

# International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 6, June 2015

## Effect of Aliphatic Amines on Coumarin

S. Bakkialakshmi\*, M.Shakthi<sup>a</sup>

Department of Physics, Annamalai University, Annamalai Nagar, Tamilnadu, India\*

Department of Physics, Dr.S.J.S.PM CET, Puducherry, India<sup>a</sup>

\*Corresponding Author

**ABSTRACT:** Effect of aliphatic amines and their concentration on Fluorescence intensity of Coumarin (Cu) have been investigated. The variation of fluorescence intensity could be used for determination of aliphatic amines in quenching region. Stern-Volmer plot has been drawn.

**KEYWORDS:** Fluorescence, Coumarin, n-Butyl amine, Triethyl amine.

### I. INTRODUCTION

Coumarines are compounds originating from the nature that can be used in industry, they are broadly used in cosmetics, in food and drinks as a flavouring. They occur in ethereal oils of many plants, e.g. cinnamon (*Cinnamomum zeylanicum*). Coumarins own their class name to coumarou, the vernacular name of the tonka bean (*Dipteryx odorata*), from which coumarin itself, was isolated in 1820 [1]. Coumarin derivatives are heterocyclic compounds containing oxygen atom and carbonyl group. Most of them have a very efficient fluorescing ability. The photophysical properties of these compounds depend on their nature and position of a substituent group in the parent molecule and also change due to a change in the surrounding media. Coumarin compounds are widely investigated due to their importance as laser dyes, as non-linear optical chromophores and as excellent probe to study of solvation dynamics in the homogeneous solutions as well as organized media [2–8]. The numerous coumarin heterodimers were synthesized and explored the possibility of their applications as laser dyes [9] as organic scintillators [10] and as triplet sensitizers [11,12].

In a series of works effect of solvents, substituents and temperature on the various photophysical properties of coumarin compounds were reported [13–16]. The biological activity of coumarin and more complex related derivatives appears to be based on the coumarin nucleus [17–19]. Biological effects observed include anti-bacterial [20], anti-thrombotic, vasodilatory [21] and anti-HIV agent [22].

### II. MATERIALS AND METHODS

Coumarin was purchased from Sigma Aldrich Company, Bangalore and was used without further purification. n-Butyl amine and triethyl amine were purchased from S.d fine chemicals (India). Fluorescence spectra were taken using **CARRY ECLIPSE VARIAN FLUORESCENCE SPECTROPHOTOMETER**.

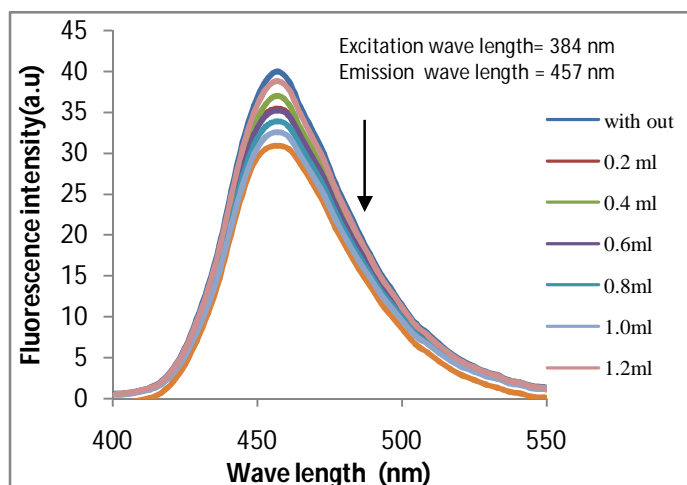
### III. RESULTS AND DISCUSSION

Figs 1 & 2 depict the fluorescence spectrum of Coumarin without and with different concentrations of two aliphatic amines NBA and TEA respectively. From the figures it can be noted that the fluorescence intensity of coumarin decreases regularly with the addition of amines.

