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NOTE

Study of Intensity Variation of Naphthalene with Acetophenone and Iodine

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The fluorescence of naphthalene at room temperature is polluted by the addition of acetophenone and iodine. The Stern-Volmer constants and the regression coefficient are reported. Ionization potential, electron affinity and the solvent parameter are calculated. It was found that among the two pollutants, iodine pollutes naphthalene more than acetophonone.

Key Words: Fluorescence quenching, naphthalene, Acetophenone, Iodine, Stern-Volmer plot, Stoke's shift, Ionization potential, Electron affinity, Solvent parameter.

Electronically excited molecules can be deactivated in bimolecular collisions with added quenching molecules and the quenching effect on the singlet and triplet states of aromatic compounds has been extensively studied. The quenching action of charge transfer complexes has been explained in various ways[1–4]. Dipolar nature of molecular complexes has been described by Beens *et al.*[5] Recently, the quenching of aromatic amines at room temperature have been reported in the literature[6–8].

AR grade sample acetophenone and iodine were purified and used. The aromatic hydrocarbon naphthalene and solvent chloroform were purified by standard methods.

The fluorescence spectra of fluorophore was measured with Jasco model FP-550 spectrofluorometer operating with 150W xenon lamp as light source. The absorption spectra of the donor were measured using a Jasco-Uvidec-650 spectrophotometer.

The fluorescence degradation spectrum of naphthalene in chloroform without acetophenone and iodine and with various concentrations of acetophenone and iodine have been shown in Figs. 1 and 2.

$[I_0/I]$ values for different concentrations of the pollutants (acetophenone and iodine) were calculated and are given in Table-1. The reduction ratios $[I_0/I]$ were plotted against pollutant concentrations [Q] and these plots are shown in Fig. 3.

Regression analysis for Stern-Volmer plot has been carried out and the values of regressing coefficient (r) and the slope are given in the corresponding figures. The slope of the Stern-Volmer plot gives the Stern-Volmer constant K_{sv}. The calculated physico-chemical constants are given in Table-2.

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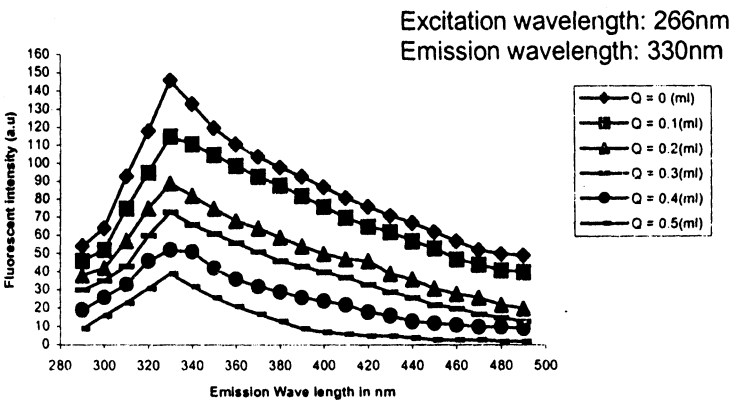

Fig. 1. Fluorescence quenching spectrum of naphthalene in chloroform-acetophenone

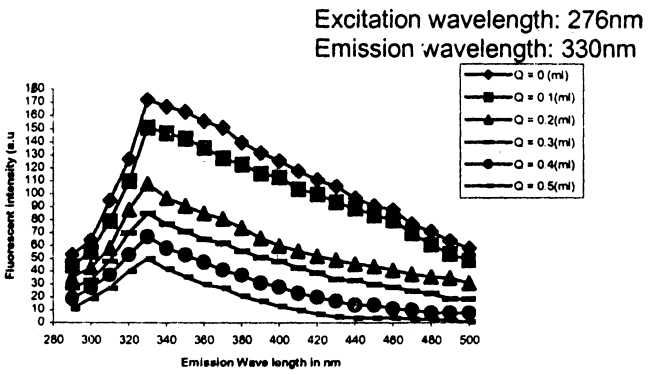

Fig. 2. Fluorescence quenching spectrum of naphthalene in chloroform-iodine

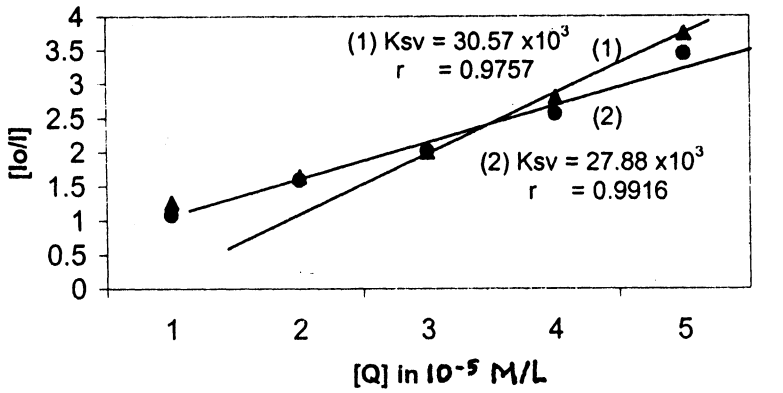

Fig. 3. Stern-Volmer plot for the quenching of naphthalene in chloroform by (1) acetophenone, (2) iodine

TABLE-1
FLUORESCENT INTENSITY RATIOS OF NAPHTHALENE AT DIFFERENT CONCENTRATIONS IN CHLOROFORM

Solvent	[Q] in 10^{-5} M/L	$[I_0/I]$	
		Acetophenone	Iodine
Chloroform	2	1.26	1.08
	4	1.64	1.59
	6	2.00	2.02
	8	2.80	2.56
	10	3.74	3.44

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

Solvent Flurophore Quenchers	Chloroform Naphthalene Acetophenone	Iodine
λ_{CT} (eV)	430	450
$h\nu_{CT}$ (eV)	2.8892	2.7608
I_D (eV)	8.8615	8.701
E_A (eV)	1.2487	1.3803
λ_{abs} (nm)	266	276
λ_{flu} (nm)	330	330
Stoke's shift $\Delta\nu$ (cm^{-1})	7290	5928
Solvent parameters (kcal/mol) (z)	62.1521	60.8297

The fluorescer naphthalene was polluted by the addition of acetophenone and iodine. So, acetophenone and iodine are called the pollutants for naphthalene. It could be noted that among the two pollutants, iodine pollutes naphthalene more than acetophenone.

The Stern-Volmer plots are linear and the regression analyses of the curves are in good correlation. Absorption spectra of naphthalene in the solvent chloroform is not affected by the addition of pollutants in the concentration range used in the fluorescence reduction experiment. This reveals that there is no complex formation or association of naphthalene with the pollutants in the ground state and the degradation occurs only due to the interaction of excited naphthalene and the pollutants.

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