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Analysis of some transition metal complexes with organ phosphorous compounds

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Abstract

This paper presents the Organ phosphorous ligand complexes of platinum (ii) and mercury(ii) have been synthesized by the reaction of triphenyl phosphine sulphide with metal (ii) chloride. The physical method of the complexes indicate the formulation of $[ML_2X_2]$ which are four coordinate species having square plannar and tetrahedral geometry respectively.

Keywords: Transition metal and organ phosphorous compounds

Introduction

The special properties of ligands are accentuated in the case of chelating polyphosphine also, the detail structural and bonding information in the form of metal- phosphorus and phosphorus- phosphours coupling constants can be obtained bt NMR [1-2] when the metal has a magnetic nucleus like^{103} RH,^{195}Pt. We here in report the synthesis and characterizationof a number of new complexes of mercury and platinum metal with triphenyl phosphine sulphide ligands. The interest in the studies of platinum metal complexes has also grown enormously due to catalytic behaviour of platinum metal compounds and anti cancer activity of their various complexes

Material and Method

The ligand triphenyl phosphine sulphide was prepared by refluxing triphenyl phosphine with sulphur powder in benzene solvent oversteam bath for about four hours. The resulting solution was filtered and concentrated to give cream colored crystals. It was crystallize with hot benzene to give pure product. Melting point 178^0C.
Found-C=73.72%, H=5.04% S=10.68%
Calculated for $C_{18}H_{15}PS$
C=73.46, H=5.102, S=10.884

Preparation of complexes

The bis ligated metal (ii) cholide complexes were prepared by refluxing MCl_2(M=Pt, Hg) with triphenyl phosphine sulphide ligand in 1:2 molar proportion according to the methods reported in the literature [3-5].

Results and Discussion

The bis ligated complexes have fair solubility in methanol and comman organic solvents.In DMF, Dioxane and Tetrahydrofurane however the dissolve appreciably. The complexes are insoluble in water. The DMF solutions of the complexes show negligible electrical conductance value suggesting the coordination of anion with mercury (ii). As expected the complexes are diamagnetic as required for Hg of d^{10} electronic system. The metal-ligand ratio and monodentate nature of triarylphosphine sulphide unambiguously suggested that mercury (ii) complexes are four coordinated and the structure must be pseudo-tetrahedral which is the most favorable geometry for mercury (ii) complexes. The square planer complexes of bivalent platinum of $[Pt(Pph_3.\ S)_2\ Cl_2]$ have been prepared and characterized on the basis of element analysis IR and spectral studies.

The I.R. Spectra

The IR spectra of triphenyl phosphine sulphide molecule, the phosphorous atom could never utilized in the bond formation.

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However, the P=S bond is involved in conjugated electron system of phenyl group. Therefore, coordination of sulphur atom with metal atom may affect some IR stretching and bonding bands of phenyl and (C-P) stretching vibration.

The phenyl group shows infrared vibration in finger print region 1650-650 cm^{-1} is highly sensitive to nature and the position of substituent groups. The IR stretches occurring near 3020-3080 cm^{-1} region is related to (C-H) vibration and the band is not affected appreciably by subsitutent groups 2003 [6]. The region 1650-1500 cm^{-1} is complicated IR region, since a number of donor groups viz, (C=O), (C=N),(C-N) and (HN=C=S) etc also display characteristic bands in the region[7].

The position of these bands are somewhat influenced by the nature of the subsistent but mainly depend upon the manner in which these groups are arranged around the aromatic molecules. It has been found that aromatic ring display shoulders or weak bands at 1580-1450 cm^{-1}. The latter is much closed to -CH_2-deformation vibration and therefore, difficult to distinguish. The bands at 1616 cm^{-1} and 1493 cm^{-1} assigned (C=C) skeletal vibration of aromatic ring. In near IR region, aromatic compound displays as strong band between 815-740 cm^{-1} attributed from (C-H) out of plane bending band. The ring deformation vibrations of aromatic rings are absorbed near 670,580 and 460 cm^{-1} region.

The IR spectrum of triphenyl phosphine sulphide displays strong absorption band in the region 1590-1610 cm^{-1} as weak band near 1370-1390 cm^{-1} and 1440-1460 cm^{-1} as medium band. These vibrations are phenyl ring skeletal vibration attributed from γ(C=C) and γ(C=C) vibrations.

Conclusion

The ligand and complexes display strong band near 1280-1260, 1150-1160 and 1000-1030 cm^{-1} attributed from (C-H) bending, (C-C) stretches and γ(C-P) vibrations. A strong and broad band observed in the complexes at 740-760 cm^{-1} in ligand is attributed to γ(P=S) vibration. The position of (P=S) stretch is shifted to lower frequency in complexes suggesting the involvement of sulphur atom in bond formation. Thus the spectral data taken together with the elemental analyses are consistent with the formulation of $[M(tpps)_2Cl_2]$ [M-Hg,Pt], which are four coordinate species having tetrahedral and square planar geometry respectively.

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