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Hussein Rasool Abid, Zana Hassan Rada, Jin Shang, Shaobin Wang

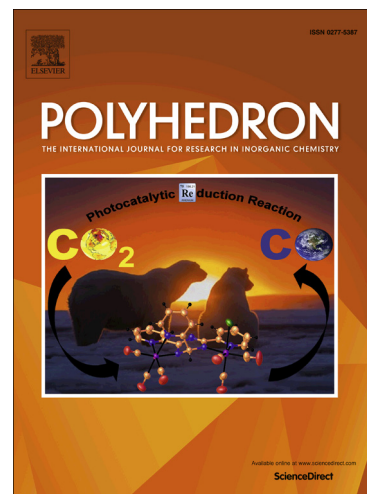
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# Synthesis, Characterization, and CO<sub>2</sub> Adsorption of three Metal-Organic Frameworks (MOFs): MIL-53, MIL-96, and Amino-MIL-53

Hussein Rasool Abid<sup>a,b</sup>, Zana Hassan Rada<sup>b</sup>, Jin Shang<sup>c,\*</sup>, and Shaobin Wang<sup>b,\*</sup>

<sup>a</sup>Environmental Health Department, Applied Medical Science, GPO Box 1152, Karbala University, Karbala, Iraq.

<sup>b</sup>Department of Chemical Engineering, Curtin University, GPO Box U1987, Perth, WA, 6845, Australia.

<sup>c</sup>Department of Chemical and Biomolecular Engineering, The University of Melbourne, Victoria 3010, Australia.

\*Corresponding authors. Tel: +61-8-9266 3776 Fax: +61-8-9266 2681 (S. Wang).

E-mail addresses: [jin.shang@unimelb.edu.au](mailto:jin.shang@unimelb.edu.au) (J. Shang),

[shaobin.wang@curtin.edu.au](mailto:shaobin.wang@curtin.edu.au) (S. Wang).

**Abstract:** In this study, MIL-53, MIL-96, and amino-MIL-53 were prepared, characterized, and tested for CO<sub>2</sub> adsorption. These metal-organic frameworks (MOFs) exhibit different characteristics, although MIL-53 and amino-MIL-53 have the same topology. The BET surface areas are 1519, 687, and 262 m<sup>2</sup>/g for MIL-53, MIL-96, and amino-MIL-53, respectively. They exhibit different thermal stability with MIL-53 having the highest stability which starts to decompose at 773 K, while amino-MIL-53 and MIL-96 show lower thermal stability, decomposing upon heating up to 650 and 570 K, respectively. Static adsorption of CO<sub>2</sub> at 1 bar and 273 K was conducted, showing CO<sub>2</sub> adsorption capacities of 64, 124, and 48 cc/g for MIL-53, MIL-96, and amino-MIL-53, respectively. The heat of adsorption for CO<sub>2</sub> was found to be 39, 28.6, and 28 kJ/mol for MIL-53, MIL-96, and amino-MIL-53, respectively. Dynamic adsorption experiment shows that MIL-53 achieves the highest working capacity among all three materials around 169 cc/g at 1 bar and room temperature (304 K). Amino-MIL-53 shows a dynamic adsorption capacity of 121 cc/g at the same conditions and MIL-96 demonstrates a dynamic adsorption of 98.2 cc/g at 1 bar and 298 K. The higher working capacity demonstrated by MIL-53 and amino-MIL-53 are attributed to their larger pore size, making them promising candidate adsorbents for practicing carbon capture in real-world applications.

**Keywords:**

CO<sub>2</sub> Adsorption

MIL-53

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