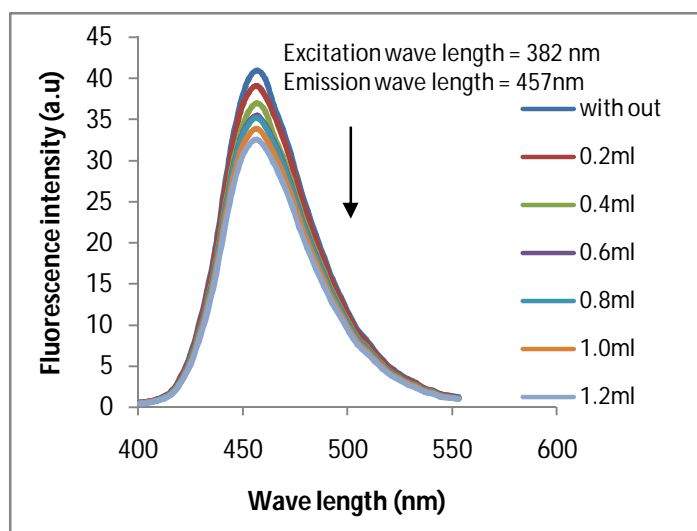
## International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 6, June 2015



**Fig.1** Fluorescence spectra of Coumarin in different concentration of NBA ( $\text{mol dm}^{-1}$ )  
(1) 0, (2) 0.2, (3) 0.4, (4) 0.6, (5) 0.8, (6) 1.0, (7) 1.2



**Fig.2** Fluorescence spectra of Coumarin in different concentration of TEA ( $\text{mol dm}^{-1}$ )  
(1) 0, (2) 0.2, (3) 0.4, (4) 0.6, (5) 0.8, (6) 1.0, (7) 1.2

In the presence of a quencher (amines), the fluorescence intensity is reduced from  $I_0$  to  $I_Q$ . The ratio ( $I_0/I_Q$ ) is directly proportional to the quencher concentration,  $[Q]$ , and is expressed by Stern-Volmer equation as the following:

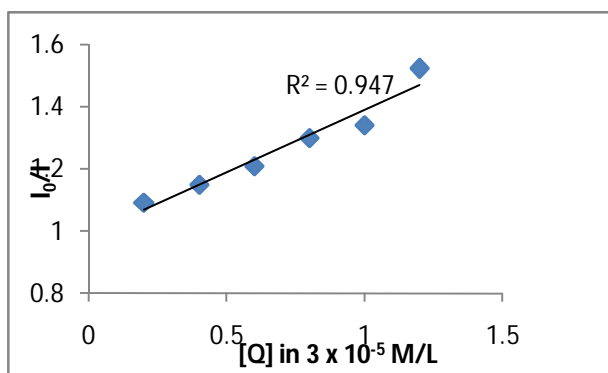
$$\frac{I_0}{I_Q} = 1 + K_Q[Q] \dots \dots \dots (1)$$

where  $K_Q$  is the Stern-Volmer quenching constant. According to Eq. (1), a plot of ( $I_0/I_Q$ ) versus  $[Q]$  shows a linear graph with an intercept of 1 and a slope of  $K_Q$ . A typical plot of ( $I_0/I_Q$ ) versus dibutyl amine concentration is shown in Figs. 3 & 4. There are many different mechanisms of quenching, such as protonation of excited states and collision. Protonation of many aromatic excited molecules are quenched by protic solvent such as alcohols, water and acids.

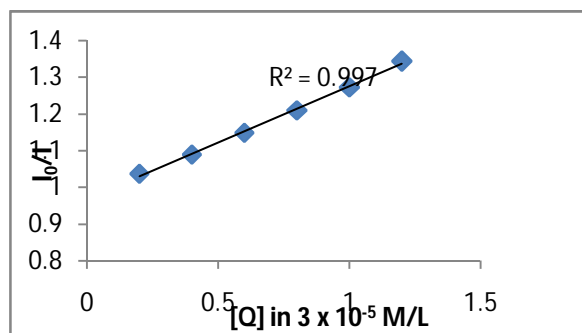
## International Journal of Innovative Research in Science, Engineering and Technology

(An ISO 3297: 2007 Certified Organization)

Vol. 4, Issue 6, June 2015



**Fig. 3 Stern-Volmer plot of Coumarin with NBA**



**Fig. 4 Stern-Volmer plot of Coumarin with TEA**

Table 1 demonstrates the calculated excited state formation constant  $K_e$  and the energy change ( $\Delta G_e$ ).

