Chemistry and Technology of Fuels and Oils, Vol. 41, No.3, 2005

COLLOIDAL STRUCTURES OF PETROLEUM RESIDUES LONG-LIVED IN METASTABLE STATES

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UDC 665.7.033.28

Experimental studies showed that colloidal subsystems of resins and asphaltenes in metastable state are most probably the basic carriers of the "thermal memory" effect of petroleum fluids. The structural transformations of the colloidal system of asphaltenes revealed probably are universal in character and are characteristic of petroleum residues of different geographic origin. It was found that not only thermodynamic but also kinetic control should be conducted in processes of transformation of the disperse phase of petroleum residues.

Utilization of petroleum residues enriched with resins and asphaltenes (RA) is one of the basic standbys for increasing the profitability of oil refining [1-3]. The resources of these residues increase with an increase in the volumes of heavy, resinous, and medium-sulfur crudes refined. A very pronounced colloidal structure caused by attempted self-organization of the molecules of RA into supramolecular aggregates of different sizes is characteristic of high-molecular-weight petroleum residues.

In refining crude oil, it is important to ensure the optimum properties of the liquid residues over the entire manufacturing chain. A detailed analysis of the state of their colloidal structures when the process parameters, the temperature in particular, change is necessary.

Comparatively "mild" heat treatment, even in the absence of chemical process, can significantly alter the structural and mechanical properties of petroleum disperse systems [3]. In particular, we previously [4-9] showed that in most petroleum products, the practical value of thermal methods of treatment is due to the presence of "memory effects" with respect to the thermal effect to a significant degree.

Liquids with a developed colloidal structure can retain properties acquired as a result of a previous thermal effect for a relatively long time and exhibit them during subsequent use. In other words, a petroleum colloidal system with a "memory" and a defined set of external parameters can not only be in a thermodynamically equilibrium state but also in some relatively long-lived metastable state whose characteristics are determined by the conditions of the preceding effect.

Our experimental studies showed that a colloidal subsystem of RA in metastable states are most probably the basic carrier of the "thermal memory" effect of petroleum fluids. We found that the equilibrium phase structures

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 0009-3092/05/4103–0230