THE NON-LINEAR BEHAVIOUR OF OIL DISPERSE SYSTEMS AT THE TECHNOLOGICAL PROCESSES OF OIL INDUSTRY

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The processes of oil industry are connected with the phase transitions as a rule. The disperse state of oil systems is necessary state between the molecular and macroscopic levels. During the crystallisation or boiling of oil systems the disperse particles of colloid dispersity in range 1-1000 nm usually appear at first steps of phase transitions I type. At the next stage the important role in kinetics of increasing particle sizes belongs to the velocity of the temperature change, the time and temperature of prevented treatment. The oil dark systems are characterised by native dispersity due to presence of high molecular components such as wax, resins and asphaltenes. The structure of the particles in oil disperse systems (ODS), named complex structural units (CSU), independently from their aggregative state and nature consists of two main parts: internal part or nucleus with value of radius (r). The nucleus is surrounded by solvate shell of definite thickness (h). Much more the crookedness's degree of the surface of discontinuity influences on the properties of the small particles. Independently from chemical nature of CSU it is possible to say about two ultimate cases: $r \rightarrow r_{min}$, $h \rightarrow h_{max}$; $r \rightarrow r_{max}$; $h \rightarrow h_{min}$, which are connected with the particular state of ODS, named extremal. The middle proportion between r and h corresponds intermediate state of ODS.

The physicochemical properties (aggregative stability, viscosity, fractional composition, temperatures of freezing, boiling and flash, etc.) of ODS are in the dependence from the sizes of CSU and define non-linear behaviour of oil systems under external factors. Taking into account the chemical nature of CSU, caused distinction of adsorptive interaction with the different oil components, we can introduce such term as distribution hydrocarbons and another oil components between volume and surface phases during usual mixing of the different oil systems, particularly dark samples, and the realising of the technological processes in oil industry. It is established, that the mixing of different oils leads to the change of their group composition in comparison with the expected additive value.

The dynamics of the changes sizes of internal part and thickness of solvate shell for CSU in oil systems at influence (additives, physical fields) are researched by modern methods. The reaching of the optimal value for the oil technological processes is possible by the way of searching accordance between the degree of external factors in the region of extreme of non-linear effects in ODS. We have many experimental evidences of non-linear changing in disperse state of mixed distillate and oil residue in dependence at proportion of the oil initial components at mixing. These changes lead to non-linear behaviour of final ODS. The above-mentioned extremal changes of some properties for mixture of oil residue upon the concentration of additives are represented on Figures 1 and 2 (the degree of the dispersity is not shown on Figure 1). Due to the optimal proportion of mixing native residuum with extract the best possibilities are created for improving vacuum distillation of the mixed ODS with concentration extract 3-4% (Fig. 1) and increasing of the output of the distillate fractions above 8% in comparison with additive value. It is investigated, that the best mixture for coking process corresponds to the proportion resine of pyrolysis to native residuum as 1:1 (Fig. 2).

One of the main factors, influenced at disperse state of oil systems, is the concentration change of CSU and chemical composition of the dispersive media. The usual practice of the processes in oil industry is connected with the mixing different oil systems in indefinite proportion, but we consider that this proportion is very important for achieving the best technological parameters. The mixed ODS are often used for common purposes: for production of some specific oil

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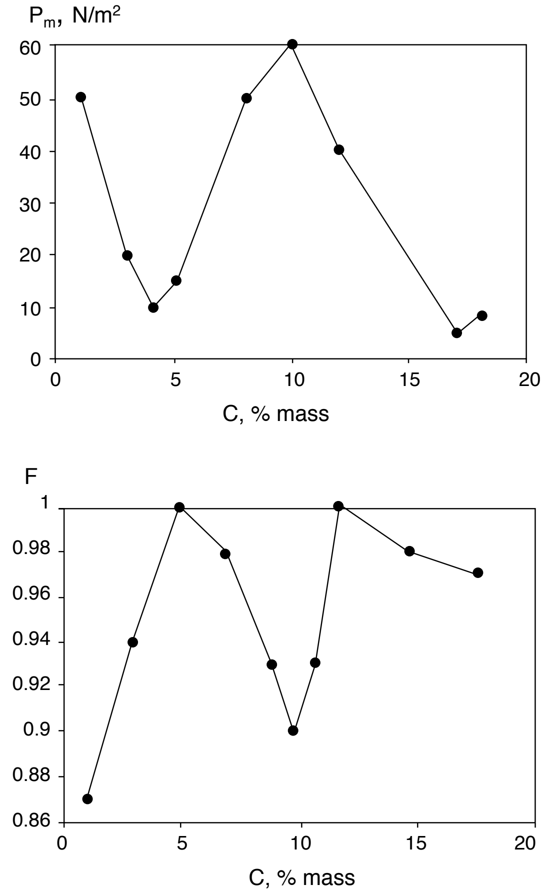

