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VISCOMETRIC STUDY OF SOME HETEROCYCLIC DRUGS LIKE PYRIDOXINE, LINCOMYCIN , QUININE AND FOLIC ACID IN THF , DMF , DMSO AND ETHANOL AT 27°C.

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ABSTRACT

Viscosity measurement are used for the study of interactions between solute and solvent. The viscometric study of freshly prepared Pyridoxine, Lincomycin , Quinine AND Folic Acid were carried out in various percentage compositions of solvents like THF , DMF , DMSO and Ethanol .

The DATA and results obtained during this investigation gave detail information regarding drug absorption, transmission activity and effect of these drugs. Taking all these things into consideration this research work was carried out.

KEYWORDS : Viscosity, Viscometry etc.

INTRODUCTION :

Viscosity measurements play an important role in medicinal an drugs chemistry. Useful information about solute-solute and solute-solvent interaction provides when the behavior of electrolytes are studied by viscometry. Many workers(1-3) have been studied these interactions in aqueous and non-aqueous solutions.

Jauhar et.al.(4) studied 1:1 electrolytes in acetic acid + water mixture at 25° c viscometrically. Peng Zhang et.al.(5) investigated the viscometric behavior of quaternary mixture (chromic anhydride + sodium dichromate + sodium chromate + water) at different temperatures to determine β-coefficient of chromic anhydride and solute-solute interaction, solute-mixed solvent interaction and structural making effect of chromic anhydride by using Hepler criterion and Jones-Dole equation.

Recently the study of dehydration effect of electrolyte upon the amino acid is done by using the viscometric behavior of amino acid in aqueous metal electrolytes solution at 308°K(6).

The Jones-Dole equation(7) accounts for the observed viscosity concentration dependence of dilute electrolyte solutions, while Breslau-Miller(8), Vand(9), Moulik(10), Thomson(11) and Einstein(12) equations account.

The present study deals with the study of molecular interactions interactions in terms of viscosity β-coefficient of different ligands in different concentrations of organic solute-water mixture.

EXPERIMENTAL:
MATERIALS AND SOLVENTS USED.

Pyridoxine(ligand-1), Lincomycin (ligand-2), Quinine (ligand-3) and Folic Acid (ligand-4) were used. The 0.01M, 0.005M, 0.0025M, 0.00125M and 0.00063M concentrated solutions of each ligand were prepared in 70 % THF-water, DMF-water, DMSO-water and Ethanol-water mixture at 27°c ($\pm$ 0.1 $^\circ$C). The constant temperature was maintained with the help of elite thermostat. All weighing were made on Mechaniki Zaktady Precyzying Gdansk balance ($\pm$ 0.001 gm) (made in Poland). The densities of solutions were determined by a bicapillary,Pyknometer ($\pm$ 0.2%) having a bulb volume of about 10 cm^3 and capillary having an internal diameter of 1 mm.

OBSERVATIONS AND CALCULATIONS:

The presence study deals with the viscosity investigation of Ligand-1, Ligand-2, Ligand-3 and Ligand-4 in 70 % THF-water, DMF-water, DMSO-water and Ethanol water mixture at different concentration at 27oC respectively. The results obtained were mentioned in table 1 to 16.
Densities and Viscosities of systems at 27°C($\pm$0.1oC)

TABLE:1

System : Ligand 1   Solvent: THF

Sr.No.	Concentration C (mole/litre)	$\overline{}$ x 10^{-2} (mole$^{1/2}$ /Litre$^{1/2}$)	Density d (gm/cc)	Time of Flow in sec. t	Relative Viscosity ηr	$\eta r - 1$	$\eta r- 1/\underline{}$
1	0.01	0.1 x 10-2	0.9776	66	2.4210	1.4210	14.21
2	0.005	0.07 x 10-2	0.9750	65	2.3780	1.3780	19.68
3	0.0025	0.05 x 10-2	0.9720	64	2.3342	1.3342	26.68
4	0.00125	0.035 x 10-2	0.9700	63	2.2930	1.2930	36.94
5	0.00063	0.025 x 10-2	0.9675	60	2.1782	1.1782	47.13

TABLE:2

System : Ligand 1   Solvant:DM

Sr.No.	Concentration C (mole/litre)	$\overline{}$ x 10^{-2} (mole$^{1/2}$ /Litre$^{1/2}$)	Density d (gm/cc)	Time of Flow in sec. t	Relative Viscosity ηr	$\eta r - 1$	$\eta r- 1/\underline{}$
1	0.01	0.1 x 10-2	0.9800	125	4.5960	3.5960	35.96
2	0.005	0.07 x 10-2	0.9725	124	4.5249	3.5249	50.35
3	0.0025	0.05 x 10-2	0.9728	122	4.4532	3.4532	69.06
4	0.00125	0.035 x 10-2	0.9705	120	4.3699	3.3699	96.28
5	0.00063	0.025 x 10-2	0.9675	119	4.3201	3.3201	132.80

