

## The Effect of Organic Additives on the Conductance of Ni-Soap Solution in non-Aqueous system and the comparative studies with Mg-Soap

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In our previous communication<sup>1</sup> we have studied the effect of different organic additives on the conductance of  $MgLt_2$  in suitable organic solvents singly and jointly.

The present work records the investigations of the conductometric studies of  $NiLt_2$  in some selected co-solvent mixtures in the interest of further elucidation of the soap-solvent interaction as corroborated earlier from the stand-point of solubility measurements by one of the authors<sup>2,3</sup>.

### Experimental

The experimental procedure is similar as detailed earlier<sup>1</sup>. The percentage of metal content was as follows: Nickel Laurate, Found: 12.81% Ni (calculated 12.84%).

The solvents employed are of reagent quality which are usually distilled after desiccation according to standard methods<sup>4</sup>.

### Results and Discussion

We have measured specific conductivity at a constant soap concentration in different mole-ratios of the two base solvents. Fig. 1 represents observations with the solvent pair propylene glycol (PG) : piperidine (PIPY), Fig. 2 with PG : diethanolamine (DEA) and Fig. 3 shows comparative results of the two soaps (Mg and Ni Laurates) in PG :  $CHCl_3$  and PIPY :  $CHCl_3$ .

We find that Nickel Laurate is insoluble in either of the pure solvents and hence the conductivity in pure solvents cannot be measured. But as soon as the second component is added, the co-solvency effect<sup>8,9</sup> sets in. As a result the solubility increases thereby increasing the conductance of the solution.

The most striking feature of all the curves is that the maximum conductivity of all the differently concentrated soap solutions occurs at a particular mole-ratio of the two selected co-solvents due to Winsor's principle<sup>5-7</sup>. For  $MgLt_2$ , the peak of the different conductivity curves lies in the mole-ratio range of 70-75% of PG : other component. For  $NiLt_2$  however, the peak lies in the mole-ratio range of 65-80 : 35-20 of the two co-solvents. The actual conductivity values for the different peak points lie in the range of  $10^{-5}$ - $10^{-6}$  mhos/cm.

In some cases,  $MgLt_2$  shows superior conductivity to  $NiLt_2$  (as in Fig. 1), but in other cases, it is reversed (as in Fig. 2). It appears therefore that the order of the maximum conductivity for the two soaps depends on the selected solvent pair. The values of the maximum conductivities for the two soaps are shown in the following table.

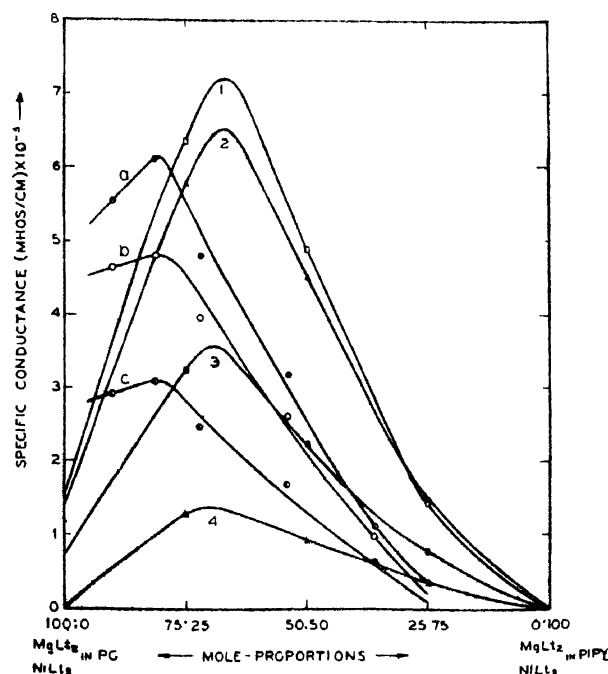


Fig. 1. Conductance values of mixtures of  
(i)  $MgLt_2$  in PG and  $MgLt_2$  in PIPY  
(ii)  $NiLt_2$  in PG and  $NiLt_2$  in PIPY  
(of equal concentrations) in different mole-proportions at 30°.  
(1) 2%  $MgLt_2$ ; (2) 1.3%; (3) 0.5%; (4) PG + PIPY (control expt.)  
(a) 2%  $NiLt_2$ ; (b) 1.3%; (c) 0.5%.

