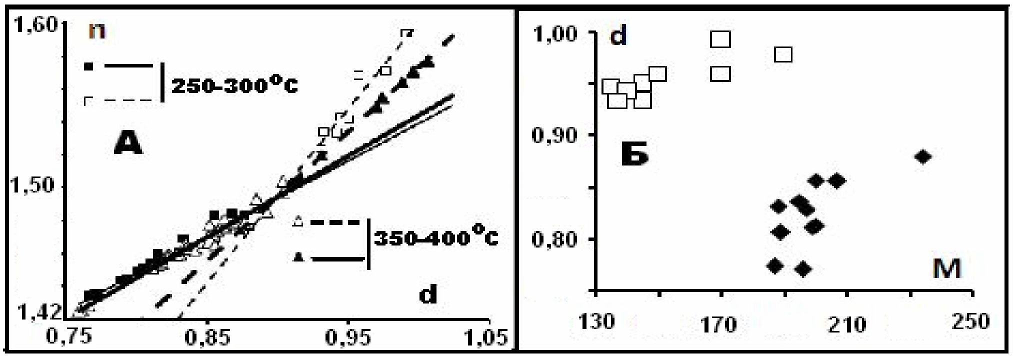

Fig. 2. Isothermal distributions of physical parameters of oil. (**A** – the Cumulative diagram of distributions; B– dependence of density d. From molecular weight of M at T=250–350°C)

Properties of substance in the oil source

I. The Estimation of parameters n_o and d_o in a source is given by the theory of the decision of a problem about sources of the substance [*Makarov,* 2008], operating with parameters *A* and *B* (1). Here two components are allocated: 1)**.** If there are some equations (1) they are characterized by pair numbers (*A,B*). Using them as coordinates, it is possible to receive a straight line of kind $B = aA + b$. If the equation is carried out, such set of straight lines (1) is called as a bunch of the straight lines crossed in one point (crossover) with coordinates (A_o, B_o), defined as $a = -A_o$ and $b = B_o$. The equation of kind $B = (-A_o) A + B_o$ is a compensatory equation. 2) Equation (1) describes distribution of the components formed at mixture of initial components at least from two sources. Application of representations about "compensation" leads to a conclusion that parameters (**A_o, B_o**) just and describe structure of one of initial components. On parameters of these equations the compensatory diagram (fig. 3A) for the first time has been constructed. On a picture the data on temperature fractions within 60 – 500°C a wide range of HC is taken out. For comparison parameters of the equations for silicate minerals and a glycerin solution in water are shown. All points HC strictly lie down on a straight line with equation $B = -0.827A + 1.459$ (fig. 3A), testifying that substances in an oil source possess the general property; coordinates of a point of a crossover are described by values d_o = 0.827 and n_o = 1.459, characterizing physical properties of the progenitress of oils.

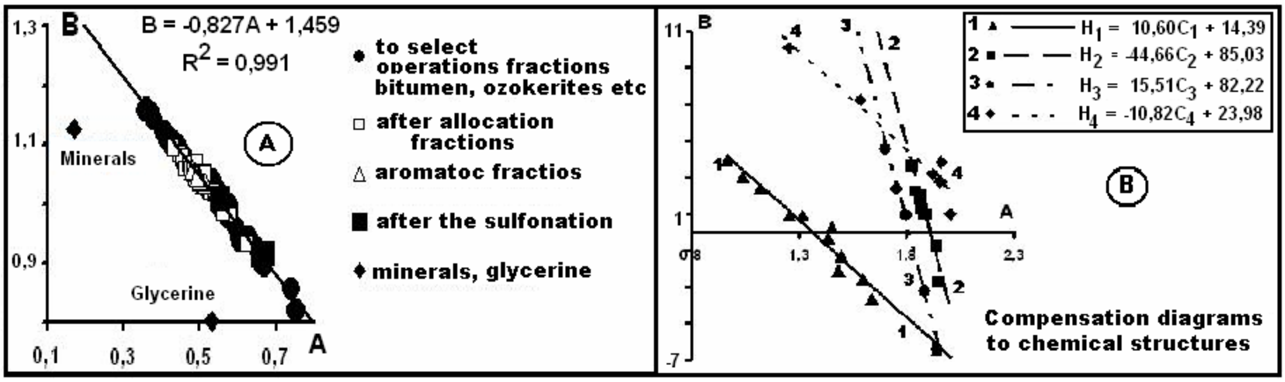

Fig. 3. The compensatory diagram on equation parameters n=Ad + B (A) and communications between C and H (B)

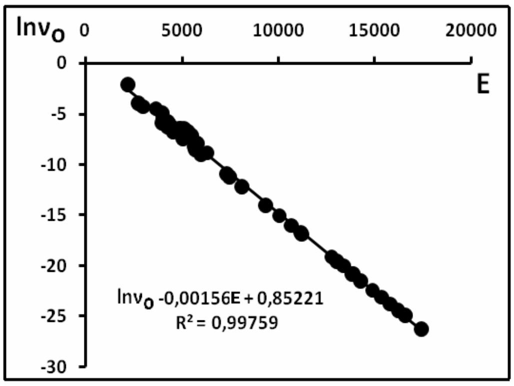

Fig. 4. The compensatory diagram for parameters of kinetic viscosity

II. The Basic equation connecting kinetic (or dynamic μ) viscosity with *T*, is the equation $ln\mu = ln\mu_o + E/RT$ (*T* - temperature in °K; *E* – energy of activation of a viscous current). In many works values of kinetic viscosity are resulted at temperatures 20 and 50°C. On deposits size E changes within 2–20 kcal/M, and $ln\mathbf{v}_o$ = (-4) ÷ (-30). The diagram Indemnifications it is resulted on fig. 4, points of all deposits lie down on one straight line, speaking about that, that oil has uniform value of viscosity in a source, corresponding to the data about distribution of other physical parameters of oil (fig. 3). In a source prevailed *T* = 40–50°C and $ln\mathbf{v}$ = 0.8522. If to lean against communication between depth and temperature revealed *T* corresponds to depth of a finding of a source of ~1800 m.

