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ABOUT THE MUTUAL INFLUENCE OF THE MIXED OILS

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ABSTRACT

Recently the steady tendency to increase in volumes of transportation, oil was outlined. Thus, developments new or optimization of the applied technologies of transportation of oil taking into account their rheological properties and operational characteristics of pipelines are necessary for the solution of a task of increase in volume of pumping of crude oil. Because of relevance of a problem, results of the pilot studies mixed crude oil by physical and chemical methods are of a great interest. The researches conducted by us have shown that when mixing crude oil it is necessary to consider a factor of interference of structures crude oil for the purpose of an assessment inadmissible and optimum concentration of separate components.

KEYWORDS: Physical-chemical, incompatibility, compounding, viscosity, hemometriya, sinergizm.

INTRODUCTION

The present stage of development of chemistry of oil is characterized by such are bright! Achievements as: identification in natural the crude oils more than 1 000 individual connections, including α-olefins; studying of chemism of thermocatalytic transformations of hydrocarbonic connections; knowledge of the nature of pitches and asphaltene. Except these traditional directions of researches in the field of crude oil chemistry scientists pay the increasing attention to studying of internal structure of crude oil systems and her structural elements.

In the present need of transition from classical chemistry of oil to physical chemistry has ripened. Really, dispersible the state is characteristic of the crude oil in situ systems and in the course of technological operations with them. To crude oil dispersible to systems practically all types of natural of hydrocarbonic raw materials, and also different types belong crude oil products, from motor fuels to coke.

Intermolecular interactions and phase transitions typical of any technological processes of production, transportation and processing of oil are the cause of the interface in the petroleum systems and related surface phenomena. Studying of countryside of these the physics-chemistry of the phenomena gives in hands of researchers the tool for optimization of technological processes. At the same time colloidal and chemical has proved to be very perspective scientific approaching to studying structures of oil systems.

MATERIALS AND METHODS

In this work develop colloidal chemical approach to the study of the structure of the oil system and the concept of an extreme condition presents VAT

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A possibility of regulation of phase transitions in oil systems at production, transportation, oil refining and use of oil products by almost available ways makes an essence of physical and chemical technology of oil.

Today mixture of crude oil is made or on mixing installations, or oil refineries which buy different types of the budgetary crude oil. Additional costs of oil refining with a high rate of TAN are in limits of 1.15-10.73$/barrel, but the economy makes 43.54-62.7$/barrel. They improve her chemical and physical properties with receiving at the minimum expenses of synthetic oil which can be processed on the equipment of oil refinery and allows to receive valuable distillates [1, 2]. Qualitative parameters determine the market value of each type of crude oil, the most important characteristics of quality are density, the total acid number (TAN) and content of sulfur. Specific weight of API varies from light crude (high API, small density) to heavy oil (low API, high density).

In the past, most refineries were designed and built for reasons of available for oil and its ease of purchase. It limits variability of many oil refineries in purchase of other types of oil, with other qualities [3, 4]. Many of these plants which are under construction for distillation of light crude oil with the low content of sulfur are limited concerning processing of heavy types of fuel. Important distinctions in their physical and chemical properties do distillation of heavy oil more difficult, in comparison with distillation of light crude.

Effective mixture of crude oil opens for the objects of mixture of oil trading in oil of the companies and terminals of an opportunity to deliver cheap mixes on the market. Strategy of mixture of crude oil includes several parameters.

Mixture of, crude oil is applied directly at oil refineries to preparation not of expensive mixes suitable for their internal consumption or to trade in the market. Generally crude oils can be divided into four main groups: light, with the low content of sulfur (API 30-40 °, S ≤ 0,5 % mass.); light, with the moderate content of sulfur (API 30-40 °, S = 0,5-1,5% of masses.); heavy, with the high content of sulfur (API 1-30 °, S 1,5-3,1% to weight.), especially heavy, with the high content of sulfur (API = 15 °, S ≥ 3% of masses.). The component share in mix is actually limited to the physical properties necessary for the maximum exit of high-valuable distillates, and a design of the equipment of processing of mix. Different types of crude oil, for example, some Venezuelan and Canadian crude oil, are very heavy, and are attractive to production of bitumen. Processing of these oils is limited to their very low specific weight API. To make from these crude oils other distillates, they need to be, enriched by dilution with light crude or kerosene.