Figure 1

The dependence of limit shear stress (Pm) and stability factor (F) of asphaltene residue upon the concentration of III fraction oil refinery extract

products (ship fuels, prophylactic substances with specific properties against freezing materials to the surfaces, etc.), based at mixing oil residue of the different origin and oil fractions of the different fraction composition, taken in the definite proportion; for the oil transport, connected as usual with nonregular proportion of the transported oils, but only in special cases for transport of bitumen sands [2]; for refinery processes, using them as the raw material. The possibility of influence at temperature of freezing mixed ODS is used for production prophylactic substances. The dependence of the temperature of freezing upon the set of factors, regulating the process of crystallisation, for mixed ODS is represented on Figure 3. During the crystallisation the velocity of particle growth from solid hydrocarbons is regulated by controlled temperature decrease, that leads to full adsorption more high dispersed of resins and asphaltenes on their surface and strong decreasing of the temperature of freezing for ODS as whole. This fact allows to prepare the mixtures, including bigger amount of residuum and satisfying the requirements for industrial uses on temperature of freezing.

At many cases the extremal values of macroscopic technological parameters correlate with extremal meanings of the unit sizes. Another examples of extremal behaviour of ODS and possibility of their successful using in the technological processes of oil industry are represented too. Such dependencies or extragramms allow to choose the optimal conditions for realising of the physicochemical technology processes of the production, transportation refinery and using of the oil systems [2].

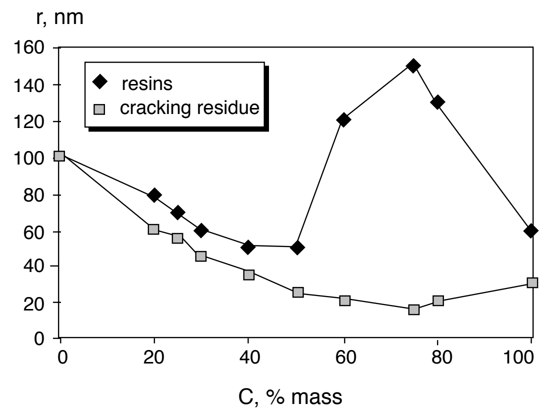

Figure 2

The dependence of dispersity of model systems, prepared from mixed ODS on the base native residue.

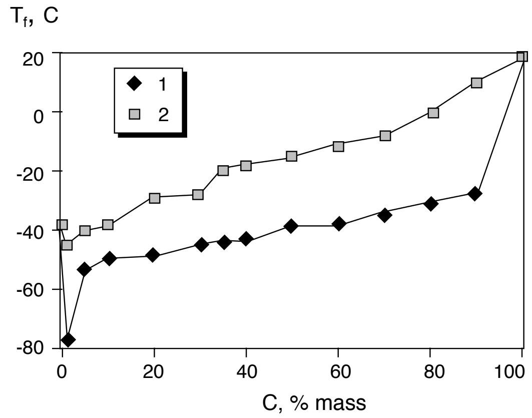

Figure 3

The depression of freezing temperature for gasoline fractions upon concentration of native residue under controlled (1) and non controlled (2) set of factors of crystallisation.

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1 *Patent 4728412* (1988), USA.

2 Syunyaev Z.I., R.Z. Safieva and R.Z. Syunyaev (1990), Oil disperse systems. *Chimiya,* Moscow, 224 p.

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