

Synthesis, structural and magnetic properties of mono- and trinuclear Co(II) complexes.

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Co(II) complexes are of particular interest for developing magnetic and optical materials because of (a) variable coordination geometries (i.e. octahedral, tetrahedral, etc.), (b) significant stability in the air, (c) two different spin states ($s = 3/2$ and $1/2$) depending on the ligand field, (d) different electronic structures and color, and (e) large orbital moment through a spin orbit coupling in octahedral geometry.

Heterocyclic N-donor ligands are widely used in assembling complexes which exhibit interesting magnetic properties. Carboxylate groups display a variety of binding geometries, such as monodentate, terminal, chelating, bidentate bridging and monodentate bridging in coordination chemistry. The reactions of cobalt(II) acetate with 2-ethylbenzimidazole (2-etbz) or with 1,10 – phenanthroline (phen) were observed at a ratio of 1:1 methanol – acetonitrile solution. Two kinds of complexes were isolated: mononuclear $[\text{Co}(2\text{-etbz})_2(\text{OAc})_2]$, (1) and linear trinuclear $[\text{Co}_3(\text{phen})_2(\text{OAc})_6]$, (2). The structures of complexes 1, 2 were determined by X-ray diffraction analysis. The complex 1 crystallizes in the monoclinic system and the centrosymmetric space group P21/n. The structure of complex 1 confirms a tetrahedral coordination with CoN_2O_2 chromophore. Several groups have reported cobalt(II) coordination compounds showing a similar stoichiometry $[\text{Co}(\text{bz})_2\text{X}_2]$ ($\text{X}^- = \text{Cl}, \text{Br}, \text{I}$) [1]. In all cases, the geometry adopted by the metal ion is tetrahedral. The complex 2 crystallizes in the triclinic system and the space group P-1. The structure of 2 consist of linear trinuclear molecules; each pair of cobalt atoms are bridged by three acetate ligands to the central Co(2) atom, which is located at an inversion center. Two of them acting as a monoatomic bridge plus bidentate chelating mode, at a distance of 2.373 Å. The coordination environment of Co(2) is completed by two N atoms of phen ligand to form a distorted CoN_2O_4 octahedron and the Co(1) has a CoO_6 octahedral geometry. The $\text{Co}_3(\text{OAc})_6$ core is similar to those found in $[\text{Co}_3(\text{bipy})_2(\text{OAc})_6]$. [2]

The objectives of this contribution are high-spin Co(II) monomer and linear trimer in various coordination. Magnetic data, reported in literature, for the high-spin Co(II) complexes are reviewed. The investigation of high-spin Co(II) monomer in distorted tetrahedral coordination and distorted octahedral coordinated linear trimer is presented.

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