The volumes of final distillates demanded by the market long and expensive laboratory analyses are necessary for check of real physical properties of mix. If these properties aren't reached, repeated mixture is required. Effective mixture demands line monitoring of properties of mix throughout all production cycle. The chemical composition at each oil different and despite the fact that whether oil is pure, or is mix crude oil, for maintenance of stable quality of production line correction has to be, carried out continuously. It demands sampling in real time and checks of physical properties of mix throughout all production cycle. Among all analyzers available in the market, line analyzers of the nuclear magnetic resonance (NMR) are the most suitable for this purpose. Crude oil represents mix of organic chemical compounds, generally molecules on the basis of carbon and hydrogen. The next atoms, such as carbon, oxygen and sulfur, and the next chemical bonds influence the size of absorption of energy and the radiation generated by hydrogen kernels in a magnetic field. Respectively, the signal of each atom of hydrogen gives shift, other than others, in a nuclear magnetic resonance range. These established chemical shifts reflect chemical structure of molecular particles. Physical properties of crude oil and distillates change with their chemical composition.

Crude oil contains heteroatomic molecules of water which easily differ with a nuclear magnetic resonance with spectrometry. The line spectrometry of a nuclear magnetic resonance with the corresponding hemometriya allows to define the following properties of crude oil: specific weight, actual temperature of boiling, maintenance aromatic, % percentages of aromatics, olefins, water, seurat; liquefaction temperature. Tracking of these parameters is the most important during mixture of crude oil.

Distinctions in cost crude oil, depending on their origin, chemical and physical properties.
Their line measurement allows to mix synthetic raw materials with obtaining previously set properties, both with physical and chemical, and from the economic point of view. Nuclear magnetic resonances application in processes of mixture of oil are justified, especially in case of line mixture. It resonance allows to control precisely quality of the made mix and if it is required, to change a ratio various crude oil channels for the purpose of lecture

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and preservation of the necessary quality of final mix. Mixture different crude oil, especially when nonconventional grades of crude oil are involved in process, can cause sedimentation of asphaltene that is the reason of pollution of pipelines and technological installations. Asphaltenes are dissolved in polar aromatic connections, such as toluene, but aren't dissolved in wax un polar solvents. The line analysis of contents saturated, pitches, aromatic and asphalten can become the potential instrument of line definition of quantitative ratios various crude oil, subject to mixture, or crude oil and polar solvents, without causing sedimentation of asphalten. Natural gas condensates (PGC) are made in processes coolings and distillations at gas and oil refineries, and are considered as by-products of the crude oil and gas industry. Gas plants take PGC for receiving profit and for ensuring production of natural gas of pipeline quality. The prices of PGC are rather low. They and other substandard materials of extraction of natural gas are used by oil refinery and the companies of mixture for enrichment heavy crude oil. Other scope is decrease in viscosity of heavy crude oil that it could flow more easily on pipelines. Use of the nuclear magnetic resonances line analyzers provides effective tools for effective mixture of PGC and crude oil with obtaining necessary physical properties, at the minimum expenses.

Distinctions in cost crude oil, depending on their origin, chemical and physical properties.
Their line measurement allows to mix synthetic raw materials with receiving previously there are various options of mixture for enrichment of non-standard crude oil in more valuable synthetic oil. Analyzers on the basis of a nuclear magnetic resonance can be used for definition of a chemical composition and physical properties of dark and opaque streams. Advantage of spectrometry of a nuclear magnetic resonance consists in its linear correlation between atoms of hydrogen in the molecules which are present at crude oil and the chemical nature of her components. Hemometriya will transform spectrometer measurements to characteristic physical properties crude oil and mixes. Use of the nuclear magnetic resonances line analyzers provides effective tools for effective mixture of PGK and crude oil. This technology provides data and information on physical and chemical properties of mix on a stream in real time. Line corrections and changes of components of mixture can be carried out, respectively, before achievement of the required physical parameters [5, 6]. The only example when data on trademarks and an origin crude oil are provided in public publications about manifestations of "incompatibility", numerous descriptions of researches of mixes of light crude oil. Of a grade of Forties, with heavy crude oil of a grade Souedie are (US Patent 5997723, 1999; US Patent 5871634, 1999; Wiehe and Kennedy, 2000; Wiehe et al., 2001; Wiehe, 2003; Mason and Lin, 2003a, 2003b; US Patent 6839137 B2, 2005; US Patent 7029570 B2, 2006). Souedie brand oil (heavy Syrian oil) has the following average characteristics: density at 15 °C, kg/m3 908.7, density in °API 24.13, viscosity, cSt at 10 °C 149.9; viscosity, cSt at 50 °C 21.6; temperature of hardening, °C (–30); Asphaltenes, masses. % 11.8, Are gray, masses. % 3.9, Nickel, ppm 36.5, Vanadium, ppm 100.0.