TABLE:3

System : Ligand 1   Solvant: DMSO

Sr.No.	Concentration C (mole/litre)	$\overline{}$ x 10^{-2} (mole$^{1/2}$ /Litre$^{1/2}$)	Density d (gm/cc)	Time of Flow in sec. t	Relative Viscosity ηr	$\eta r - 1$	$\eta r - 1/\underline{}$
1	0.01	0.1 x 10-2	0.9870	96	3.5554	2.5554	25.554
2	0.005	0.07 x 10-2	0.9840	94	3.4707	2.4707	35.296
3	0.0025	0.05 x 10-2	0.9830	90	3.3196	2.3196	46.393
4	0.00125	0.035 x 10-2	0.9800	88	3.2360	2.2360	63.886
5	0.00063	0.025 x 10-2	0.9770	85	3.1161	2.1161	84.645

TABLE:4

System : Ligand 1   Solvant: Ethanol

Sr.No.	Concentration C (mole/litre)	$\overline{}$ x 10^{-2} (mole$^{1/2}$ /Litre$^{1/2}$)	Density d (gm/cc)	Time of Flow in sec. t	Relative Viscosity ηr	$\eta r - 1$	$\eta r - 1/\underline{}$
1	0.01	0.1 x 10-2	1.0030	79	2.9732	1.9732	19.73
2	0.005	0.07 x 10-2	0.9990	72	2.6989	1.6989	24.27
3	0.0025	0.00305 x 10-2	0.9800	68	2.5005	1.5005	30.01
4	0.00125	0.035 x 10-2	0.9960	64	2.3918	1.3918	39.76
5	0.00063	0.025 x 10-2	0.9948	60	2.2396	1.2396	49.58

TABLE:5

System : Ligand 2   Solvant: THF

Sr.No.	Concentration C (mole/litre)	$\overline{}$ x 10^{-2} (mole$^{1/2}$ /Litre$^{1/2}$)	Density d (gm/cc)	Time of Flow in sec. t	Relative Viscosity ηr	$\eta r - 1$	$\eta r - 1/\underline{}$
1	0.01	0.1 x 10-2	0.785	80	2.3564	1.3564	13.56
2	0.005	0.07 x 10-2	0.780	78	2.2829	1.2829	18.32
3	0.0025	0.05 x 10-2	0.755	75	2.1247	1.1247	22.49
4	0.00125	0.035 x 10-2	0.740	74	2.0547	1.0547	30.13
5	0.00063	0.025 x 10-2	0.721	73	1.9749	0.9749	38.99

TABLE:6

System : Ligand 2   Solvant: DMF

Sr.No.	Concentration C (mole/litre)	$\overline{}$ x 10^{-2} (mole$^{1/2}$ /Litre$^{1/2}$)	Density d (gm/cc)	Time of Flow in sec. t	Relative Viscosity ηr	$\eta r - 1$	$\eta r - 1/\underline{}$
1	0.01	0.1 x 10-2	0.881	95	3.1405	2.1405	21.41
2	0.005	0.07 x 10-2	0.877	93	3.0604	2.0604	29.43
3	0.0025	0.05 x 10-2	0.869	91	2.9673	1.9673	39.34
4	0.00125	0.035 x 10-2	0.845	87	2.7585	1.7585	50.24
5	0.00063	0.025 x 10-2	0.829	85	2.6440	1.6400	65.76

TABLE:7

System : Ligand 2   Solvant: DMSO

Sr.No.	Concentration C (mole/litre)	$\overline{}$ x 10^{-2} (mole$^{1/2}$ /Litre$^{1/2}$)	Density d (gm/cc)	Time of Flow in sec. t	Relative Viscosity ηr	$\eta r - 1$	$\eta r - 1/\underline{}$
1	0.01	0.1 x 10-2	0.7671	78	2.3151	1.3151	13.15
2	0.005	0.07 x 10-2	0.7780	77	2.2478	1.2478	17.82
3	0.0025	0.05 x 10-2	0.7650	75	2.1529	1.1529	23.05
4	0.00125	0.035 x 10-2	0.7630	76	2.1473	1.1473	32.78
5	0.00063	0.025 x 10-2	0.7490	73	2.0516	1.0516	42.06

