Spectroscopic study of acid – base ionization and aggregation processes of fluorescent dyes in a reversed micellar solution of cetyltrimethylammonium chloride in 1-hexanol-cyclohexane.

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The photophysical properties of rhodamine B (RB) and fluorescein (Fl) were studied in reversed micellar solutions of cetyltrimethylammonium chloride. The distribution of the RB dye species RBH^+, $RB^{\pm}$ and RB^{o} in the micellar system was studied using absorption and emission spectra. The results obtained that the increasing of pH in 1-hexanol-cyclohexane/ CTAC/H_2O system (at molar ratio of water to surfactant R_w =[H_2O]/[CTAC] = 4 and mole fraction of 1-hexanol =0.045) causes a decrease in emission intensity of RB suddenly at around pH=3.3 but the increasing of pH in aqueous solution causes increasing of emission intensity of RB suddenly at around pH=3.3 as shown in Fig. (1). Therefore, the variations produced by the increasing of pH on the absorption and emission spectrum of RB are attributed to the change of its cationic forms, RBH^+ Cl^- in W.P., to the neutral one, mainly lactone form RB° in the reverse micellar system, because of low polarity in the bulk, and to the change of RBH^+ to $RB^{\pm}$ in aqueous solution. The pK_a of the equilibrium between the cationic and neutral form was evaluated from a previous results. RB and Fl were used as a probe for determination of the critical micelle concentration (CMC). With an increase in the CTAC concentration at a fixed R_w, the absorbance and emission intensity of RB are increasing suddenly at CMC. Furthermore, the standard free energy of micellization (ΔG°_m), calculated from the CMC data, indicates that the micellization is promoted by an increase in the water ratio R_w and a decrease in the 1-hexanol fraction in the reversed micellar bulk solvent.

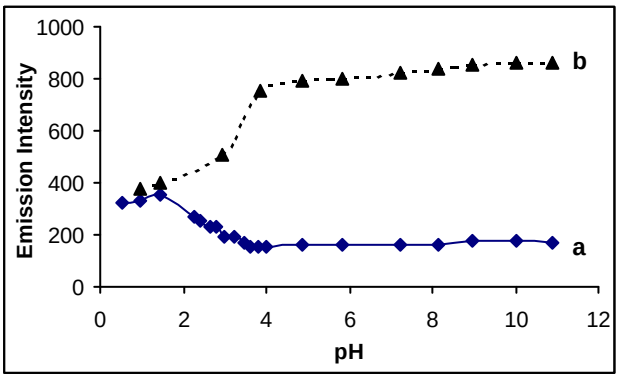

Fig. (1): Variation of emission intensity of RB with the pH (a) in the reversed micellar medium, (b) in the aqueous solution.