Coordination Polymers Constructed from Bis-pyridyl-bis-amide and 1,4,5,8-Naphthalenetetracarboxylic Acid: Ligand Transformation and Metal Ion Sensing

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Keywords: Coordination Polymer; Hydrothermal Reactions; Topology; Metal Ion Sensing;

Hydrothermal reactions of 1,4,5,8-naphthalenetetracarboxylic acid (1,4,5,8-H_4NTC) with various bis-pyridyl-bis-amide, *N,N'*-di(pyridin-3-yl)adipamide (**L**^{1}), *N,N'*-di(pyridin-3-yl)succinamide (**L**^{2}), *N,N'*-di(pyridin-3-yl)oxalamide (**L**^{3}) or *N,N'*-bis(pyridin-3-ylmethyl)oxalamide (**L**^{4}) and transition metal salt afforded seven coordination polymers (CPs) and one dinuclear complex, including $[Cd(\mathbf{L}^{1})_{0.5}(1,4,5,8\text{-NTC'})(H_2O)_2]_n$ (1,4,5,8-H_2NTC' = 1,4,5,8-naphthalenetetracarboxylic acid 1,8-monoanhydride), **1**, $\{[Zn(\mathbf{L}^{2})_{0.5}(1,4,5,8\text{-NTC'})(H_2O)_2]\cdot H_2O\}_n$, **2**, $\{[Cd(\mathbf{L}^{2})_{0.5}(1,4,5,8\text{-NTC'})(H_2O)_2]\cdot H_2O\}_n$, **3**, $\{[Zn(\mathbf{L}^{5})(1,4,5,8\text{-NTC'})(H_2O)]\cdot 0.5OA\}_n$, {**L**^{5} = 2,7-di(pyridin-3-yl)benzo[lmn][3,8]phenanthroline-1,3,6,8(2H,7H)-tetraone}, **4**, $[Cd(\mathbf{L}^{5})(1,4,5,8\text{-NTC'})(H_2O)]_n$, **5a**, $\{[Cd(\mathbf{L}^{5})(1,4,5,8\text{-NTC'})(H_2O)]\cdot 2H_2O\}_n$, **5b**, $[Zn_2(\mathbf{L}^{4})(1,4,5,8\text{-NTC'})_2(H_2O)_6]$, **6**, and $\{[Cd(\mathbf{L}^{4})(1,4,5,8\text{-NTC})_{0.5}(H_2O)]\cdot 0.5H_2O\}_n$ (1,4,5,8-H_4NTC = 1,4,5,8-naphthalenetetracarboxylic acid), **7**. These CPs and dinuclear complex were structurally characterized by using X-ray single-crystal diffraction. CPs **1**, **2**, and **3** exhibit one-dimensional (1D) structures with the 2,3C2 topology and **4** and **5** display two-dimensional (2D) structures with the 2,4L1 topology, whereas **6** is a dinuclear complex and **7** shows a three-dimensional (3D) framework with the **mog** topology. Ligand transformations from 1,4,5,8-H_4NTC to 1,4,5,8-NTC'$^{2-}$ and **L**^{3} to **L**^{5} are observed. The evaluation of the metal ion sensing properties of **1**, **2**, **3**, **6**, and **7** shows that **7** has the highest potential for detecting Fe^{3+} ions in aqueous solution with 1.06×10^{3} M^{-1} and 1.99×10^{-4} M for the Stern-Volmer constant (K_{SV}) and the limit of detection (LOD), respectively.