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Summary: 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-acceptor species such as I_2. 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.[1] In a subsequent step, we studied the preparation of UiO-66_NH$_2$-based extrudates and granules with improved mechanical properties by adding biopolymers. With lesser than 5 wt.% of chitosan, the textural properties of the resulting composites are barely affected - in line with the chitosan loading, and as-prepared materials present both high adsorption capacity towards iodine (see Figure 1.A-B) and a significantly improved mechanical resistance.[2] Still, shifting from a fixed bed of powder to a fixed bed of granules has consequences over the adsorption kinetics, with gaseous I_2 diffusing in-between the granules. Hence, in a next step, we prepared composite films with up to 60 wt.% of UiO-66_NH$_2$ MOF (Figure 1.C). By doing so, the adsorption equilibrium was reached within 24 h as per the MOF powder. Moreover, the total quantity of I_2 adsorbed correspond to the loading of the MOF, meaning that up to 40 wt.% of chitosan, the porosity of the MOF remains fully accessible. The main results and perspectives of these works will be discussed.

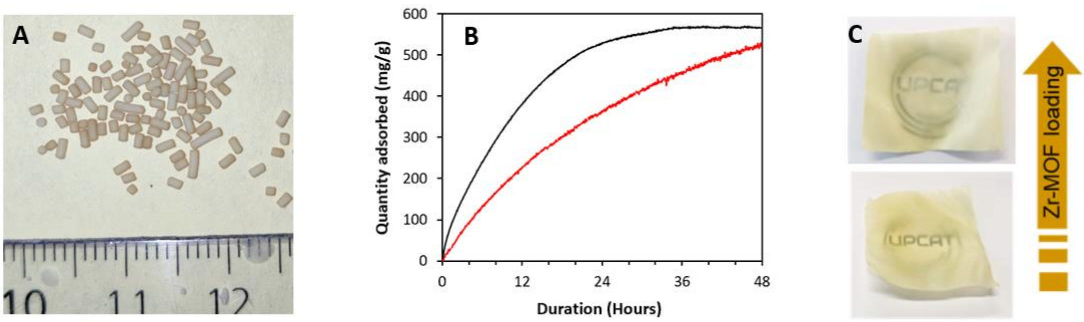

Fig. 1 UiO-66_NH$_2$@chitosan granules (A) and their relative iodine adsorption kinetic curve (B, red) compared to their powder counterpart (B, black). UiO-66_NH$_2$@chitosan films with various MOF loadings (B).

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