Application of Shaped UiO-66_NH2 Metal-Organic Framework for Gaseous Iodine Capture

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Metal-organic frameworks (MOF) is an emerging class of crystalline and porous materials. Their structure results from the combination of metal clusters (or ions) with multitopic organic linkers. By changing the metal or the linker, or by adding organic functionalities to the linker, the physicochemical properties of the MOF can be tailored for specific applications. For instance, iodine-131 is a major fission by-product which can increase the incidence of thyroid cancers. Following a nuclear meltdown, venting is conducted to avoid overpressurization. The vented steam, containing radionuclides such as $^{131}I_2$, passes through a filtered containment venting system to capture the contaminants. Typically, a fixed bed of silver-doped ZSM-5 zeolite is used. However, several limitations remain due to the small pore aperture of the zeolite (0.55 nm), hardly accommodating bulky iodine derivatives, and the competitive adsorption of contaminants (mainly CO). Hence adsorbents more specific towards I_2 and its derivatives, presenting larger pores and/or higher iodine capture capacity, remain desired.

In particular, the UiO-66 MOF presents a good stability against water, a high adsorption capacity, and larger pore sizes (0.8 to 1.1 nm). By adding amino moieties on the terephthalate linker, one can obtain UiO-66_NH_2, an adsorbent with high binding energy towards electro-acceptors such as I_2 [1]. Recently, our group applied severe nuclear accidental conditions to this MOF, previously shaped as binderless granules, showing high retention of $^{131}I_2$ and preserved physicochemical properties [2]. In a subsequent step, we studied the preparation of UiO-66_NH_2-based extrudates and granules that present both high adsorption capacity towards iodine (see Figure 1) and a significantly improved mechanical resistance [3]. The main results and perspectives of this work will be discussed.

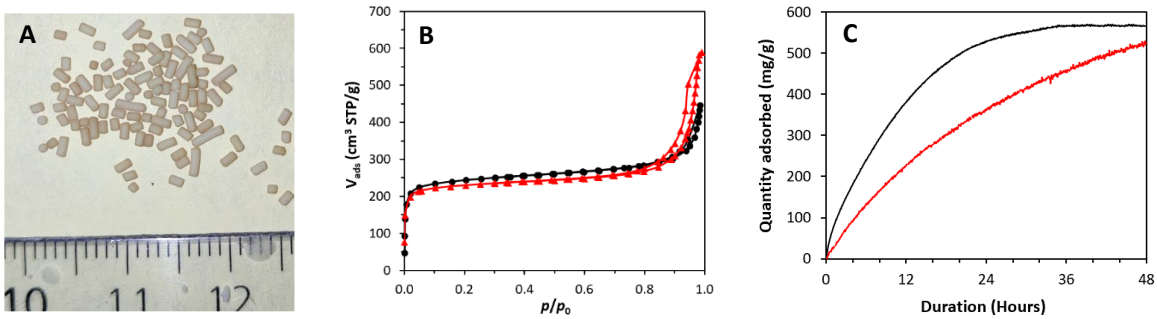

Figure 1: *UiO-66_NH_2@chitosan granules (A) and their relative N2 isotherms (B, red) and iodine adsorption kinetic curve (C, red) compared to their powder counterpart (black).*

References:

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