TABLE:8

System : Ligand 2   Solvant: Ethanol

Sr.No.	Concentration C (mole/litre)	$\overline{}$ x 10^{-2} (mole$^{1/2}$ /Litre$^{1/2}$)	Density d (gm/cc)	Time of Flow in sec. t	Relative Viscosity ηr	$\eta r - 1$	$\eta r - 1/ \overline{}$
1	0.01	0.1 x 10-2	0.790	83	2.4606	1.4604	14.60
2	0.005	0.07 x 10-2	0.776	81	2.3585	1.3585	19.40
3	0.0025	0.05 x 10-2	0.765	78	2.2390	1.2390	24.78
4	0.00125	0.035 x 10-2	0.750	76	2.1388	1.1388	32.53
5	0.00063	0.025 x 10-2	0.755	74	2.0964	1.0964	43.85

TABLE:9

System : Ligand 3   Solvant: THF

Sr.No.	Concentration C (mole/litre)	$\overline{}$ x 10^{-2} (mole$^{1/2}$ /Litre$^{1/2}$)	Density d (gm/cc)	Time of Flow in sec. t	Relative Viscosity ηr	$\eta r - 1$	$\eta r - 1/ \overline{}$
1	0.01	0.1 x 10-2	0.800	105	3.1519	2.1519	21.51
2	0.005	0.07 x 10-2	0.778	103	3.0069	2.0069	28.67
3	0.0025	0.05 x 10-2	0.771	99	2.8641	1.8641	37.28
4	0.00125	0.035 x 10-2	0.762	96	2.7449	1.7449	49.85
5	0.00063	0.025 x 10-2	0.758	95	2.7020	1.7020	68.08

Table:10

System : Ligand 3   Solvant: DMF

Sr.No.	Concentration C (mole/litre)	$\overline{}$ x 10^{-2} (mole$^{1/2}$ /Litre$^{1/2}$)	Density d (gm/cc)	Time of Flow in sec. t	Relative Viscosity ηr	$\eta r - 1$	$\eta r - 1/\underline{}$
1	0.01	0.1 x 10-2	0.880	65	2.1463	1.1463	11.46
2	0.005	0.07 x 10-2	0.873	63	2.0637	1.0637	15.19
3	0.0025	0.05 x 10-2	0.869	62	2.0216	1.0216	20.43
4	0.00125	0.035 x 10-2	0.844	60	1.9001	0.9001	25.71
5	0.00063	0.025 x 10-2	0.825	58	1.7954	0.7954	31.81

TABLE:11

System : Ligand 3   Solvant: DMSO

Sr.No.	Concentration C (mole/litre)	$\overline{}$ x 10^{-2} (mole$^{1/2}$ /Litre$^{1/2}$)	Density d (gm/cc)	Time of Flow in sec. t	Relative Viscosity ηr	ηr - 1	ηr- 1/ $\overline{}$
1	0.01	0.1 x 10-2	0.777	73	2.1283	1.1283	11.28
2	0.005	0.07 x 10-2	0.772	71	2.0567	1.0567	15.09
3	0.0025	0.05 x 10-2	0.771	69	1.9962	0.9962	19.92
4	0.00125	0.035 x 10-2	0.760	67	1.9106	0.9106	26.01
5	0.00063	0.025 x 10-2	0.752	64	1.8059	0.8059	32.23

TABLE:12

System : Ligand 3   Solvant: Ethanol

Sr.No.	Concentration C (mole/litre)	$\overline{}$ x 10^{-2} (mole$^{1/2}$ /Litre$^{1/2}$)	Density d (gm/cc)	Time of Flow in sec. t	Relative Viscosity ηr	ηr - 1	ηr- 1/ $\overline{}$
1	0.01	0.1 x 10-2	0.778	65	1.8975	0.8975	8.975
2	0.005	0.07 x 10-2	0.774	63	1.8297	0.8297	11.85
3	0.0025	0.05 x 10-2	0.771	61	1.7647	0.7647	15.29
4	0.00125	0.035 x 10-2	0.768	59	1.7002	0.7002	20.00
5	0.00063	0.025 x 10-2	0.765	57	1.6362	0.6362	25.44

TABLE:13

System : Ligand 4   Solvant: THF

Sr.No.	Concentration C (mole/litre)	$\overline{}$ x 10^{-2} (mole$^{1/2}$ /Litre$^{1/2}$)	Density d (gm/cc)	Time of Flow in sec. t	Relative Viscosity ηr	ηr - 1	ηr- 1/ $\overline{}$
1	0.01	0.1 x 10-2	0.789	89	2.6349	1.6349	19.34
2	0.005	0.07 x 10-2	0.782	85	2.4941	1.4941	21.34
3	0.0025	0.05 x 10-2	0.765	83	2.3825	1.3825	27.65
4	0.00125	0.035 x 10-2	0.752	82	2.3138	1.3138	37.53
5	0.00063	0.025 x 10-2	0.739	79	2.1906	1.1906	47.62