**Table 1: Formation constant ( $K_e$ ) and free energy ( $\Delta G_e$ ) of Coumarin with NBA, TEA**

Quenchers	K <sub>e</sub> (M <sup>-1</sup> )	ΔG <sub>e</sub> (kJ mol <sup>-1</sup> )
NBA	0.0022	15.414
TEA	0.0003	25.010

### III. CONCLUSION

It can be concluded that both of the amines n-Butyl amine and Triethyl amine were good quenchers of Coumarin. The dye, Coumarin with inherent high fluorescence intensity is a suitable reagent for determination of different amines.

### REFERENCES

1. J.I. Kvoschwitz, Kirk-Othmer Encyclopedia of Chemical Technology, 3<sup>rd</sup> ed., Wiley, New York, 1978, pp. 196–206.
2. F.P. Schafer (Ed.), Dye-Lasers, Topics in Applied Physics, 2nd ed., Springer-Verlag, New York, 1973.
3. C.R. Moylan, J. Phys. Chem. 98 (1994) 13513–13516.
4. N. Sarkar, A. Datta, S. Das, K. Bhattacharyya, J. Phys. Chem. 100 (1996) 15483–15486.
5. G. Jones II, J.A.C. Jimenez, J. Photochem. Photobiol. B 65 (2001) 5–12.
6. B. Bangar Raju, S.M.B. Costa, J. Phys. Chem. B 103 (1999) 4309–4317.
7. M. Kaholek, P. Hrdlovic, J. Photochem. Photobiol. A 108 (1997) 283–288.
8. S. Kumar, R. Giri, M.K. Machwe, Ind. J. Pure Appl. Phys. 36 (1998) 622–626.
9. M.R. Padhye, T.S. Varadarajan, A. Deshpande, Spectrosc. Lett. 15 (1982) 597–608.
10. J. Bourson, J. Mugnier, B. Valeur, Chem. Phys. Lett. 92 (1982) 430–432.

## International Journal of Innovative Research in Science, Engineering and Technology

*(An ISO 3297: 2007 Certified Organization)*

**Vol. 4, Issue 6, June 2015**

11. P. Specht, P.A. Martic, S. Farid, Tetrahedron 38 (1982) 1203–1211.
12. T. Urano, H. Nagasaka, M. Tsuchiyama, S. Shimizu, K. Kawazoe, M. Shimizu, T. Yamaoka, Bull. Chem. Soc. Jpn. 68 (1995) 1661–1668.
13. S. Kumar, R. Giri, S.C. Mishra, M.K. Machwe, Spectrochim. Acta A 51 (1995) 1459–1467.
14. S. Kumar, R. Giri, S.C. Mishra, M.K. Machwe, Ind. J. Pure Appl. Phys. 33 (8) (1995) 431–435.
15. R. Giri, M.M. Bajaj, Curr. Sci. 62 (1992) 522–525.
16. R. Giri, Spectrochim. Acta A 48 (1992) 843–848.
17. H. Kolodziej, O. Kayser, H.J. Woerdenbag, W. Van Ulden, N. Pras, Z. Naturforschung. C: Biosci. 52 (1997) 240–244.
18. F.A. Jimenez-Orozco, J.A. Molina-Guarneros, N. Mendoza-Patino, F. Leon-Cedeno, B. Flores-Perez, E. Santos-Santos, J.J. Mandoki, Melanoma Res. 9 (1999) 243–247.
19. G.J. Finn, B. Creaven, D. Egan, Melanoma Res. 11 (2001) 461–467.
20. P. Laurin, M. Klich, C. Dupis-Hamelin, P. Mauvais, P. Lassaigue, A. Bonnefoy, B. Musicki, Bioorg. Med. Chem. Lett. 9 (1999) 2079–2084.
21. J.R.S. Hoult, M. Paya, Gen. Pharmacol. 27 (1996) 713–722.
22. C. Spino, M. Dodier, S. Sotheeswaran, Bioorg. Med. Chem. Lett. 8 (1998) 3475–3478.