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Six metal-organic frameworks assembled from asymmetric triazole carboxylate ligands: synthesis, crystal structures, photoluminescence properties and antibacterial activities

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Abstract

Based on an asymmetric 1-(2-carboxyethyl)-1*H*-1,2,4-triazole-3-carboxylic acid (H₂ctp), six new MOFs [Cd(ctp)(H₂O)]_n (**1**), [Cd₂(ctp)₂(phen)]_n (**2**) [phen=1,10-Phenanthroline monohydrate], [Cd₂(ctp)₂(pbbbm)(H₂O)₂]_n (**3**) [pbbbm=1,4-bis(benzimidazole-1-ylmethyl)benzene], [Mn(ctp)(H₂O)]_n (**4**), {[Pb₂(ctp)₂·H₂O]}_n (**5**) and [Cu(ctp)(H₂O)₂]_n (**6**) have been synthesized and structurally characterized by single-crystal X-ray diffraction, elemental analysis and IR spectroscopy. **1**, **4** and **5** display (4,4)-connected 3-D frameworks which all can be simplified into the Schläfli symbol of (4²·6³·8) with *sra* topology, while **2** is also a (4,4)-connected 3-D network which has the Schläfli symbol of (4²·8⁴) with *pts* topology. **3** exhibits a 2-D structure with 3,4L83 topology and **6** is a 1-D chain structure. The fluorescent properties of **1-3** and **5** have been studied in the solid state at room temperature. **5** has significantly stronger fluorescence emission than **1-3** due to its crystal structure features. The antibacterial activities of **1-6** against four strains bacteria of *Bacillus subtilis*, *Staphylococcus aureus*, *Salmonella enteritidis* and *Escherichia coli* have been examined. The results indicated that **2** has better activity against *Bacillus subtilis* than **1**, **3**, **4** and **6** due to the effect of chelation, auxiliary ligands and the Cd(II) ion with the feature of strong toxicity.

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