Asian Journal of Chemistry Vol. 10, No. 2, (1998), 381–382

NOTE

Spectral Absorbance of Dye Indicator and Liquid-Liquid Interactions

ASHVIN. N. MODI* and C.M. DESAI†
Junior Laboratory Technician
Gujarat Narmada Valley Fertilizers Co. Ltd.
Narmada Nagar, Bharuch-392 015, India

Molecular interactions have been investigated in binary mixtures of hexane or heptane with CCl_4, $CHCl_3$ or CH_2Cl_2 using dye indicators.

Excess volume measurements of binary liquid mixtures of hexane with polar molecules such as chloroform, methylene chloride and ethylene dichloride, (dipole moments being 1.15 D, 1.59 D, and 1.86 D respectively), indicate V^E hexane + $C_2H_4Cl_2$ > + CH_3Cl > + $CHCl_3$ > + CCl_4 and further that V^E for CCl_4 being very small, since CCl_4 has no diplar structure in pure CCl_4.[1] In the present work dye indicator spectral absorbance method[2, 3] has been used to study the interactions of hexane or heptane with variable concentration on one hand and CCl_4 or $CHCl_3$ or CH_2Cl_2 with constant concentration on the other hand, using monovariation method, keeping dye concentration also constant.

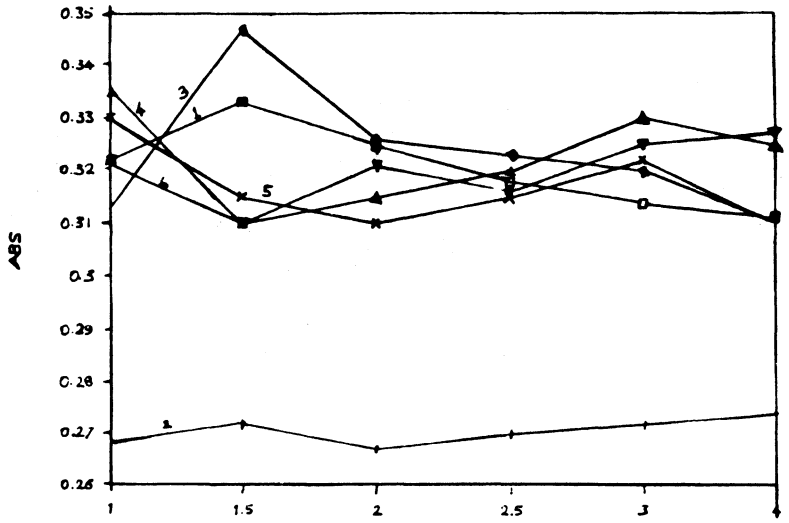
Hexane or heptane and $CHCl_3$ or CCl_4 or CH_2Cl_2 M/10 concentration solution and dye dimethyl yellow (D.M.Y.) 5.0×10^{-1} M concentration solution were prepared in petroleum ether (60–80°C). Different sets of solutions were prepared by increasing hexane or heptane and $CHCl_3$ or CCl_4 or CH_2Cl_2 dye dimethyl yellow concentration being constant and made up to 25 mL with petroleum ether.

A Shimadzu double beam spectrophotometer UV-160A was used for spectral measurements. Absorbance of pure dye solutions at λ_{max} in each set of solutions was measured and plotted against increasing hexane or heptane concentration. The graph indicate peaks corresponding to the ratio of concentration of two liquids in stoichiometric proportion. These are indicated in Graph-I.

When the absorbance of the mixture (2.5 mL $CHCl_3$ or CCl_4 or CH_2Cl_2) with hexane variable concentration is against the variant, the graph indicates peaks at 1.5 mL of hexane; thus $CHCl_3$ or CCl_4 or CH_2Cl_2 show similar behaviour; however the absorbance peak value for CCl_4 is much lower as shown in graph; peak value is in the order $CHCl_3$ (4.3) > CH_2Cl_2 (3.48) > CCl_4 (2.73). It means that in a mixed solvent with hexane, chlorine of CCl_4 must have polar interactions

†Artemis Reaserch Centre, Themis Chemicals Ltd, Vapi-396195, India.

GRAPH-1



□ $CHCl_3$-A + CCl_4-A ◊ CH_2Cl_2-A Δ $CHCl_3$-B × CCl_4-B ∇ CH_2Cl_2-B

1. □ ml of Hexane + 2.5 ml $CHCl_3$ + 5 mL 5.0×10^{-5} M D.M.Y. $CHCl_3$-A
2. + mL of Hexane + 2.5 mL CCl_4 + 5 mL 5.0×10^{-5} M D.M.Y. CCl_4-A
3. ◊ mL of Hexane + 2.5 mL CH_2Cl_2 + 5 mL 5.0×10^{-5} M D.M.Y. CH_2Cl_2-A
4. Δ mL of Heptane + 2.5 mL $CHCl_3$ + 5 mL 5.0×10^{-5} M D.M.Y. $CHCl_3$-B
5. × mL of Heptane + 2.5 mL CCl_4 + 5 mL 5.0×10^{-5} M D.M.Y. CCl_4-B

with H-atoms of hexane in chain form susceptible to such interactions. However, with heptane there is decrease in absorbance intensity at lower concentrations of heptane; peaks appear at 3.0 mL of CCl_4 or $CHCl_3$ or CH_2Cl_2.

The initial decrease in intensity may be interpreted due to aggregation of heptane molecule with chloroalkanes in small proportion; the solvent-solute relation must be operating resulting in polar H-Cl interactions depolymerising with increasing absorbance. It may be concluded that when hexane or heptane is in comparatively higher proportions, H-bonded molecules exist in the solvent hexane or heptane monomers.

ACKNOWLEDGEMENT

The authors are grateful to Gujarat Narmada Valley Fertilizers Co. Ltd,Bharuch for providing research facilities.

REFERENCES

1. A.K. Gupta, C.K. Yadav and A.S. Ansari, *Asian J. Chem.*, **9**, 493 (1997).
2. P.L. Farasram and R. Farasram, *Asian J. Chem.*, 195, 201 **10** (1998).
3. Ashvin Modi and C.M. Desai, *Asian J. Chem.*, 192, **10** (1998).
4. H.D. Joshi and C.M. Desai, *Indian J. Chem.*, **33A**, 965 (1994).
5. Firoz Kapadia, H.D. Joshi and C.M. Desai, *Indian J. Chem.*, **35A**, 884 (1996).

(*Received:* 9 September 1997; *Accepted:* 14 November 1997) AJC-1402