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NOTE

Study of Molecular Complex Formation between Components, Methanol and Hydrocarbons, in Petroleum Spirit with Dye Indicator—Part-II

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Different physical properties of binary organic liquids have been studied and have shown molecular interaction between two liquids, forming molecular complex; this concept has been used to study molecular complex formation between organic components methanol and hydrocarbons in nonpolar solvent petroleum spirit spectrophotometrically by monovariation method using dye indicator.

Several workers[1-13] studied different physical properties such as vapour-liquid equilibrium, excess Gibb's energy of activation, excess volume, viscosity, dipole moment and dielectric constant of binary organic liquid mixtures and showed molecular interactions between two liquids, with molecular complex formation due to different types of interactions. Such type of molecular complex formation can take place between organic components methanol and hydrocarbons in non-polar solvent petroleum spirit and it was thought interesting to study these spectrophotometrically by monovariation method using dye *p*-dimethylamino-azobenzene (DMY) as an indicator.[14]

Organic components methanol, chloroform, carbon tetrachloride, benzene, toluene, *m*-xylene, naphthalene, chlorobenzene and cyclohexane M/10 concentration and dye *p*-dimethylaminoazobenzene (DMY) 5×10^{-6} M concentration solutions were prepared in petroleusm spirit. All compounds used in the study were of A.R. grade.

Eight sets of solutions of methanol with hydrocarbons (chloroform, carbon tetrachloride, benzene, toluene, *m*-xylene, naphthalene, chlorobenzene and cyclohexane) were prepared by monovariation method, increasing concentration of methanol solution and hydrocarbon-dye *p*-dimethylaminoazobenzene solution concentration being kept constant. Absorbance of pure dye solution at λ_{max} was taken as standard and absorbance at λ_{max} in each set of solutions was measured and plotted against increasing methanol solution concentration. The graphs indicate peaks corresponding to the ratio of concentrations of two components methanol and hydrocarbons in stoichiometric proportions 1 : 1 and 1 : 2. For

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spectral measurements Shimadzu double beam spectrophotometer UV-160 A was used.

Mixture of methanol with hydrocarbon in non-polar solvent petroleum spirit was studied spectrophotometrically using dye indicator and it was found that methanol with chloroform, carbon tetrachloride and chlorobenzene, due to interaction forms 1 : 1 and 1 : 2 molecular complexes; with benzene, toluene, naphthalene and cyclohexane only 1 : 1 molecular complex, and with *m*-xylene no complex formation was observed.

In mixture of methanol with chloroform, hydrogen of chloroform forms bond with oxygen of methanol and chloroform chlorine forms bond with methanol, hydroxyl hydrogen forms a cluster and in this cluster one molecule of chloroform is associated with one to three molecules of methanol.[1] In carbon tetrachloride one to four molecules of methanol will be in a cluster around carbon tetrachloride molecule due to specific molecular interaction of C—Cl- - -H—O of four chlorine atoms of carbon tetrachloride.[1] In chlorobenzene methanol hydrogen forms hydrogen bond with chlorobenzene chlorine and also with π electrons of benzene nucleus resulting in H-π interaction. Hence in all three mixtures due to interaction dielectric constant of the system increases and 1 : 1 and 1 : 2 molecular complex formation is facilitated.

Benzene, toluene and naphthalene with methanol form 1 : 1 molecular complex due to methanol and with π-electron of benzene nucleus there is H-π interaction and in cyclohexane there is no H-π interaction but only dipole-dipole interaction; hence 1 : 1 molecular complex is formed.[7]

In *m*-xylene with methanol there is no molecular complex formation due to steric hindrance of two methyl groups, which inhibit H-π interaction.[7]

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