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Abstract

One-Dimensional Coordination Polymers Constructed from Bimetallic Vanadium(V) Complex: Synthesis, Crystal Structure and Catalytic Activity †

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Coordination polymers containing different metal ions and ligands have been widely studied in materials science and synthetic chemistry. For constructing a coordination polymer, the most useful method is to employ an appropriate bridging ligand. Many multidentate ligands bind to two metal ions in two different directions, which shows bridging capability via simultaneous ligations. In our study, we selected N′1-((E)-2-hydroxybenzylidene)-N′2-(2-hydroxybenzylidene)oxalohydrazide (L), which is a multidentate ligand that can bind to metal ions from more than one donor's atom. The ligand (L) was synthesized by reaction of oxalyldihydrazide (Sigma Aldrich, Saint Louis, MO, USA) with salicylaldehyde (Sigma Aldrich, Saint Louis, MO, USA) in 1:2 molar ratios in ethanol (Sigma Aldrich, Saint Louis, MO, USA). In the first step, the coordination polymers were prepared by reacting the ligand (L) with vanadium acetylacetonate (Sigma Aldrich, Saint Louis, MO, USA), which yielded a dioxidovanadium(V) complex. In the second step, dioxidovanadium(V) complex was then reacted with sodium carbonate (Tata Chemicals, Maharashtra, India) in ethanol solution, resulting in the formation of the one-dimensional vanadium(V) coordination polymer. A novel one-dimensional metal-based coordination polymer of the composition $[VNaO_6C_{11}H_{14}N_3]_n$ was characterized by IR (BX-III/FTIR Spectrophotometer, Bruker Corporation, Billerica, MA, USA) and NMR (Bruker Avance II 400 instrument (Bruker Corporation, Billerica, MA, USA), and the structure was established by single-crystal X-ray crystallography (Xcalibur, Oxford Diffraction, Yarnton, UK, diffractometer). The coordination sphere of the vanadium atom is square pyramidal and chelates to a tridentate (-ONO-) ligand, while the square pyramidal conformation of the sodium atom consists of one bridging oxygen atom link to the vanadium atom and the ligand which coordinates in a bidentate fashion. The coordination polymer showed very selective homogeneous catalytic activity with 80-96% conversion in oxidative bromination of the organic substrate under mild conditions.

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