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IN SIGHT

Golubeva I.A., Mescherin I.V., Dubrovina E.P., Bakanev I.A.

Technologes liquefied natural gas

Keywords: liquefied natural gas, a fuel, LNG technology, coolants, cascade, floating complex.

Abstract. The article discusses the proposed industrial and implemented technology of liquefaction of natural gas, the main principles of large- and small-capacity liquefaction process technology, given the description of the flow charts, analysis and comparison of technologies, their advantages and disadvantages. The technology for floating LNG complex.

Russian State University of Oil and Gas named I.M. Gubkin, Moscow

PETROLEUM PRODUCTS:
TECHNOLOGY, INNOVATION, MARKET

Glagoleva O.F., Odnol'ko I.S., Piskunov I.V.

Problem of crude oil incompatibility on blending as a barrier for improvement of refinery efficiency

Keywords: Crude oil, oil disperse systems, intermolecular interaction, crude oil blending, compatibility (stability), methods of measurement and regulation, distillation.

Abstract. Article is dedicated to the relevant problem of crude oil blending and incompatibility issues. It is shown that blending of components in optimum proportions, introduction of active additives and etc. can help to regulate balance of intermolecular interactions and prepare a stable mix characterized by maximum distillate yields that finally can improve profitability of refinery. Correlation of physical-chemical properties of crude oil blends and distillates yields from component content is not linear and has polyextreme form due to impact of colloidal properties caused by intermolecular interactions. Resolution of crudes incompatibility issues can help to boost refinery profit by extra optimization of colloidal properties of crude oil systems.

Gubkin Russian State University of Oil and Gas, Moscow
LUKOIL Oil Company

Samedova F.I., Guseynova B.A., Aliyev A.D., Gasanova G.M., Rukhullayeva S.U.

The hydrocarbons of deepwater Guneshli oil

Keywords: oil, field, individual hydrocarbon composition, saturated naphthene-paraffinic, aromatic, isoprenoid, gas chromatography-mass spectrometry, alkyl-substituted benzene and naphthalene

Abstract. The article presents the results of a study of the hydrocarbon composition of the fractions with the boiling point 150-250°C, the Azerbaijan deepwater Guneshli deposit oil. Oil is characterized as a light, low-sulfur, low-resinous slightly waxy (3.7% by weight of solid paraffin), without asphaltenes.

Fractionation of oil at 50-degree fraction (up to 450°C) on the APH-2 apparatus (ГОСТ 11244-85) found that the total output of light fractions boiling up to 450°C is 70% by weight. Fractions with a boiling range of 150-200°C and 200-250°C were combined. Obtained in this wider boiling range fraction 150-250°C was 19.4 wt% oil. This fraction was divided into groups of saturated naphthene-paraffinic and aromatic hydrocarbons. The separation was carried out by liquid eluent, adsorption chromatography (ГОСТ 11244-85) on activated КСМ silicagel.

Individual hydrocarbon composition obtained by individual groups of hydrocarbons, saturated naphthene-paraffin and aromatic studied by gas chromatography-mass spectrometry.

Studies have shown that the dominant class in the concentrate saturated hydrocarbons are alkanes, in total constituting 77.09% of its weight and the amount represented by the normal structure of the paraffinic hydrocarbons – 46.19% by weight and isomeric structure – 30.9% by weight. Among the identified paraffinic hydrocarbons predominate normal alkanes with number of carbon atoms in the molecule, C11, C12 and C13 (9.72, 9.25 and 10.72 wt%, respectively). Among the iso-alkane hydrocarbon structure representatives discovered isoprenoid hydrocarbons such as 2,6-dimetiloktan (1.45 wt%), 2,6-dimetilundekan (1.93 wt%), 2,6,10-trimetildodekan (2.11wt%). The ratio of the total concentration of the identified methane hydrocarbons and naphthenic M: N to the 150-250°C fraction is 4.17. On this basis the oil refers to a marked paraffinic hydrocarbon type.

Among the identified monocyclic naphthenes maximum concentration of C10 and C12 differ (2.09 wt% and 2.77 wt% respectively), including bicyclic – C11 (3.98 wt%). The composition concentrate of aromatic hydrocarbons include benzene and naphthalene alkyl-substituted. The latter are mainly represented by mono- and disubstituted derivatives. In the arena of concentration are located in the following series: dimethylnaphthalenes> methylnaphthalenes> naphthalenes> tetramethylbenzene.

Shatalov K.V.

Analysis of petroleum products as the object of metrological support

Keywords: analysis of petroleum products, metrological support, derivative and ordinal values, standard samples, test procedures, certification of test equipment, random value, normal law of distribution, intralaboratory quality control of tests, Shewhart charts.

Abstract. In the article the analysis process of petroleum products is described from the perspective of metrology, its differences from the quantitative chemical analysis and measurements of physical quantities. An important difference is that in quantitative chemical analysis the measurement result is expressed using the basic unit of SI - mole, and the petroleum product analysis result is expressed mostly either in derived units, or in ordinal values. However, the basic unit of SI mole and the vast majority of derivative and ordinal values used in describing the quality of petroleum products do not have the relevant standards, and their creation is impossible. Consequently, the classical scheme of measurement units transfer on the basis of the system of standards, both in case of quantitative chemical analysis and analysis of petroleum products, cannot be realized and the metrological support should be based on standard samples of composition and properties of substances (materials).

To date, there are 748 types of State standard reference samples in Russia, maintaining and transferring the units, that characterize the composition and properties of petroleum products. This gives the possibility of experimentally determining the systematic error component of petroleum product test methods and determining therefore the attributed characteristics of error in a full scale and created the basis to ensure metrological traceability of petroleum product analysis results.

The result of petroleum product analysis is a random value, so for the correct processing of the measurement results the confirmation is needed that the results obtained are normally distributed, since this assumption built metrological models of domestic and foreign technical standards. [e.g. ISO 4259].

In 2015 the author studied the normality of errors distribution of more than 1800 measurements for the quality evaluation of fuels and oils. Using multi-directional test (ISO 4259), x2-test, Geary's and D'Agostino's two-sided tests it has been proven that the distribution of measurement errors probability of physical and chemical properties and performance of petroleum products are different from normal. Consequently, the metrological models of ISO 4259 should be applied with great care to the results of conventional methods of petroleum product analysis and cannot be used for research and qualification test procedures.

Due to the fact, that the essence of petroleum product analysis predetermines, that the result of the analysis is a random value, and the dominant share of the total error is the random component, testing laboratories should have special methods of reducing errors, other than those used in the "classical" measurements of physical quantities. Since in the petroleum product analysis the bulk of the total measurement error is a random component of the error, which is due to the quality and stability of test equipment, and the quality of implementation of the test procedure in a single laboratory, main ways of reducing error of measurements the composition and properties of petroleum products are a confirmation of the test equipment's ability to reproduce test conditions with a given accuracy (certification of the test equipment according to GOST R 8.568) and experimental laboratory confirmation of the ability to correctly and efficiently apply the standardized test methods (intralaboratory quality control of analysis results according to RMG - 76). Intralaboratory control should include the procedures for confirming the possibility of a separate test laboratory to properly use a standardized test procedure, experimental determination of the quality parameters of analysis results, obtained using a specific standardized test procedure in a single laboratory, and control of analysis results stability by keeping the Shewhart control charts (cumulative sum). It should be considered, that the conducting the intralaboratory quality control of analysis results is expensive, and certainly requires a revision of the production load on the laboratory staff, as well as allocation the laboratory of additional financial and material resources.

FAE «The 25th State Research Institute of Chemmotology
of the Ministry of Defence of the Russian Federation», Moscow