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RHEOLOGICAL CHARACTERIZATION OF DIFFERENT ASPHALTS, AND THEIR MALTENES.

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Asphalts with different composition and maltenes obtained from such asphalts were characterized through oscillatory shear flow, to investigate the effect of the composition of asphalt on its rheological behavior. Asphalt is considered a mixture of hydrocarbon species with minor amounts of functional groups such as oxygen, nitrogen, sulfur, vanadium, and nickel; and its composition depends on the source and extraction process. The thermo-mechanical properties of asphalt are directly related to its composition and undergoing conditions. According to their n-heptane solubility, the main components of asphalt are classified as asphaltene (non-soluble) and maltene (soluble). In this work, three asphalts (A1, A2 and A3) having different asphaltenes/maltenes weight ratios (13/87, 17/83, and 19/81, respectively) and their corresponding maltenes (M1, M2, and M3) were tested with a rheometer (TA-Instruments AR-G2) equipped with parallel plate geometry (25 mm diameter, and 0.5 mm gap). All samples were yielded to oscillatory shear flow at frequencies ranging from 0.1 to 500 rad/s at various temperatures (40-90 °C), under linear viscoelastic conditions ($\delta \approx 15\%$). Storage G' and loss G'' moduli as a function of reduced frequency ω were used to construct master curves of the complex modulus $G^*(\omega)$ and the phase angle $\delta(\omega)$, from which the rheological behavior of the asphalts and maltenes are explained. Results indicate that all asphalts exhibited practically the same $G^*(\omega)$ curve; however, when they are compared in terms of $\delta(\omega)$, A3 is more elastic than A1 and A2, particularly for $\omega > 10^{-2}$ rad/s. In contrast, the $G^*(\omega)$ and $\delta(\omega)$ curves of M3 are respectively on top and below of those of M1 and M2, which indicates that M3 is more elastic than M1 and M2.