Table 1. Parities of groups of hydrocarbons on a chemical compound.

№№ п.п.	Empiric formula	NN samples	NN samples,%	Group
1	$C_{10,60}H_{14,39}$	12	40	C_nH_{n+3}
2	$C_{44,66}H_{85,03}$	8	26,8	C_nH_{2n-4}
3	$C_{10,82}H_{23,98}$	5	16,6	C_nH_{2n+2}
4	$C_{45,51}H_{82,22}$	5	16,6	C_nH_{2n-9}
	Всего	30	100	

III. Always in formula C_nH_m communication between concentration C and *H* is linear kind H = aC + A. On the compensatory diagram (fig. 3B) distinctly allocates the groups of points differing with a chemical composition (tab. 1). The quantity of points reflects their parities in diagrams. High concentration in substance of a source of oil of an aromatic component (№1) and low concentration metane (№3) components come to light.

IV. On fig. 5 distribution of various groups HC in oilfield of Ozek-Suat is shown. Reverse linear dependence are outlined between napfthene and metane groups and between napfthene and methane fractions on the one hand and aromatic fractions – with another (fig. 5B). The behavior of napfthene and methanes is similar to behavior of components in the closed systems in which one component replaces another. Interaction between napfthene (Hf) and methane (Mn) groups is caused by influence ***T*** and, probably, caused by transformation of one HC in another on reaction of type $C_6H_{12} + H_2 \rightarrow C_6H_{14} + Q$ (=-71550 the J/M).

According to the compensatory analysis the initial parity between components in substance of a source of oil is reflected by estimated sizes of $Nf_o \approx 55.67$ % and $Mn_o \approx 31.51$ %.

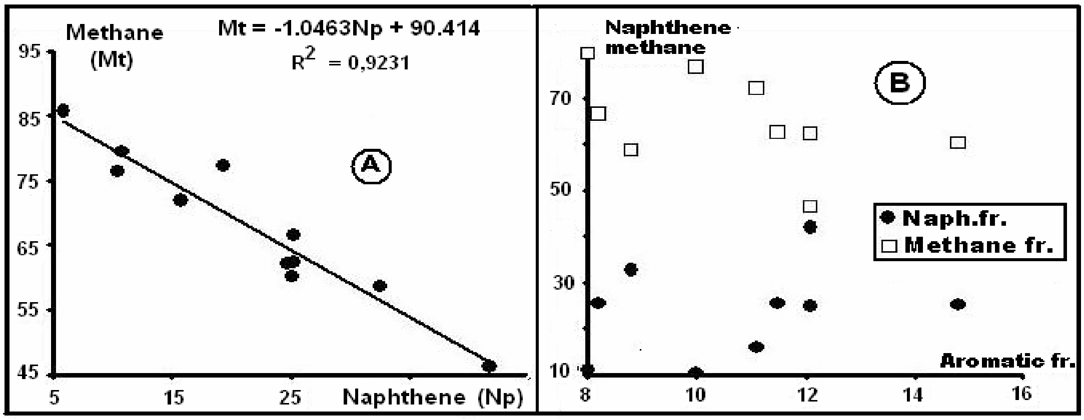

Fig. 5. Distribution of group oils components [*Kotina, Chihacheva*, 1961].

Some conclusions

The literature review has shown that all oil unites in two groups by which the small part belittling value of this division for understanding of the nature of oil is taken away.

1. Oil, in which *d* and *n* decrease with depth. It is prevailing group нефтей (≈70 %).
2. Oil, in which *d* and *n* grow in which density with depth.

For all нефтей connection only a kind $n_D^{20} = Ad_4^{20} + B$ is established.

The main agent of influence on formation of the first group is T. Under the action ***T*** there is a thermal redistribution of substance of oil. The similar behavior is possible at a constancy of weight of object of influence T and its invariance in time, i.e. in stable tectonic conditions. In this case speed of thermal redistribution of oil should be more speeds of its immersing.

The main mechanism of formation of the second group isn't absolutely clear. A possible condition - gradual immersing of object owing to what there is gradual growth T, distillation of fractions to the lowered values ΔH_{eva} (eva- evaporation) and accumulation in roots of object of heavy fractions of oil. In this case speed of immersing of substance should be more speeds of its thermal redistribution.

Despite a variety нефтей, for them uniform properties of substance in an oil source for the first time are established: $d_o = 0.827$ g/sm^3 and $n_o = 1.459$, $T = 40–50$°**C**, $ln\mathbf{v} = 0.8522$; depth of a source of ~1800 m. the Chemical compound substances (microoil [*Vassoevich*, 1959]) in a source develops of fractions $C_{10,60}H_{14,39}$, close to structure C_nH_{n-4} (aromatic group), and $C_{44,66}H_{85,03}$, close to structure C_nH_{2n-4} (complex naphthenes). These conclusions it will be coordinated with A.F.Dobrjansky's opinion [*Andreev, et al.* 1958] on which the composition of the primary source of oil is close to composition of aromatic connections. Intuitively having applied the analysis of indemnification, have established that «hypothetical alkanes» in a source have $T_{melt} = 125$°C and $n_o = 1.4750$.

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