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Excited State Bonding Effect on Fluorescence of Coumarin-1

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Abstract: ***Coumarin-1 (C1) chromophore is an ideal system for exploring the possibility of having a complete understanding of the effect of excited state hydrogen bond on the photophysics and photo-chemistry of hydrogen-bonded donor-acceptor molecular system. The time resolved fluorescence spectra of coumarin-1 has been used to study the effect of excited-state hydrogen bond on the fluoresences of C1 chromophore. To understand the excited state bonding effect on the fluoresences of coumarin-1, the life time spectra has been recorded for coumarin 1 without and with n-butyl amine. The results have been discussed in detail.***

Keywords: Coumarin-1, NBA, Lifetime, measurements

1. Introduction

Organic dyes are really promising alternative to the nobel ruthenium complexes sensitizers. In deed, they exhibit many advantages such as easy tailoring of the structure and properties, higher molar extinction coefficients and less complicated synthesis and purification step with respect to the metal – based ones. In addition, concerning cost and environment issues, they are superior to metal complexes since they are cheeper and without problem of limited source.

Several groups reported solar cell performance based on organic dyes, such as Lyamines (1), merocyamines (2), hemi cyamines (3), perylernes (4), xanthesnes (5), porphyrins (6), phthalocyamines (7), polyenes (8), polythiophenes (9), coumarins (10), etc., Among the organic dyestuff tested so far, coumarin dye may be the most promising sensitizer.

2. Materials and Methods

Coumarin-1and n-butyl amine were purchased from Sigma Aldrich Company, Bangalore, and were used without further purification.

UV/Vis absorption spectra were taken using 1650 PC SHIMADZU UV-Visible SPECTROMETER Fluorescence measurements were made by CARRY ECLIPSE VARIAN FLUORESCENCE SPECTRO PHOTOMETER.

3. Results and Discussion

Pico and nano second resolved photo are important spectroscopic techniques for characterizing quenching processes that are associated with the generation and the fate of photo excited state. The fine resolved spectra reveal as to how the acceptor is distributed in space around the donors (11). In addition to this, they give information on the quenching process, specifying whether it is due to diffusion or complex formation. The lifetime spectra of Cou-1 without and with n-butyl amine are shown in Fig.1. and the compiled data have been presented in Table 1. The occurrence of the shorter fluorescence decay times may be due to the distance between the pair (12).

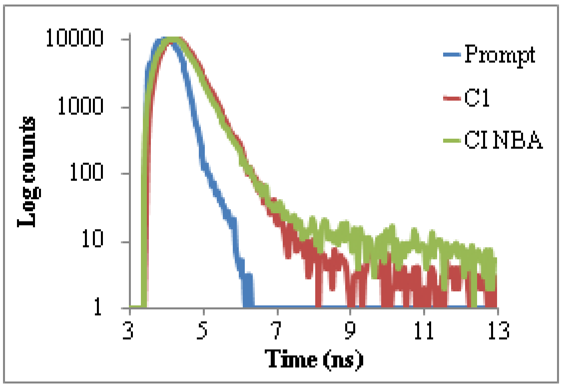

Figure 1: Fluorescence decay curves of Coumarin1 with and without NBA

The increase in lifetime indicates that the complexes may form in the solution such change in the lifetime occurs because quenching is an additional rate process that depopulates the excited state.

In the present investigation the lifetime of Cou-1 in both conditions [(i) Cou-1 & (ii) Cou-1 + NBA], hence the merging of the kinetic traces is not observed (The plots not look like a single decay curve). This shows that the quenching of Cou-1 might be dynamic in nature.

4. Conclusion

Time-resolved fluorescence technique has been studied to know the bimolecular reaction of Cou-1 with NBA. Excited state bonding effect on fluorescence of coumarin-1 has been discussed clearly.

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