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Research Paper :

Studies on coordination compounds of Cr(III), Mn(II), Fe(III), Co(II), Ni(II), Cu(II) and Zn(II) with butyldithiocarbamate ligand

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ABSTRACT

Some new coordination compounds of Cr(III), Mn(II), Fe(III), Co(II), Ni(II), Cu(II) and Zn(II) with butyldithiocarbamate ligand have been synthesised satisfactorily by substitution reaction method in good yield. The characterization of newly synthesized compounds has been performed on the basis of elemental analyses, molar conductance and FT-IR spectroscopy. All the colourless to colourful complexes were inert to atmospheric oxygen and moisture at room temperature. The analytical data indicated the composition ML_2 for the chelates of Mn(II), Co(II), Ni(II), Cu(II) and Zn(II) and $M'L_3$ for those of Cr(III) and Fe(III). These complexes were observed to be non-ionic in nature. These observations revealed the symmetrical coordination by the bidentate ligand forming four membered ring.

Key words : Dithiocarbamates, Transition metals, Coordination compounds

The dithiocarbamate core, $M\text{-}S_2CNR_2$, could prove to be of great synthetic utility in radio pharmacology as a wide variety of organic substituents can be incorporated in the stable bidentate ligand.[1] In some cases the bidentate anion also acts as a bridge between two transition metal centres.[2] In recent years, the study of transition metal complexes of substituted dithiocarbamates has been a subject of considerable interest because of their structural, magnetic, electrochemical and thermal properties. Some noble work has also been done on the formation of mixed ligand dithiocarbamates of metals and mixed heterocyclic ligand dithiocarbamates.[3,4] The coordination chemistry of transition metal ions and Group (IV) metals with several new dithiocarbamate ligands derived from heterocyclic bases has also been explored by many chemists.[5-7] The synthesis of acyclic and macrocyclic transition metal dithiocarbamate complexes containing positively charged imidazolium moieties has been reported.[8]

Due to the interest in the study of sulphur and nitrogen containing ligands[9-13] this communication describes the preparation and characterization of complexes of first row transition metals with butyldithiocarbamate with the goal to observe the coordination behaviour of the dithiocarbamate moiety and some other physico-chemical characteristics of these complexes.

MATERIALS AND METHODS

Butylamine, carbon disulphide, sodium hydroxide, salts of first row transition metals (all E. Merck) were used as received. Solvents (all BDH) were purified by standard methods[14] before use. Elemental analyses of the complexes for carbon, hydrogen and nitrogen were done 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.[15] Infrared spectra in the region 4000-200 cm^{-1} were recorded in Nujol mull on Perkin Elmer Model 1620 FT-IR spectrophotometer by Jamia Millia Islamia University, New Delhi, India. Conductometric measurements were done on Systronics 321 Conductivity Bridge.

The metal dithiocarbamate complexes may be synthesized either by insertion reaction method or by substitution reaction method. In the present work the second method was adopted for the synthesis.

Butylamine, 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 of Butylamine, was added carefully with constant stirring by means of a magnetic stirrer. 0.1 mol of carbon disulphide was then added drop by drop keeping the temperature, 12-16^{0}C. The stirring was continued at room temperature for about 45 minutes. On completion of the reaction solid sodium butyldithiocarbamate was obtained. The separated solid salt was filtered off and washed with toluene. It was dried at 80^{0}C. This salt was soluble in water.

In appropriate molar ratio (1:2), the 0.01 M solutions of metal salts of the type MCl_2 were added to 0.02 M aqueous solution of sodium butyldithiocarbamate dissolved in distilled water at 20^{0}C. In 1:3 molar ratio, 0.01 M