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NOTE

Studies on Pb(II), Ag(I) and Ca(II) Chelates of L-Lysine Monohydrochloride

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In the present note, stepwise stability constants of Pb(II), Ag(I) and Ca(II) chelates of L-lysine monohydrochloride are reported.

Key Words: Stability constants, Pb(II), Ag(I), Ca(II) chelates, L-Lysine monohydrochloride.

In our earlier[1–3] communication, we reported the synthesis and characterization of different metals with L-lysine monohydrochloride. Some very interesting work has been reported on compounds acting as antidotes against manganese poisoning[4, 5]. The use of L-lysine monohydrochloride as a mouthwash has been proposed by Schmitt *et al.*[6]

The careful literature survey[7–9] reveals that chelates of Ag(I), Ca(II), Pb(II) with L-lysine monohydrochloride have not yet been reported. In the present work the author reports the synthesis and properties of Ag(I), Ca(II) and Pb(II) chelates of this amino acid.

The chemicals and apparatus employed in the present investigation are the same as those reported earlier[1]. Thermogravimetric analyses were carried out using a modern thermogravimetric balance with a Toshniwal furnace at a heating rate of 10°C min^{-1}. L-Lysine monohydrochloride and its chelates with Pb(II), Ag(I), Ca(II) were isolated by the method reported earlier[1].

The chelates gave satisfactory elemental analysis and display 2 : 1 ligand : metal stoichiometry. All the metal chelates were found to be diamagnetic because unpaired electrons were absent in these chelates. Low conductivity values (5.5–7.9) of the compounds in double distilled water suggest them to be non-electrolytes.

The weight loss curve indicates that all complexes dehydrated at 65–145°C suggests that water is present in the complexes as lattice water. The major part of the reaction takes place between 160 and 450°C in all metal chelates. The end product of decomposition was obtained around 500–550°C.

The plateau occurring above 500°C corresponds to metal oxides. The results were also supported by the differential thermal analysis curves. The percentage weight loss observed for different products formed during heating almost coincides with the calculated figures.

The following principal bonds (cm^{-1}) were obtained in the IR spectra of the ligand and its chelates.

	$\nu(NH_3Cl)$	ν_{asym}(COO—)	ν_{sym}(COO—)
Ligand	2100	1560	1390
Pb(II) chelate	—	1570	1380
Ag(I) chelate	—	1590	1375
Ca(II) chelate	—	1560	1400

The band at 2100 cm^{-1} in the ligand and assigned to NH_3^+ Cl group disappears in chelates due to the fact that the chelates were isolated at pH about 8.0 and therefore an NH_3 group was deprotonated. It is well known that amino acids exist as dipolar zwitter ions in the crystalline state and therefore the two relevant IR bands of amino acids from the coordination point of view are the antisymmetric and symmetric stretching frequencies of the carboxyl group. Of these the antisymmetric (COO$^-$) stretching frequency is much more sensitive[11] than the symmetric and its value in a complex is a function of the mass, radius, charge and electronegativity of the metals. Thus any shift in $\textit{new}_{asym}$(COO$^-$) in Ag(I) and Pb(II) chelates is significantly increased to a higher value, indicating co-ordination of carboxyl group to the metal. The increase in frequency is due to the formation of (M—O) which lengthens one (C—O) bond formation, the asymmetry of the COO$^-$ group is increased and thereby ν_{asym}(COO$^-$) is also increased. It is, therefore, expected that the more covalent the character of the (M—O) bond, the more would be the shift of ν_{asym} to a higher frequency. The IR spectrum of the ligand also has a broad bond in the 3400–2800 cm^{-1} region, evidently due to (O—H) and (N—H) stretching and almost remains intact in the spectra of chelates.

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