

Viscometric Study of S-Substituted Triazinothioureas at Various Compositions

M. S. Lunge.

Department of Chemistry. Government Vidharbha Institute of Science and Humanities, Amravati (M.S.) Pin – 444 604, India.

Abstract: Nitrogen and sulphur containing heterocycles have much more significance in drug, pharmaceutical and medicinal chemistry since from last four decades. Hence, the viscometric study of recently synthesized heterocycles viz. 1-(4-hydroxy)-S-triazino-3-p-chlorophenylthiourea (L_1), 1-(4-hydroxy)-S-triazino-3-allylthiourea (L_2) and 1-(4-hydroxy)-S-triazino-3-t-butylthiourea (L_3), were carried out at various percentage compositions of solvent to investigate effect of structure, group on S-triazinothiourea. The data and result obtained during this investigation is useful in pharmacokinetics and pharmacodynamics. Taking all these things into consideration this research work was carried out.

Keywords: 1-(4-Hydroxy)-S-triazino-3-substitutedthiourea, dioxane-water, viscometric study.

I. Introduction:

Viscosities of the solution play an important role in pharmaceutical, medicinal and drug chemistry.¹⁻³ Solute-solute, solute-solvent, solvent-solvent interactions in drug chemistry were studied by viscometric information. Hence, taking all these things into consideration and as wider programme of this laboratory in the synthesis of nitrogen, sulphur and nitrogen and sulphur containing heterocycles and heterocycles, it was thought interesting to carry out the viscometric study of newly synthesized heterocycles in this laboratory. This study explores the potency of synthesized drug, stability of drug and also renovates and modifies the traditional drugs which are used by medicinal practitioner.

The pharmaceutical and medicinal literature survey clearly indicated that newly synthesized drugs are the best for particular diseases but after some time interval, the drug effect and their activities become less and those drugs became out dated for that disease, due to continuous evolutions in the pathogens. It was observed that in the universe these pathogens have a great and rapid evolutionary phenomenon and the drug become food for those pathogens. It became challenge to chemist and researchers to synthesized new type drugs for old diseases.

S-Triazino and thiourea nucleus containing drugs create its own identity and significance in drug and pharmaceutical chemistry⁴⁻¹⁰ Hence for studying the potency of recently synthesized drugs in this laboratory, the viscosity study of 1-(4-hydroxy)-S-triazino-3-p-chlorophenylthiourea (L_1), 1-(4-hydroxy)-S-triazino-3-allylthiourea (L_2) and 1-(4-hydroxy)-S-triazino-3-t-butylthiourea (L_3), were studied at various percentage compositions. This study becomes milestone in the drug medicinal, pharmaceutical of triazinothiourea.

II. Experimental:

All the chemicals used of A.R grade and doubly distilled water was used. Weighing was made on Mechaniki Zaktady Precyzyjnej Gdansk balance made in Poland (± 0.001 gm). Densities of solutions were determined by a bicapillary pycnometer (± 0.2 %) having a bulb volume of about 10 cm^3 and capillary having an internal diameter of 1mm and calibrated with deionised doubly distilled water. The accuracy of density measurements were within $\pm 0.1\text{ Kgm}^{-3}$. The viscosities were measured by means of Ostwald's viscometer thoroughly cleaned and dried. The viscometer was kept in Elite thermostatic water bath and temperature variation was maintained at 30°C (± 0.1) for each measurements, sufficient time was allowed to attain thermal equilibrium between viscometer and water bath.

Observations and calculations:

The present study deals with the viscosity investigation of Ligand (L_1), Ligand (L_2), Ligand (L_3) in 65%, 75% and 85% dioxane-water mixture at different compositions and at 303.15 K (30°C). The data obtained have been used to compute molecular interactions in terms of β -coefficient of different ligands. The viscometric readings were taken as described in literature¹¹. The results obtained was mentioned in **Table No, 1-9**.

According to Jone's-Dole equation, $(\eta_r - 1)\sqrt{C} = A + \beta\sqrt{C}$ at different concentration and different percentage. \square and β -coefficient values calculated and are enlisted in **Table No 10-12**.

