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Bioactive silicone composed of porous 3D Cu-MOF

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Recently, owing to their high porous and regular structure properties, MOFs (metal organic frameworks) make possible to expand in biology and medicine. Transition metal ions and metal nanoparticles containing Cu, Zn, Co, and Ag have gained prominance as substitutes for new antibacterial agent to effect on bacteria. However, it is known that excessive metal ions leached from metal nanoparticles would be harmful to the normal tissue as well as to bacteria. To solve these leakage problems, many researchers tried to trap the metal ion in MOF through coordination of bioactive metal ion to organic ligands. New antimicrobial materials composed of robust and porous Cu-MOFs are designed in consideration of the inherent characteristics of the metal and organic ligand such as oxidation number, counter ion, the coordination mode, the size and bridging property of the ligand. We introduce here, porous three-dimensional Cu-MOF representing antibacterial effect as well as high selective gas sorption synthesized by hydrothermal reaction. Bioactive Cu-MOF containing Cu_2 dinuclear units connected by flexible glutarate and 1, 2-bis(4-pyridyl)ethane ligands are formulated as $[Cu_2(Glu)_2(\mu\text{-bpa})]\cdot 3(H_2O)$ (Glu = glutarate, bpa = 1,2-bis(4-pyridyl) ethane). The single crystal X-ray study showed that Cu-MOF contains paddle-wheel Cu_2 dinuclear units connected by glutarates to form two-dimensional (2D) sheets, and these sheets were bridged by 1, 2-bis(4-pyridyl)ethane ligand to form three-dimensional (3D) frameworks. The number of solvent water molecules in MOF was calculated from elemental analysis and TGA. The solvent-free Cu-MOF has 28.3% of void volumes based on the PLATON analysis and contain well-defined 1D channels. Porous 3D Cu-MOF exhibited high selective sorption of quadrupolar CO_2 over N_2 and H_2. The bactericidal rates of Cu-MOF applied on the silicone rubber against *E.coli, S. aureus* and *MRSA* were observed 88.6%, 88.7 %, and 81.5%, respectively and Cu-MOF showed the possibility of new material for bioactive commercial applications.

Recent Publications:

1. Islas M S, et al. (2014) Antitumoral, antihypertensive, antimicrobial, and antioxidant effects of an octanuclear copper(II)-telmisartan complex with an hydrophobic nanometer hole. Inorg. Chem. 53:5724–5737.
2. Lu X, et al. (2014) Silver carboxylate metal-organic frameworks with highly antibacterial activity and biocompatibility. J. Inorg. Biochem. 138:114–121.
3. Liu Z, et al. (2014) Synthesis of polyethylenimine (PEI) functionalized silver nanoparticles by a hydrothermal method and their antibacterial activity study. Mater. Sci. Eng. C 42:31–37.
4. Horcajada P, et al. (2012) Metal-organic frameworks in biomedicine. Chem. Rev. 112: 1232–1268.
5. Horcajada P, et al. (2010) Porous metal-organic-framework nanoscale carriers as a potential platform for drug delivery and imaging Nat. Mater. 9:172–178.

Biography

Do Nam Lee received her BS and MS from Yonsei University in Chemistry. She earned her PhD from Yonsei University (1992) under the supervision of Professor Chang Hwan Kim and completed Post-doctorate as a Member of the group of Professor Robert West at University of Wisconsin-Madison. She worked as Visiting Scholar at Peking University. She is currently an Associate Professor at Kwangwoon University, Republic of Korea and mostly focusing on researches of synthesis and application of coordination complexes, functional metal organic frameworks, and polymers.

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