Forties brand oil (from fields of Great Britain in the North Sea) has the following average characteristics:
Distinctions in cost crude oil, depending on them Refers. Density of g/cm3 0.8090, Density in °API 43.4, Viscosity, cSt at 40 °C 2.12, Viscosity, cSt at 50 °C 1.81, Temperature of hardening, °C (–15) Asphaltenes, masses. % 0.16, Are gray, masses. % 0.21, Nickel, ppm 0.80, Vanadium, ppm 1.6. Direct laboratory researches of mixes of crude oil have shown that the maximum loss of rainfall ("incompatibility") is characteristic of the mixes containing, about, 67 volume percent of oil of a grade of Forties and 33 volume percent of oil of a grade of Souedie. In researches the essential role of such factor as a mixture order a component is found. In case of gradual addition of small portions of Forties light crude to large volume of heavy Souedie oil, the volume of colloids of the asphaltene which are dropping out in a deposit increases gradually and sharp increase in rainfall is observed only at achievement of a threshold "incompatibility at, about, 67% of Forties oil. So, for the considered mix Forties-Souedie concentration of asphalten between phase borders, namely 50÷60 of mg/l are optimum.

Distinctions in cost crude oil, depending on them It is known that the oil streams coming to a network from certain fields are unstable in time and are non-uniform in quality parameters (on hydrocarbonic composition, density, viscosity, content of sulfur, water of mechanical impurity, salt, etc.) . The design of a network and feature of an arrangement of areas (regions) of production don't allow to transport oil from concrete fields in points of delivery (oil refinery, export) with preservation of their initial quality. The existing systems in trade and main oil pipelines technologically can provide only transportation of oil in mix. Besides, because of development of oil branch there are new transport directions, new fields are developed and connected, sales markets change, change structure of production. Therefore the problem of continuous intervention for the purpose of quality management is actual. For this purpose now the following technology is generally applied:

- consecutive transfer of crude oil;
- compounding.

Compounding as technology of quality management provides the stable, guaranteed deliveries to export without "splashes" of indicators of quality.

For achievement of favorable economic results when processing crude oil it is often necessary to mix two or more different types of crude oil before carrying out various processes of processing. However there are specific problems connected with mixing of different types of crude oil. The first main problem is incompatible with each other that leads to a contamination, sometimes even to an equipment stop (pipelines, tanks, heat exchangers, furnaces, rectifying columns, etc.).

Other main problem connected with mixing crude oil and other hydrocarbons, is generation of emulsions of oil and water in system.

Shows results of the conducted researches that one of the reasons which causes not miscibility various crude crude oil is presence of organic solid substances in the form of the besieged asphaltene in mix crude oil. It is known that asphaltene are soluble in the aromatic-connections, such as toluene, but insoluble in compounds of paraffin, it as a n-pentane. The main problem connected with presence of asphaltene at different types of crude oil is what asphaltene often drops out in a deposit of solution during mixing of different types of crude oil remain still unresolved. So far there is a need for creation of practical and economic favorable means and ways of determination of ability to mixing the differently sortable of crude oil.

Follows, will note that resources and efforts to development of new methods and technologies for a solution of the problem of mixing of crude oil have allowed to achieve only partial success in creation of practical and economic (rational) ways of mixing.

RESULTS AND DISCUSSION

Researches of the last years have drawn a conclusion that nonlinear deviations of properties of mix the differently sortable crude oil from the existing models of ideal mixes most likely are caused by structural transformations of oil nanophases [7]. At concentration of asphaltene in mix crude oil to the corresponding borders of nanophases perhaps emergence of undesirable manifestations of incompatibility.

Thus, the existing recommendation about technologies of mixing should add with the criteria taking into account interference as a part of separate components allowing to make a necessary assessment of "unacceptable", and also "optimum" concentration of asphaltene and other high-molecular chemical compounds in oil mixtures [8, 9].

Various models of the considered processes existing now don't allow to predict changes of indicators of quality of examinees of oil mixtures with a sufficient accuracy, necessary for engineering calculations yet.

In work on the example of crude oil Azerbaijan it is established that besides loss of various rainfall, manifestation of "incompatibility" in oil mixtures can be expressed also in noticeable anomalies of quality indicators.

For the purpose of studying of interference of components as a part of mix various tests of crude oil and their mix have been investigated in vitro. According to the corresponding state standard specifications researches on definition of physical and chemical indicators "density", "viscosity", "hardening temperature", and "quantity of ballasts" of examinees of systems have been conducted.