Determination of Relative and Specific Viscosities at Different Concentrations

A) For Ligand L₁

Table No 1:- Dioxane-water (65%)

Temp-(303.15 K) System L₁, Medium: - Dioxane-water

Conc.	\sqrt{C}	Time flow (sec) t	Density $\rho \times 10^3$	η_r Relative viscosity	$\eta_{sp} = \eta_r - 1$ specific Viscosity	$\eta_r - 1/\sqrt{C}$
0.1	0.31633	376	1.0243	1.5535	0.5532	1.74848
0.075	0.27394	364	1.0241	1.4991	0.4990	1.81997
0.056	0.23673	349	1.0237	1.4408	0.4408	1.86024
0.042	0.20502	340	1.0234	1.3993	0.3992	1.94504

Table No2:- Dioxane-water (75%)

Temp-(303.15 K) System L₁, Medium:- Dioxane-water

Conc.	\sqrt{C}	Time flow (sec) t	Density $\rho \times 10^3$	η_r Relative viscosity	$\eta_{sp} = \eta_r - 1$ specific Viscosity	$\eta_r - 1/\sqrt{C}$
0.1	0.31630	401	1.0294	1.4184	0.4184	1.32126
0.075	0.27393	392	1.0287	1.3796	0.3796	1.38397
0.056	0.23671	379	1.0278	1.3343	0.3344	1.41020
0.042	0.20501	369	1.0263	1.2974	0.2973	1.44781

Table No3:- Dioxane-water (85%)

Temp-(303.15 K) System L₁, Medium: - Dioxane-water

Conc.	\sqrt{C}	Time flow (sec) t	Density $\rho \times 10^3$	η_r Relative viscosity	$\eta_{sp} = \eta_r - 1$ specific Viscosity	$\eta_r - 1/\sqrt{C}$
0.1	0.31630	419	1.0320	1.3809	0.3809	1.20267
0.075	0.27393	408	1.0299	1.3418	0.3418	1.24591
0.056	0.23671	398	1.0287	1.3059	0.3059	1.29019
0.042	0.20502	390	1.0271	1.2796	0.2796	1.36144

B) For Ligand L₂

Table No 4:- Dioxane-water (65%)

Temp-(303.15 K) System L₂, Medium: - Dioxane-water

Conc.	\sqrt{C}	Time flow (sec) t	Density $\rho \times 10^3$	η_r Relative viscosity	$\eta_{sp} = \eta_r - 1$ specific Viscosity	$\eta_r - 1/\sqrt{C}$
0.1	0.31630	398	1.03398	1.6614	0.6614	2.08939
0.075	0.27393	381	1.02951	1.5824	0.5824	2.12450
0.056	0.23671	377	1.02617	1.5223	0.5223	2.20423
0.042	0.20501	354	1.02187	1.4700	0.4700	2.29002

TableNo5:- Dioxane-water (75%)

Temp-(303.15 K) System L₂, Medium:- Dioxane-water

Conc.	\sqrt{C}	Time flow (sec) t	Density $\rho \times 10^3$	η_r Relative viscosity	$\eta_{sp} = \eta_r - 1$ specific Viscosity	$\eta_r - 1/\sqrt{C}$
0.1	0.31630	431	1.03506	1.5321	0.5321	1.68049
0.075	0.27393	413	1.03108	1.4624	0.4624	1.68593
0.056	0.23671	402	1.02597	1.4190	0.4190	1.76771
0.042	0.20502	396	1.02079	1.3884	0.3884	1.89234

Table No 6:- Dioxane-water (85%)

Temp-(303.15 K) System L₂, Medium: - Dioxane-water

Conc.	\sqrt{C}	Time flow (sec) t	Density $\times 10^3$	η_r Relative viscosity	$\eta_{sp} = \eta_r - 1$ specific Viscosity	$\eta_r - 1/\sqrt{C}$
0.1	0.31630	423	1.0362	1.4074	0.4074	1.28617
0.075	0.27393	420	1.0320	1.3840	0.3841	1.31004
0.056	0.23671	413	1.0268	1.3603	0.3603	1.52092
0.042	0.20500	403	1.0232	1.3241	0.3241	1.57810

C] **For Ligand L₃**

TableNo7:-Dioxane-water (65%)

Temp-(303.15 K) System L₃, Medium: - Dioxane-water

Conc.	\sqrt{C}	Time flow (sec) t	Density $\times 10^3$	η_r Relative viscosity	$\eta_{sp} = \eta_r - 1$ specific Viscosity	$\eta_r - 1/\sqrt{C}$
0.1	0.31630	479	1.03607	2.0087	1.00817	3.18764
0.075	0.27393	478	1.03308	1.99790	0.99790	3.64363
0.056	0.23671	454	1.02907	1.88428	0.88427	3.73650
0.042	0.20500	437	1.02409	1.80279	0.80279	3.91694

TableNo8:-Dioxane-water (75%)

Temp-(303.15 K) System L₃, Medium: - Dioxane-water

Conc.	\sqrt{C}	Time flow (sec) t	Density $\times 10^3$	η_r Relative viscosity	$\eta_{sp} = \eta_r - 1$ specific Viscosity	$\eta_r - 1/\sqrt{C}$
0.1	0.31630	488.11	1.03879	1.76446	0.76447	2.41732
0.075	0.27393	470.24	1.03347	1.69118	0.69118	2.52367
0.056	0.23671	451.58	1.02907	1.61706	0.61708	2.60738
0.042	0.20500	443.37	1.02578	1.58232	0.58232	2.84262

