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Influence of chemical composition of water-in-oil emulsion interphase layer of resinous oil to the deposits formation

© **Lyudmila V. Ivanova**,*+ **Veronika K. Miller**, **Vladimir N. Koshelev**, **Vladimir D. Ryabov**, and **Nina A. Sokova**
Department of Organic Chemistry & Petroleum Chemistry. Gubkin Russian State University of Oil and Gas (National Research University). Leninsky pr., 65/1. Moscow, 119991. Russia. Phone: +7 (499) 507-84-11. E-mail: ivanova.l@gubkin.ru

*Supervising author; +Corresponding author

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Abstract

Formation of asphalt-resin-wax deposits on the surface of oilfield equipment is one of the major factors complicating oil production, transportation and storage. Amount of deposits on cold surface of the equipment increases with the presence of formation water in the feed stream. In this study on the example of two crude oils it was shown that, an increase in the amount of deposits on the cold surface is associated with the stability of the water-oil emulsions that are formed, which is determined by the presence of natural surfactants in the oil, primarily asphaltenes. The quantity and group chemical composition of the organic components included in the stabilization layer of water-oil emulsions were determined. It was established that with the increase in water content to 60%, the quantity of natural stabilizers involved in the interphase layer increases and their chemical composition changes. The predominant components are asphaltenes. The paper presents the results of physicochemical and structural parameters determination of the average molecules of asphaltenes of the investigated oils. Differences in the molecular weight of the average molecules of asphaltenes of these oils, in the number of individual blocks in the composition of asphaltene molecules, in the distribution of carbon atoms over individual structural fragments, and in the content of heteroatoms were established. It was shown, that the oil forming more stable water-oil emulsions contains asphaltenes, the average molecule of which characterized by a higher proportion of carbon atoms in the ring structures with a significant proportion of aromatic rings. It was suggested that heteroatoms in the average molecule of asphaltenes in this oil are in the composition of functional groups that provide higher surface-active properties to the molecules of asphaltenes. Knowledge of the qualitative and quantitative composition of water-oil emulsion stabilizers can serve as a basis for making recommendations on the choice of the demulsification method.

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