In particular, physical and chemical indicators crude oil fields the Bulla (BCO) and Garachukhur (GCO) of Azerbaijan which have been used with a research objective their interaction at mixture are provided in the table. As are visible from the table, the qualities considered oil in parameters differ from each other.

As a result of researches depending on ratios of components of mixture not additive properties of noted parameters have been found. In oil mixtures in some cases the effect of a sinergizm (fig. 1÷8) was observed. In fig. 1-8 pressure of elasticity of saturated steam, temperatures of hardening and content of mechanical impurity depending on a mass fraction of the mixed oil, i.e. from sequence of mixture of the GCO and BCO components are presented according to change of parameters of density, viscosity, content of pitches, asphaltene, wax. Apparently from fig. 1-4, in change of parameters of density, viscosity, content of pitches and asphaltene irrespective of sequence of mixture at a ratio of the GCO:BCO=42:58 components of % (or % BCO:GCO=58:42) observes abnormal growth.

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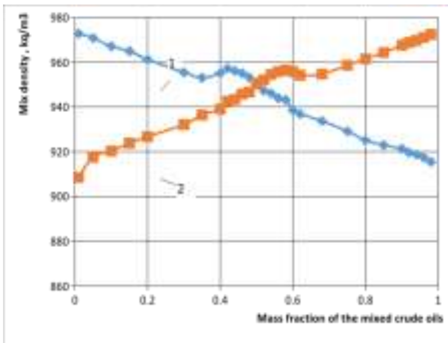
CONCLUSIONS

Thus, it has been shown that as a result of interference crude oil at their mixture in technological pipelines of system of collecting production of wells formation of various traffic jams and abnormal changes of almost important parameters, such as density, viscosity, hardening temperature, volume, etc. can be observed. Therefore when mixing crude oil it is necessary to consider a factor of interference of structures crude oil for the purpose of an assessment "inadmissible" and "optimum" concentration of separate components. For this purpose when mixing crude oil and crude oil products under production conditions, physical and chemical and rheological characteristics of the received oil mixtures it is expedient to define experimentally. Laboratory researches as it is possible a bigger, variety of crude oil mixtures also for development of sufficient exact empirical formulas are extremely necessary.

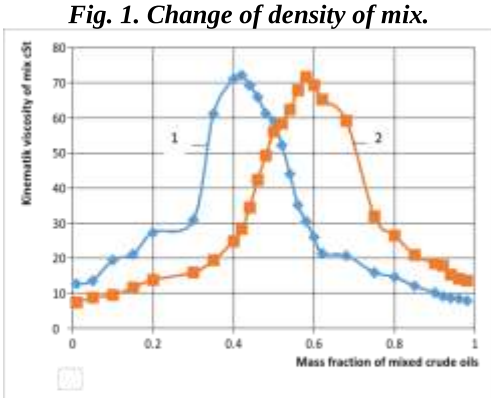
Table
Physical and chemical indicators crude oils fields Bulla (BCO) and Garachukhur (GCO) of Azerbaijan.

Physico-chemical parameters	Crude oil		Methods of carrying out analyses
	BCO	GCO	
Density at 20 ^{0}C, kg/m^3	973,4	914,7	GOST 3900
Kinematic viscosity at 20 ^{0}C, cSt	15,76	6,41	GOST 33
Pitch, weight %	10,27	13,28	Hromotagrap.
Asphaltene, weight %	0,23	0,64	GOST 11858
Wax, weight %	13,34	2,53	GOST 11851
Reid vapour pressure, kPa	16,2	9,7	GOST 1756
Temperature of hardening (pour point), °C	+9	+3	GOST 20287
Sediments, weight %	5,72	6,42	GOST 6370
Salts, mg/l	480,6	530,3	GOST 21534
Content of water, weight %	43,2	56,4	GOST 2477



1-GCO+BCO, 2-BCO+GCO

Fig. 1. Change of density of mix.



1-GCO+BCO, 2-BCO+GCO
Fig. 2. Change of kinematic viscosity of mix.