TABLE:14

System : Ligand 4   Solvant: DMF

Sr.No.	Concentration C (mole/litre)	$\overline{}$ x 10^{-2} (mole$^{1/2}$ /Litre$^{1/2}$)	Density d (gm/cc)	Time of Flow in sec. t	Relative Viscosity ηr	ηr - 1	ηr- 1/ $\overline{}$
1	0.01	0.1 x 10-2	0.911	112	3.8285	2.8285	28.28
2	0.005	0.07 x 10-2	0.882	109	3.6074	2.6074	37.24
3	0.0025	0.05 x 10-2	0.879	106	3.4962	2.4962	49.92
4	0.00125	0.035 x 10-2	0.869	103	3.3586	2.3586	67.38
5	0.00063	0.025 x 10-2	0.845	101	3.2024	2.2024	88.09

Table:15

System : Ligand 4   Solvant: DMSO

Sr.No.	Concentration C (mole/litre)	$\overline{C} \times 10^{-2}$ (mole$^{1/2}$ /Litre$^{1/2}$)	Density d (gm/cc)	Time of Flow in sec. t	Relative Viscosity η_r	$\eta_r - 1$	$\eta_r - 1/\overline{C}$
1	0.01	0.1 x 10-2	0.780	77	2.2536	1.2536	12.53
2	0.005	0.07 x 10-2	0.759	73	2.0790	1.0790	15.41
3	0.0025	0.05 x 10-2	0.741	71	1.9741	0.9741	19.48
4	0.00125	0.035 x 10-2	0.719	68	1.8345	0.8345	23.84
5	0.00063	0.025 x 10-2	0.700	65	1.7073	0.7073	28.29

TABLE:16

System : Ligand 4   Solvant: Ethanol

Sr. No.	Concentration C (mole/litre)	$\overline{C} \times 10^{-2}$ (mole$^{1/2}$ /Litre$^{1/2}$)	Density d (gm/cc)	Time of Flow in sec. t	Relative Viscosity η_r	$\eta_r - 1$	$\eta_r - 1/\overline{C}$
1	0.01	0.1 x 10-2	0.786	89	2.6249	1.6249	16.24
2	0.005	0.07 x 10-2	0.779	85	2.4846	1.4846	21.20
3	0.0025	0.05 x 10-2	0.773	83	2.4074	1.4074	28.14
4	0.00125	0.035 x 10-2	0.761	81	2.3129	1.3129	37.51
5	0.00063	0.025 x 10-2	0.747	77	2.1583	1.1583	46.33

RESULT AND DISCUSSION:

      The large and small values of 'A' Shows the stronger and weaker solute-solute interactions respectively as listed in following Tables 17 to 2

TABLE-17
A AND B COEFFICIENT VALUES IN THF MEDIUM

Sr. No.	System	A	B (lit/mole)
1	Lgand-L1	0.117	-0.002
2	Lgand-L2	0.124	-0.002
3	Lgand-L3	0.117	-0.001
4	Lgand-L4	0.126	-0.002

TABLE-18
A AND B COEFFICIENT VALUES IN DMF MEDIUM

Sr. No.	System	A	B (lit/mole)
1	Lgand-L1	0.111	-0.001
2	Lgand-L2	0.122	-0.001
3	Lgand-L3	0.29	-0.003
4	Lgand-L4	0.119	-0.001

TABLE-19
A AND B COEFFICIENT VALUES IN DMSO MEDIUM

Sr. No.	System	A	B (lit/mole)
1	Lgand-L1	0.473	-0.005
2	Lgand-L2	0.117	-0.002
3	Lgand-L3	0.127	-0.003
4	Lgand-L4	0.146	-0.004

TABLE-20
A AND B COEFFICIENT VALUES IN ETHANOL MEDIUM

Sr. No.	System	A	B (lit/mole)
1	Lgand-L1	0.131	-0.002
2	Lgand-L2	0.121	-0.002
3	Lgand-L3	0.126	-0.004
4	Lgand-L4	0.125	-0.002

Solutes with positive viscosity β-coefficient are characterized as "Structure formers" and will impose a new order by reorientation of the adjacent water molecules indicating strong solute- solvent interactions.

Solutes with   negative viscosity β- coefficient is characterized   as "Structure Breakers" indicating weak solute - solvent interactions.

Here I was found that all Ligands in THF system, DMF system, DMSO system and Ethanol system shows negative value i.e. Structure Breaking activity and no one shows Structure forming activity. Such type of results is also shown by Pandey et al.(13)

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