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Research Paper :

Cr (III), Mn (II), Fe (III), Co (II), Ni (II), Cu (II) and Zn (II) chelates with S and N containing ligand diisopropyldithiocarbamate

MOHAMMAD TARIQUE AND MOHAMMAD ASLAM

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See end of the article for authors' affiliations

Correspondence to:

MOHAMMAD TARIQUE
Department of Chemistry,
G.F. (P.G.) College,
SHAHJAHANPUR (U.P.)
INDIA

ABSTRACT

The synthesis of sulphur and nitrogen containing dithiocarbamate ligand derived from diisoproylamine as well as its coordination compounds with first series transition metals has been described. These synthesized compounds were characterized through elemental analysis, conductometric measurements and IR spectral studies. The analytical data showed the stoichiometry 1:2 and 1:3 for the compounds of the types ML_2 {M=Mn(II), Co(II), Ni(II), Cu(II) and Zn(II)} and $M'L_3${M'=Cr(III) and Fe(III)}, respectively. The conductometric measurements indicated the compounds to be non-ionic in nature. The bidentate nature of dithiocarbamato moiety was confirmed on the basis of IR spectral data.

Key words : Transition metal chelates, Dithiocarbamates, Metal complex

Dithiocarbamates the half amides of dithiocarbonic acids were discovered as a class of chemical compounds in the history of organo sulphur chemistry.[1,2] The structures of the metal dithiocarbamate are being investigated because of (a) the fact that most of their detailed structures are unknown, (b) the theoretical interests arising from the sulphur containing four membered rings present in these compounds, (c) their biological fungitoxic activity and (d) the lack correlation between structural properties of these compounds.[1] The utilities of dithiocarbamates are several from insecticides, fungicides to therapeutic agents for alcoholism and metal intoxication.[1] They have also been reported to treat acquired immune depressive syndrome and cancer.[3-5] Recently, new method for the determination of dithiocarbamate fungicidal activity has been described.[6]

Several reports on metal complexes containing dithiocarbamates are available yet the studies on first series transition metal complexes with diisopropyldithiocarbamate are scarce. In the framework of systematic study of various dithiocarbamates,[7-11] we chose diisopropyldithiocarbamato complexes with main aim to explore the coordination aspects of the ligand.

MATERIALS AND METHODS

Diisopropylamine, carbon disulphide, sodium hydroxide, salts of chromium, manganese, iron, cobalt, nickel, copper and zinc (all E. Merck) were used as received. Solvents (all BDH) were purified by standard methods[12] before use. Elemental analyses of the complexes for carbon, hydrogen and nitrogen were performed by the Regional Sophisticated Instrumentation Centre (R.S.I.C.), Central Drug Research Institute (C.D.R.I.), Lucknow (U.P.), India. Sulphur was estimated gravimetrically by known procedure.[13] Infrared spectra in the region 4000-200 cm^{-1} were recorded in Nujol mull on Perkin Elmer Model 1620 Fourier-Transform Infrared (FT-IR) spectrophotometer by Jamia Millia Islamia University, Delhi, India. Conductometric measurements were done on Systronics 321 Conductivity Bridge.

In our work replacement reaction method was adopted for the synthesis. This method involves replacement reaction using the sodium salt of the dithiocarbamate with metal salt:

$$n(RHNCS_2)Na + MX_n \rightarrow (RHNCS_2)_nM + nNaX$$

***Preparation of sodium salts of dithiocarbamate*:**

Diisopropylamine, sodium hydroxide and carbon disulphide were taken in 1:1:1 molar ratios, respectively. Sodium hydroxide 0.1 mol was dissolved in 50 ml distilled water and into it 0.1 mol diisopropylamine was added carefully with constant stirring by means of a magnetic stirrer. Then at 12-16^{0}C, 0.1 mol of carbon disulphide was added drop by drop. The stirring was continued at room temperature for about 45 minutes. On completion of the reaction solid sodium diisopropyldithiocarbamate was obtained. The separated solid salts were filtered off and washed with toluene. These were dried at 80^{0}C. These salts were soluble in water.