Raman spectroscopy applied to the study of phase transitions in lyotropic liquid crystal

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Liquid crystals have attracted great interest from the scientific community, not only for their technological applications, but mainly for their unusual physical properties, which are due to the conformations and orientations exhibited in the different phases. Lyotropic liquid crystals are formed by amphiphilic surfactant molecules with polar characteristics, a long hydrocarbon chain and a solvent (usually water). Above the critical concentration, aggregates of the molecules are formed, denominate micelles, which may assume different shapes and sizes resulting in several mesophases. These one can be obtained by relative concentration change of components and temperature variation [1]. This work aims to identify the phase transition temperatures of a lyotropic liquid crystal by Raman spectroscopy. This technique allows to obtain informations about the chemical groups, molecular structure and the interaction with neighborhood, thus enabling the study of the micelles in the different mesophases. The liquid crystal was synthesized in the proportion of 25.8\% Potassium Laurate (KL), 6.24\% Decanol (DeOH) and 67.96\% heavy water (D\textsubscript{2}O) [2]. The phase transition temperatures were determined by the polarized light optic microscope technique. The Raman experiments were performed as function of temperature, from 8 up to 50\textdegree C, and the spectra were obtained by micro-Raman spectrometer, with an excitation at 532nm, between 80 to 4000 cm\textsuperscript{-1} with spectral resolution of 4 cm\textsuperscript{-1}. The main Raman bands of the liquid crystal were identified, and more significant changes were detected in relation to the phase transition in the bands centered at K\textsuperscript{+} - O\textsuperscript{-} (468 cm\textsuperscript{-1}), CH\textsubscript{3} bending ( 890 cm\textsuperscript{-1}), CH\textsubscript{3} stretching ( 2851 cm\textsuperscript{-1}) and CH\textsubscript{3} stretching ( 2884 cm\textsuperscript{-1}) [3,4]. From the thermal dependence of position and intensity of the bands were obtained the phase transition temperatures, which are in agreement with the results from optical polarized light microscopy technique.

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References:
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