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CALCULATION METHOD FOR DETERMINING THE YIELD OF VACUUM DISTILLATES AS A RESULT OF ATMOSPHERIC DISTILLATION

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Fractional composition is an important characteristic of the quality of oils and gas condensates. In determining the fractional composition of the selection exercise distillate fractions up to 200 °C at atmospheric pressure and the residue was distilled under vacuum at higher temperatures. This method is widely used in the study of crude oil and its fractions and residues, however, is complex analysis and time-consuming, especially at the stage of vacuum distillation.

It is interesting to determine the estimated fractional composition of crude oil in the temperature at which atmospheric distillation is impossible. Development of the design method for determining yield fractions, taken from the AVR–2 apparatus under reduced pressure, to simplify a preliminary assessment of oil and gas condensates.

When analyzing a sample containing data on the fractional composition of oils 128, it was found that the yield of individual fractions of IBP-X ° C (X is in the range 250 – 500 °C) can be calculated by multiple linear regression equation. The purpose of this study was to determine the regression coefficients, providing forecasting yield fractions with satisfactory accuracy. As an objective function was defined residual sum of squares of the deviations of the calculated values of output fractions IBP – X ° C from the reference. To find the minimum of the objective function and the regression coefficients used Newton's method.

Obviously, if the value of X lies in the temperature range 250 – 500 °C, to obtain data on total fractional composition of oil without the use of vacuum distillation is impossible. Therefore investigated the possibility of a regression equation to calculate the yield fractions of IBP ° C to X, where X is in the range 200 – 500 ° C. It was established the possibility of calculating the yield fractions of IBP-X ° C in the presence of crude oil distillation data only up to 200 ° C, on which were drawn up the equation of the regression model.

The validity of the equations for calculating the yield fractions of IBP-X °C was assessed by the coefficient of determination R2. The value of R2 was assessed using the F-distribution. The probability of validity of the equations is equal to 1, the coefficient of determination is in the range 0,75 – 0,99. In calculating fractions yield an absolute error of the proposed method on average is 1 – 2%, relative – 2 – 5%.

The proposed method of determining the fractional composition can be used for rapid analysis of crude oil in the consideration and evaluation of suspected variants of its processing.

Quite a number of studies devoted to identifying the possibility of calculating the potential content of light fractions of oil and gasoline and diesel fractions. As shown in the content in the oil fraction IBP – 350 ° C can be calculated from the equation of the linear dependence of the density of oil and its content of light fractions. Proposed dependence of the fraction IBP – 180 ° C, the IBP – 360 ° C, the density of oil, as well as the equation for calculating the content sulfur in fractions 180 – 360 and 240 –350 ° C by a well-known sulfur content in oil. In proposed a scheme for calculating the potential content of light fractions of crude oil at a known density based on the consistent calculation of molecular weight, enthalpy of vaporization, saturated vapor pressure. Obviously, all these methods allow us to calculate only

the content of the oil fractions and large balance. In order to determine with reasonable accuracy out of narrow fractions boiling in the temperature range 250 – 500 ° C, the data on the density of oil is not enough. It is shown that the normal distribution are subject to density fractions of the equilibrium formation of oil, ie, the calculation of the density of possible renewals oil fractions.

Normal distribution of the components boiling points should be subject to oil in the composition in which it was formed in the bed. This oil can be represented as a large number of components within each other in an unstable thermodynamic equilibrium. However, the oil flowing in the analysis represents only a fraction of the equilibrium of the original oil. Dissolved gases and light components in the process of production, transportation and storage are separated in the form of associated gas and natural losses. Oil, which contains all these components should have an equilibrium composition corresponding to normal distribution of fractions boiling point.

Fractional composition of petroleum and petroleum products can be accurately approximated as a Gaussian curve of normal distribution with parameters: a - the expectation of having the physical meaning of the average boiling point (approximately equal to the temperature of boiling 50%) and – standard deviation, which characterizes the smearing of the curve distillation. You can take = 0,95 (t70 – t30), where t70 and t30 – boiling temperature, respectively, 70 and 30% by volume. In the works of Eigenson shown that the normal distribution applies not only to characterize the fractional composition of oil, and sulfur, nitrogen, and aromatic hydrocarbons.

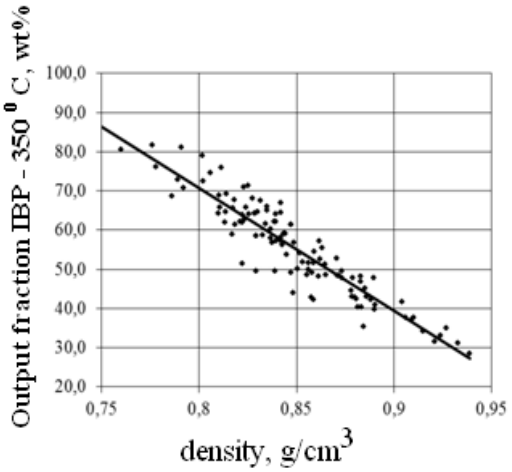

Figure 1. Dependence of the fraction of the density

In some cases, for rapid monitoring of the quality of crude oil or its preliminary assessment requires the definition of content in the light fractions of NK – 350 ºC. We propose a simplified method for calculating the oil content in the raw light fractions and the residue > 500 ° C at a certain density of raw materials. Experimental determination of the density of crude oil is not difficult and takes a little time. Thus, without distillation is possible to predict the content of light fractions in the raw materials and tar.

The regression equations for calculating the content of light fractions and tar were based on analysis of a sample containing data on the fractional composition and density of around 120 oils. The coefficient of determination of the equation to calculate the fraction of the content of IBP – 350 ° C is 0.89, the equation for calculating the content of the balance of > 500 ºC – 0,73. The figure shows the dependence of the fraction of NK – 350 ° C on the density of the oil and gas condensate feedstock.

The proposed method of determining the fractional composition can be used for rapid analysis of crude oil in the consideration and evaluation of suspected variants of its processing.

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