TABLE

Specific conductivity ( $ohm^{-1} cm^{-1}$ )  $\times 10^{-5}$  at 30°

Figs.	Soap used	Solvent mixture	2% Soap	1.3% Soap	0.5% Soap
1	$MgLt_2$	PG + PIPY	7.2	6.55	3.6
	$NiLt_2$	"	6.16	4.84	3.1
2	$NiLt_2$	PG + DEA	3.94	3.3	1.92
	$MgLt_2$	"	2.22	1.97	1.32
3	$MgLt_2$	PG + $CHCl_3$	3.12	2.95	1.53
	$NiLt_2$	PIPY + $CHCl_3$	0.29	0.275	0.18

From the above observations, we find that at a particular mole-ratio of the two co-solvents, the environmental condition for complex formation or chelation is the most favourable (according to Winsor's Principle<sup>5-7</sup> as in solubility phenomena) causing a maximum rise in conductance. This chelation mechanism between soap and additive through the parallel principle of co-ordination of the metal atom with -NH- group and the H-bonding for the glycolic -OH with the carboxylate O-atom of soap (for Ni-soap in PG and DEA) may be empirically represented as follows :

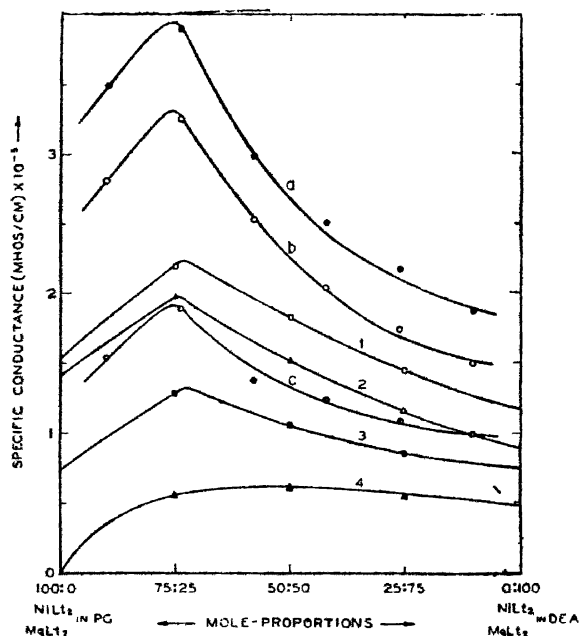
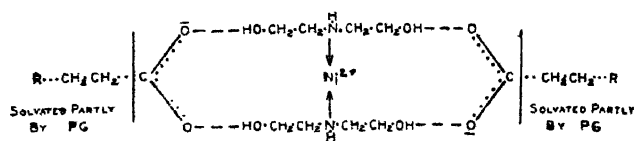


Fig. 2. Conductance values of mixtures of  
(i)  $MgLt_2$  in PG and  $MgLt_2$  in DEA  
(ii)  $NiLt_2$  in PG and  $NiLt_2$  in DEA  
(of equal concentrations) in different mole-proportions at 30°  
(1) 2%  $MgLt_2$ ; (2) 1.3%; (3) 0.5%  
4. PG+DEA (Control expt.)  
(a) 2%  $NiLt_2$ ; (b) 1.3%; (c) 0.5%

These chelate units are formed at the optimum ratio of co-solvents, causing a rise in conductivity. Also the influence of metal cation cannot be ignored in this case. For example, the structural factor of Ni, being a transition member enhances solubility and hence conductivity for its reactivity of 3d-inner electrons with -NH- group of DEA and hence more significant.

**Acknowledgement**

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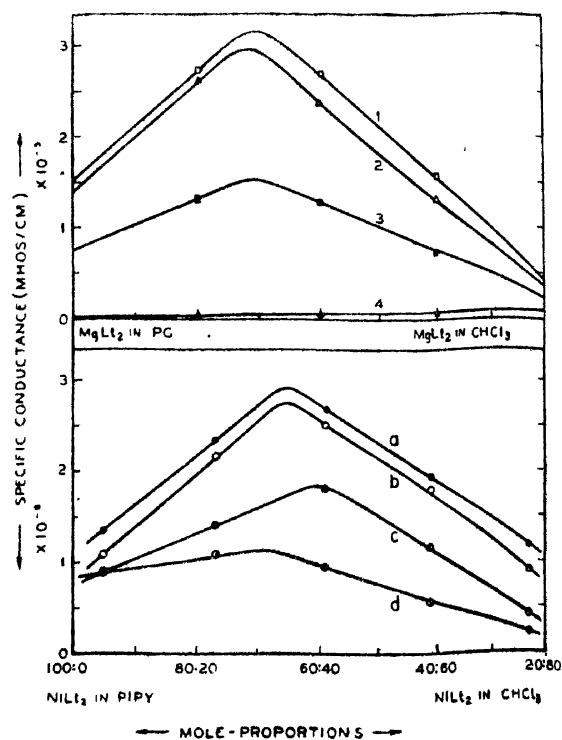


Fig. 3. Conductance values of mixtures of  
(i)  $MgLt_2$  in PG and  $MgLt_2$  in  $CHCl_3$   
(ii)  $NiLt_2$  in PIPY and  $NiLt_2$  in  $CHCl_3$   
(of equal concentrations) in different mole-proportions at 30°.  
(1) 2%  $MgLt_2$ ; (2) 1.3%; (3) 0.5%; (4) PG+ $CHCl_3$  (control expt.)  
(a) 2%  $NiLt_2$ ; (b) 1.3%; (c) 0.5%; (d) PIPY+ $CHCl_3$  (control expt.)

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