Asian Journal of Chemistry Vol. 17, No. 2 (2005), 1352–1354

NOTE

Changes in Fluorescent Intensity in Aniline with Benzoic Acid and Carbon Tetrachloride

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The quenching of fluorescence of aniline by benzoic acid and carbon tetrachloride has been studied in benzene solvent at room temperature to understand the quenching mechanism. The Stern-Volmer plot has been found to be linear for both the quenchers. Regression coefficient (r), the Stern-Volmer constant (K_{sv}), Stoke's shift, ionization potential, electron affinity and the solvent parameter have also been calculated. The results suggest that the quenching here is not static but dynamic in nature.

Key Words: Fluorescence quenching, Benzoic acid, Carbon tetrachloride, Aniline, Stern-Volmer plot.

Any reduction in the intensity of fluorescence is called fluorescence quenching. Quenching can also be caused by non-radiation loss of energy from the excited molecules. In solutions the major energy deactivation process occurs by collisional energy transfer through excited state complex. Research in this area has been stimulated by Mulliken's theory of charge transfer interaction. Dipolar nature of molecular complexes formed in the excited state was given by Beens *et al.*[1] Aditya *et al.*[2] studied the charge transfer complexes of some substituted benzenes. Fluorescence quenching of aniline and *p*-touidine quenching by picric acid was studied earlier[3].

AR grade sample benzoic acid and carbon tetrachloride were purified and used. m.p.s are 121 and 76–77°C respectively. The aromatic amine aniline and solvent benzene were purified by standard methods. The fluorescence spectra of aniline was measured with JASCO model FP-550 spectrofluorometer operating with 150W xenon lamp as light source. The absorption spectrum of the amine was measured using a JASCO-UV/DEC-650 spectrophotometer.

The reduction in intensity of aniline due to the addition of benzoic acid and carbon tetrachloride in various concentrations is shown in Figs. 1 and 2.

Stern-Volmer plot has been drawn (Fig. 3) using the calculated values of (I_0/I) and the quencher concentration. The Stern Volmer constant K_{sv} and the regression coefficient (r) have been calculated. It could be noted that these plots are linear and this shows that the quenching is bimolecular.

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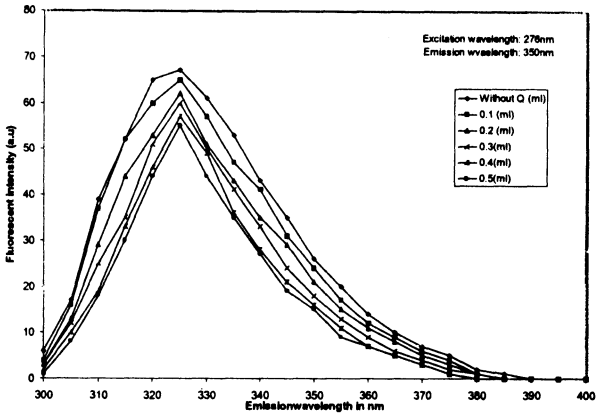


Fig. 1. Fluorescence spectrum of aniline in benzene with the quencher benzoic acid

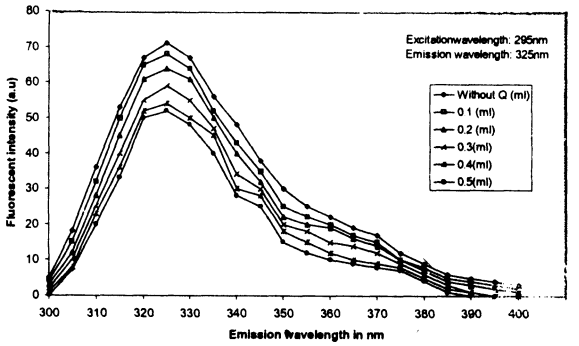
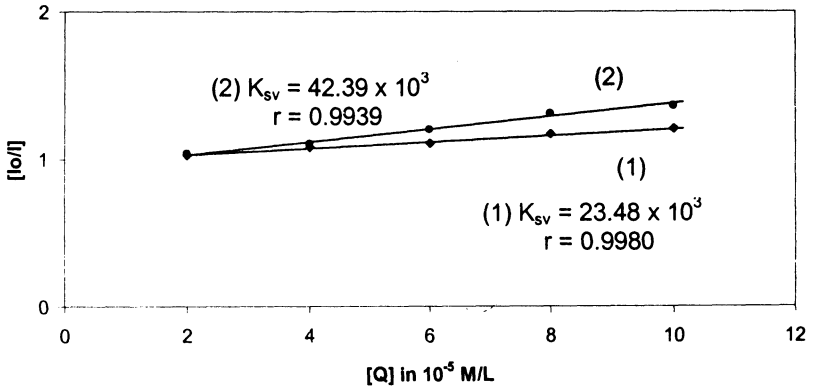


Fig. 2. Fluorescence spectrum of aniline in benzene with the quencher carbon tetrachloride



1. Aniline-Benzoic acid-Benzene; 2. Aniline-Carbon tetrachloride-Benzene

Fig. 3. Fluorescent intensity ratios of aniline with benzoic acid and carbon tetrachloride at different concentrations in benzene

Absorption spectrum of aniline in benzene is not affected by the addition of quencher in the concentration range used in fluorescence quenching experiment. This reveals that there is no complex formation or association of aniline with the quenchers in the ground state and the quenching occurs only due to the interaction of exerted aniline and quencher. Hence, it is not static but dynamic in nature.

TABLE-1
FLUORESCENT INTENSITY RATIOS OF ANILINE AT DIFFERENT CONCENTRATION IN BENZENE

Solvent	[Q] in 10^{-5} M/L	$[I_0/I]$	
		Benzoic acid	Carbon tetrachloride
Benzene	2	1.03	1.04
	4	1.08	1.10
	6	1.11	1.20
	8	1.17	1.31
	10	1.21	1.36

Stokes shift, ionization potential, electron affinity and the solvent parameter are calculated and are presented in Table-2.

TABLE-2
ENERGY, IONIZATION POTENTIAL, ELECTRON AFFINITY, STOKE'S SHIFT AND SOLVENT PARAMETER VALUES OF THE COMPLEXES IN BENZENE

Solvent	Fluro-phore	Quenchers	λ_{CT} [ev]	$h\nu_{CT}$ [ev]	I_D [ev]	E_A [ev]	λ_{abs} [nm]	λ_{flu} [nm]	Stoke's shift $\Delta\nu$ [cm^{-1}]	Solvent parameters (kcal/mol)(z)
Benzene	Aniline	Benzoic acid	591	2.1021	7.8776	2.0552	282	325	4691	48.3756
		Carbon tetrachloride	595	2.0880	7.8600	2.0696	295	325	3129	48.0504

Benzoic acid and carbon tetrachloride act as pollutants for aniline and it could be noted that among the two pollutants carbon tetrachloride pollutes aniline more than benzoic acid.

Conclusion

Changes in fluorescent intensity in aniline with benzoic acid and carbon tetrachloride were successfully observed. The regression analysis of the curves gives a very good correlation. We can conclude that carbon tetrachloride pollutes aniline more than benzoic acid.

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(*Received*: 16 September 2004; *Accepted*: 19 January 2005) AJC-4104