



BIMOLECULAR ELECTRON TRANSFER REACTIONS IN COUMARIN – AMINE SYSTEMS

S.Bakkialakshmi¹ | M. Shakthi² | K.B.Renuga Devi³

¹ Department of Physics, Annamalai University, Annamalainagar, Tamilnadu, India-608 002.

² Christ Institute of Technology, Pondicherry.

³ Rajiv Gandhi College of Engineering and Technology, Pondicherry.

ABSTRACT

Electron transfer (ET) reactions between excited coumarin dyes and an aliphatic amine, Triethylamine (TEA) donor have been investigated using time-resolved (TR) fluorescence quenching measurements. Time-resolved measurements give the quenching constant (K_q), suggesting dynamic nature of interaction in this system. Fluorescence decay curves have recorded for coumarin without and with Triethyl amine (TEA) and average lifetime values have been calculated and reported.

Keywords: Electron transfer, coumarin, Triethylamine, Fluorescence, Life time.

1. Introduction

Electron transfer (ET) is one of the interesting subjects that have experienced extensive experimental and theoretical research for last few decades (1-8) studies on ET reactions have immense importance from the view point of both academic and applied implications, as these reactions are ubiquitous in chemistry and biology. Understanding various factors that control ET reaction is the main impetus in most of the research on ET processes. Photoinduced ET reaction, where either the acceptor or the donor is photoexcited to trigger the reaction, is the most suitable experimental scheme, and has been used quite extensively to investigate various factors that control the ET mechanisms and dynamic in various ET systems (1-8). Coumarin dyes are reported to be good electron acceptors in their excited (1) states (9-11).

2. Materials and Methods

Coumarin and TEA 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 (12). 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 Coumarin without and with TEA 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 (13).

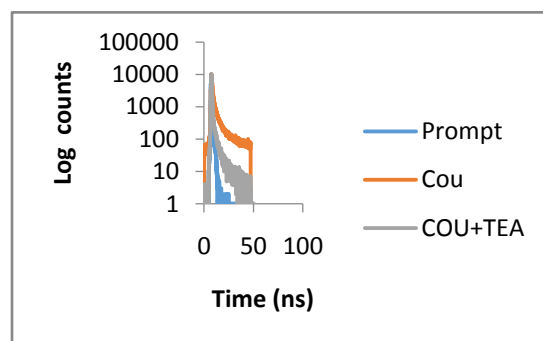


Fig.1. Fluorescence decay curves of Coumarin with and without TEA

Table 1: Fluorescence life time and amplitudes of Coumarin without and with different concentrations of TEA

Concentration of TEA (M)	Lifetime (ns)			Average life time 10 ⁻⁹ sec	Relative amplitude			χ^2	S.D 10 ⁻¹¹ sec		
	τ_1	τ_2	τ_3		a_1	a_2	a_3		τ_1	τ_2	τ_3
COU	1.04	5.58	0.042	1.75	27.73	25.86	46.41	1.177	2.32X10 ⁻⁴	3.49X10 ⁻⁵	7.95X10 ⁻³

COU+TE A	0 · 9 5 8	0. 21 7	6 · 9 8 9	0.74	10. 94	82. 41	6. 64	1. 3 4 0	6. 6 X 1 0 ⁻¹¹	0. 49 2 X 10 ⁻¹¹	1 4. 9 X 1 0 ⁻¹¹
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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 Coumarin in both conditions [(i) Coumarin & (ii) Coumarin + TEA], 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.

Conclusion

The fluorescence decay, however always follow a single exponential function irrespective of the amine concentrations used. The average lifetime values for coumarin-TEA systems are listed in Table. The results indicate that the interactions in the present coumarin-triethyl amine systems are mainly dynamic in nature.

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