Bioactivities of Porous 3D Cu-MOF Containing Flexible Ligands and Its Application to Silicone

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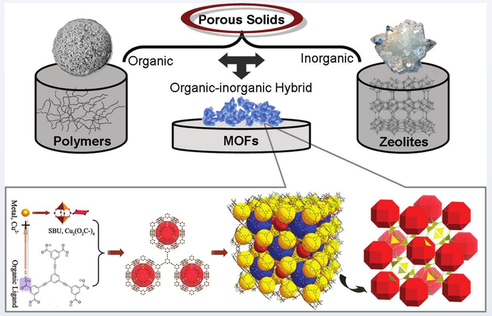
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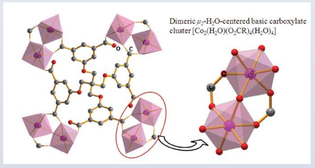
I. Introduction

▶ Metal Organic Framework(MOF)

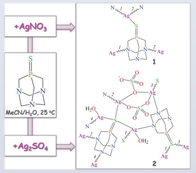


Li, Sculley and Zhou, *Chem. Rev.* **2012**, *112*, 869-932.

▶ Reported bioactive MOFs



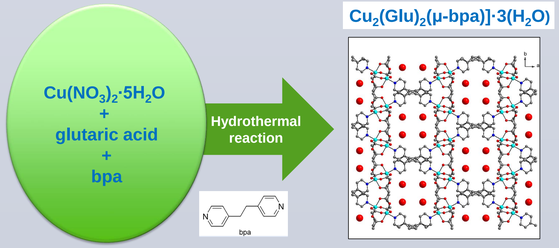
Wenjuan Z. et al *Adv. Healthcare Mater.* **2012, *1, 225–238***



Sabina W. et al. *CrystEngComm*, **2013**,*15*, 8060

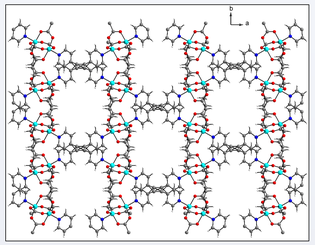
II. Result and Discussion

A. Synthesis of bioactive 3D Cu-MOF

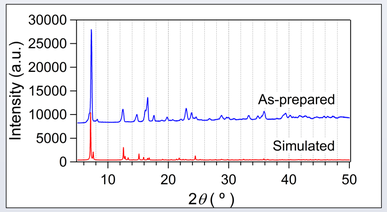


I. H. Hwang et al *Dalton Trans.* **2012,** *41*, 12759-12765.

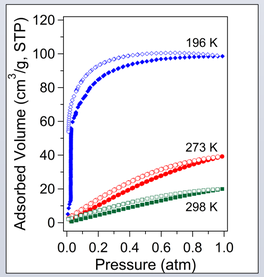
B. Illustration of the solvent accessible void and PXRD patterns



Void volume without water solvent molecules: 26.5 %



C. CO_2 sorption isotherms at 196 K, 273 K, and 298 K



D. Antibacterial test of Cu-Glu-bpa/Silicone (Cu-Glu-bpa/Si)

▶ **Preparation of Cu-Glu-bpa/Silicone**

Silicone rubber(ShinEtsu) + Cu-Glu-bpa

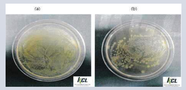
▶ **Antibacterial test samples**

Blank : Stomarker film 5cm x 5cm,
Sample : Silicone rubber 5cm x 5cm

▶ Test strains

- *Escherichia coli* (ATCC 8739)
- *Starphylococcus aureus* (ATCC 6538p)
- *MRSA* (ATCC 33591)

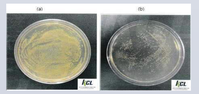
Test Items		Test Results: Early Conc. (CFU/mL)	After 24h, Conc. (CFU/mL)	Reduction rate of bacteria (%)	Test Method	Test Environment
Antibacterial test for *Escherichia coli*	BLANK	1.2 x 10^5	3.8 x 10^6	-	KCL-FIR-1003 : 2011	Temp. (37.0±0.2)℃, Conc. 100ppm
	Cu-Glu-bpa/Si	1.2 x 10^5	4.3 x 10^5	88.6		
Antibacterial test for *Starphylococcus aureus*	BLANK	1.6 x 10^5	2.2 x 10^6	-		
	Cu-Glu-bpa/Si	1.6 x 10^5	2.7 x 10^5	87.7		
Antibacterial test for *MRSA*	BLANK	3.0 x 10^5	9.8 x 10^5	-		
	Cu-Glu-bpa/Si	3.0 x 10^5	1.8 x 10^5	81.6		



E. coli



S. aureus



MRSA

E. Transesterification of esters by methanol in the presence of Cu-MOF



All esters were completely converted to the corresponding products, methyl acetate and methyl benzoate. Reaction conditions: esters; 0.05 mmol, catalyst; 8.2 × 10^{-3} mmol for **1**, solvent; methanol (1 mL).
[b] Time necessary for the complete conversion of substrate to product. [b] The solvent was a mixture of CH_3OH/CH_2Cl_2 (1/1) because of low solubility of substrate in CH_3OH.

Entry	Substrates	Time (d)[a]
1	4-Nitrophenyl acetate	0.3
2	Phenyl acetate	2
3	4-Methylphenyl acetate	5
4	4-Nitrophenyl benzoate[b]	3
5	4-Chlorophenyl benzoate	4
6	Phenyl benzoate	8
7	4-Methylphenyl benzoate	10
8	Vinyl acetate	0.3

III. Conclusion

▶ We synthesized porous 3D Cu-MOF containing flexible glutarate and 1,2-bis(4-pyridyl) ethane(bpa) ligands by hydrothermal reaction and applied it to silicone rubber for developing new antibacterial material.

▶ The solvent-free Cu-MOF has 26.5% of void volumes based on the PLATON analysis and 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 candidate for bioactive commercial applications.

▶ All esters were completely converted to the corresponding products, methyl acetate and methyl benzoate in the presence of Cu-MOF.

Acknowledgment

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