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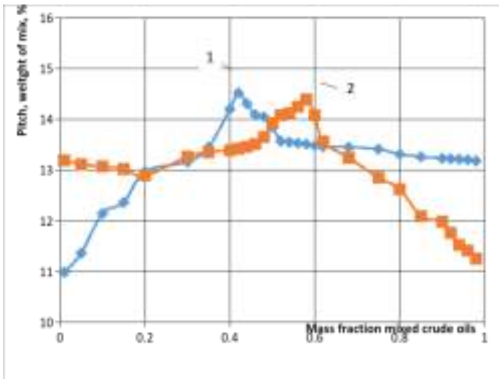
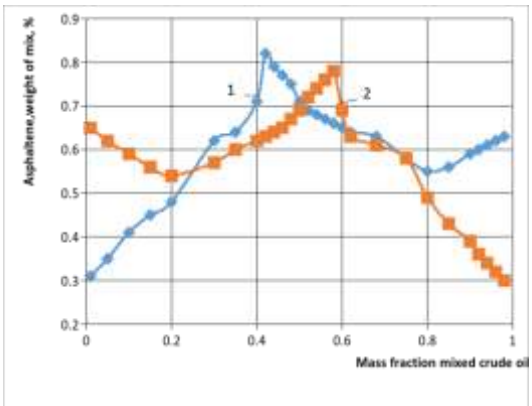


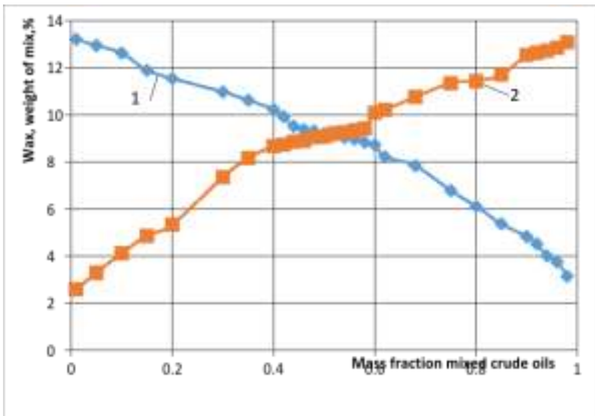
1-GCO+BCO, 2-BCO+GCO

Fig. 3. Change the content of pitches in mix.



1-GCO+BCO, 2-BCO+GCO

Fig. 4. Change of maintenance of asphaltene in mix.



1-GCO+BCO, 2-BCO+GCO

Fig. 5. Change of content of wax in mix.

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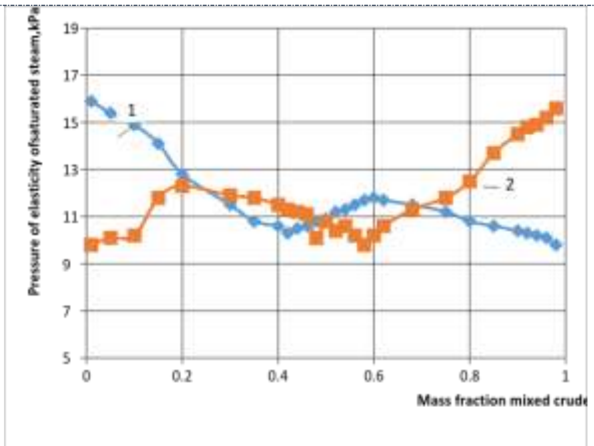
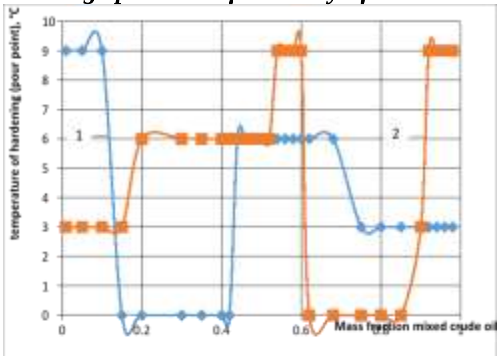


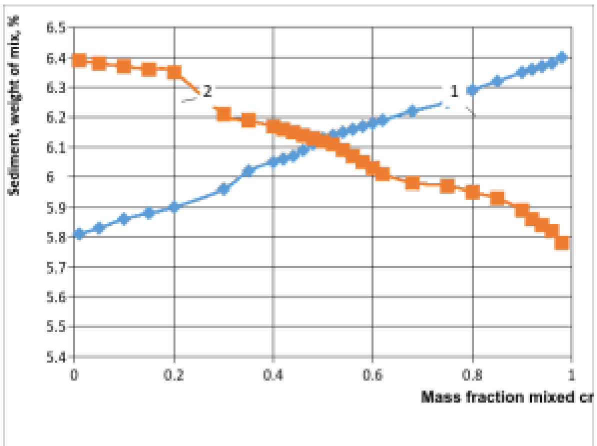
1-GCO+BCO*, *2-BCO+GCO

Fig. 6. Change pressure of elasticity of saturated steam.



1-GCO+BCO*, *2-BCO+GCO

Fig. 7. Change of temperature of hardening (pour point).



1-GCO+BCO*, *2-BCO+GCO

Fig. 8. Contents change fur of impurity.

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