TableNo9:-Dioxane-water (85%)

Temp-(303.15 K) System L₃, Medium: - Dioxane-water

Conc.	\sqrt{C}	Time flow (sec) t	Density $\times 10^3$	η_r Relative viscosity	$\eta_{sp} = \eta_r - 1$ specific Viscosity	$\eta_r - 1/\sqrt{C}$
0.1	0.31630	504	1.0402	1.67587	0.67586	2.13714
0.075	0.27393	486	1.0364	1.60972	0.60972	2.22620
0.056	0.23671	474	1.0320	1.56397	0.56397	2.38297
0.042	0.20500	459	1.0281	1.50989	0.50989	2.48774

□- β Coefficient value according to Jone's –Dole Equation at different concentrations and different percentage

Table No 10:-For Ligand L₁

Temp-(303.15 K) System L₁,

% Dioxane-Water	α - coefficient	β - coefficient
65	1.35984	-1.8756
75	1.09343	-1.1537
85	0.95267	-1.2506

Table No 11:-For Ligand L₂

Temp-(303.15 K) System L₂,

% Dioxane-Water	α - coefficient	β - coefficient
65	1.8073	-1.4287
75	0.98288	-3.0008
85	0.95480	2.8757

Table No 12:-For Ligand L₃

Temp-(303.15 K)	System L ₃ ,	% Dioxane-Water	α - coefficient	β - coefficient
		65	2.07367	-6.0006
		75	1.53254	-4.1307
		85	1.52702	-3.0308

III. Result and Discussion:

The relative viscosity of each solution during study was determined by formula depicted below
 $\eta_r = \frac{D_s \times t_s}{D_w \times t_w}$ Where, η_r = Relative viscosity of ligand solution, D_s and D_w are Density of ligand solution and density of water, t_s and t_w = Time of flow for ligand solution and water respectively. The relative viscosities have been analyzed by Jones's-Dole equation

$(\eta_r - 1) \sqrt{C} = \alpha + \beta \sqrt{C}$ Where, C is molar concentration of the ligand solution, α -is the Falkenhagen coefficient which is the measure of solute-solute interactions and β -is the Jones's -Dole coefficients which is the Measure of solute -solvent interactions.

The graph are plotted between $(\eta_r - 1) \sqrt{C}$ versus \sqrt{C} . The graph for each system gave linear straight line showing validity of Jones's -Dole equation. The slope of straight line gave value of β coefficient.

In the present study, relative viscosity of ligand solutions increases with increase in the concentrations of solute (ligand). This is due to the increase in the relative viscosity with increase in the concentration of ligand which causes much more solute -solvent interactions, and hence the viscous property of that system increases which clearly indicate that when the percentage of solute increases and hence transmission and absorption of drug decreases in this case, it means that drug activity and effect for that drug is less at higher concentration while at lower concentration these effects are good. This study attributes to increase in solute-solvent interactions and favors homeopathy therapy.

The large and small values of α show the stronger and weaker solute -solute interactions respectively. Solute with positive viscosity β coefficient are characterized as "Structure formers" and will impose a new order by reorientation of the adjacent water molecules. The β coefficient values are positive for all the systems. This showed stronger interactions between solute and solvent. It was observed from Table No 10-12 that α coefficient values of L₃ is comparatively more than L₂ and L₁. This is due to bulkier nature and unsaturation of substituent's groups present on thiourea moiety. From this study it was cleared that when the bulky group is present on ligand then solute -solvent interactions in those system increases and mobility of drug (solute) and transmission decreases. From this study, it was observed that the drug activity and effect of S-triazinothiourea drug will be increase by avoiding the substitutions of bulkier groups in triazinothiourea nucleus. This data is useful to chemist and researcher of pharmaceutical and medicinal sciences.

For the ligand L₁, L₂ and L₃ α and β coefficient values were decreases with increase in percentage of dioxane -water, which indicate that solute-solvent interactions goes on decreasing due to which drug mobility and transmission goes on increasing of solvent. We can say that the drug activity and effect of S-triazinothiourea drugs will be increase in higher percentage of solvent. At the same time, at 65% Dioxane-water. α and β coefficient goes on increasing for the ligand L₁, L₂, L₃, which indicate solute - solvent interaction goes on increases at the same time mobility of drug and transmission goes on decreases. Similarly, result obtained for 75% and 85 % dioxane water mixture. All the three ligand L₁, L₂, L₃, have the β positive values which indicate that stronger interaction between solute and solvent. At lower concentration the drug activity and effect of triazinothiourea is the best.

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