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Bioactive silver—organic networks assembled from 1,3,5-triaza-7-phosphaadamantane and flexible cyclohexanecarboxylate blocks.

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Streszczenie

Three novel bioactive silver–organic networks, namely, the 2D polymer $[Ag(\mu_3\text{-PTA})(chc)]_n \cdot n(Hchc) \cdot 2nH_2O$ (**1**), the 3D bioMOF $[Ag_2(\mu_3\text{-PTA})_2(\mu_2\text{-chdc})]_n \cdot 5nH_2O$ (**2**), and the 2D polymer $[Ag_2(\mu_2\text{-PTA})_2(\mu_4\text{-}H_2chtc)]_n \cdot 6nH_2O$ (**3**), were constructed from 1,3,5-triaza-7-phosphaadamantane (PTA) and various flexible cyclohexanecarboxylic acids as building blocks {cyclohexanecarboxylic (Hchc), 1,4-cyclohexanedicarboxylic (H_2chdc), and 1,2,4,5-cyclohexanetetracarboxylic (H_4chtc) acid, respectively}. The obtained products **1**–**3** were fully characterized by IR and NMR spectroscopy, ESI-MS(±) spectrometry, elemental and thermogravimetric (TGA) analyses, and single-crystal and powder X-ray diffraction. Their structural diversity originates from distinct coordination modes of cyclohexanecarboxylate moieties as well as from the presence of unconventional *N,N,P*-tridentate or *N,P*-bidentate PTA spacers. Topological classification of underlying metal–organic networks was performed, disclosing the **hcb**, **4,4L28**, and a rare **fsc-3,4-*Pbcn*-3** topology in **1**, **2**, and **3**, respectively. Moreover, combination of aqueous solubility ($S_{25°C}$ ≈ 4–6 mg mL^{-1}), air stability, and appropriate coordination environments around silver centers favors a release of bioactive Ag^+ ions by **1**–**3**, which thus act as potent antibacterial and antifungal agents against Gram-positive (*S. aureus*) and Gram-negative (*E. coli* and *P. aeruginosa*) bacteria as well as a yeast (*C. albicans*). The best normalized minimum inhibitory concentrations (normalized MIC) of 10–18 (for bacterial strains) or 57 nmol mL^{-1} (for a yeast strain) were achieved. Detailed ESI-MS studies were performed, confirming the relative stability of **1**–**3** in solution and giving additional insight on the self-assembly formation of polycarboxylate Ag–PTA derivatives and their crystal growth process.

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