**Al-based MOF upscaling for adsorption applications**

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Metal-Organic Frameworks (MOFs), particularly HKUST-1, ZIF-8 and Al-based MOFs, are promising candidates for various applications in particular, Catalysis, thermal heat management, and enhanced gas storage and separation. Unfortunately, significant challenges remain in the synthesis of these materials, particularly low yields (<90%) and the use of metal salts. This requires extensive washing, which generates large volumes of aqueous waste containing both organic compounds and salts that must be treated before disposal. The viability of such synthetic approaches at large industrial scale therefore remains questionable.

We present here an alternative, scalable route for the production of HKUST-1, ZIF-8 and Al-based MOFs that generates no waste and requires no workup steps.

For Al-based MOF as an example, the use of aluminium alkoxides enables yields approaching 100%, with alcohols as the only co-product, which can be recovered by simple evaporation. This synthesis approach has been successfully demonstrated at the 100 kg scale for Al-fumarate [1] and MIL-160 [2].

The applications of Al-fumarate as a desiccant for adsorption chiller will be described. It surpasses state of the art silica-based technology by large and offer for the first time solutions for adsorption chiller operating at temperature as low as 55°C.

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Figure 1: Calibrated Al-fumarate grains obtained at spray-drier pilot (left) and schematic representation of the all-in-one designed synthesis process (right).

**References**

[1] M. Perbet, et al. Ind. Eng. Chem. Res. 2025, 64, 12, 6541–6549

[2] M. Perbet, et al. ChemComm, Accepted article - DOI: 10.1039/D5CC03405A