Coordination Compounds of Fe^{3+}, Co^{2+} and Ni^{2+}, with (1-Amino-1-methyl-ethyl)phosphonic Acid and a New Schiff Base Ligands

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In the last decade, there has been a great interest in the phosphonic acid-based molecular complexes and coordination polymers. Because the M-O-P bonds are 1.5 times stronger then M-O-C bonds in carboxylates, phosphonates were used in the role of molecular precursors for the synthesis of new materials, such as polynuclear metal phosphonates, layered compounds, and porous metal-organic frameworks, with a wide range of properties and different applications. Phosphonate mononuclear complexes or molecular clusters with paramagnetic metal cations are very interesting objects because of their magnetic properties. We synthesized and isolated new molecular complexes and coordination polymers of AIPA ((1-amino-1-methyl-ethyl)phosphonic acid), Na_2SAA (disodium hydrogen (2-{[(*E*)-(2-oxidophenyl)methylidene]amino}propan-2-yl)phosphonate) and Na_2BSAA (sodium hydrogen(2-{[(*E*)-(5-bromo-2-hydroxyphenyl)methylidene]amino} propan-2-yl) phosphonate) ligands with Fe^{3+}, Ni^{2+} and Co^{2+}. Their properties were studied by a variety of physicochemical methods including structural analyses by single-crystal X-ray diffraction methods. Their magnetic properties were studied on a SQUID magnetometer. Among the most interesting results obtained in this study are isolation and characterization of hexanuclear iron(III) phosphonate $Fe_6(NH_3(CH_3)_2CPO_3)_{12}(OH)_6].31H_2O$, a 1D coordination polymer of Fe with the SAA ligand, a series of heptanuclear Co^{2+} phosphonates with a Star-of-David structural motif, and a coordination polymer of Ni^{2+} with SAA ligands. Beside that, mononuclear isostructural complexes of Ni^{2+} and Co^{2+} with AIPA were obtained and characterized. The presence of non-coordinated active groups in the complexes with described phosphonic ligands makes these compounds potential precursors for the synthesis of new extended structures.