membranes

MDPI

Supplementary Materials

A Straightforward Method to Prepare MOF-Based Membranes Via Direct Seeding of MOF-Polymer Hybrid Nanoparticles

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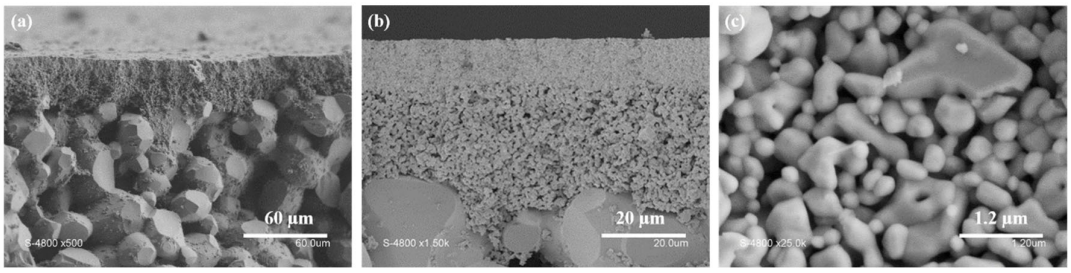

Figure S1. SEM images for (**a**,**b**) cross-section and (**c**) top view of α-alumina tubular membrane supports.

Table S1. Experimental parameters for the synthesis of UiO-PMAA-*b*-PMMA NPs and UiO-NH_2-PMAA-*b*-PMMA NPs.

NPs	$ZrCl_4$ (mmol)	Organic Linker (mmol)	PMAA-*b*-PMMA (mmol)[a]	PMAA-*b*-PMMA 20 wt% in EtOH (mg)[b]
UiO-PMAA-*b*-PMMA	0.5	0.5	3.2×10^{-3}	290
UiO- NH_2-PMAA-*b*-PMMA	0.5	0.5	3.2×10^{-3}	290

[a] One polymer chain of PMAA-*b*-PMMA containing 64 units of carboxylic functions.[b] Average molecular weight of PMAA-*b*-PMMA is calculated from $PMAA_{64}$-*b*-$PMMA_{124}$.

Characterization results for UiO-NH_2-PMAA-*b*-PMMA NPs

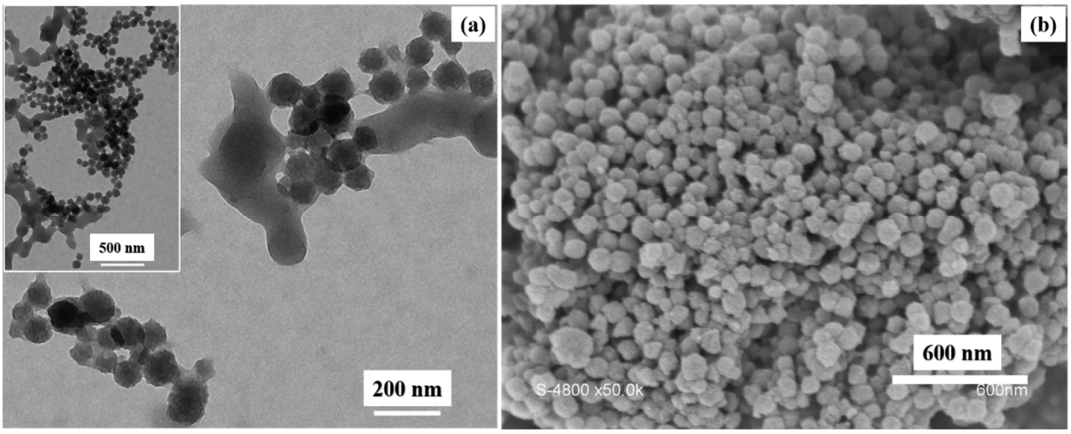

Figure S2. (**a**) TEM and (**b**) SEM images of UiO-NH_2-PMAA-*b*-PMMA NPs.

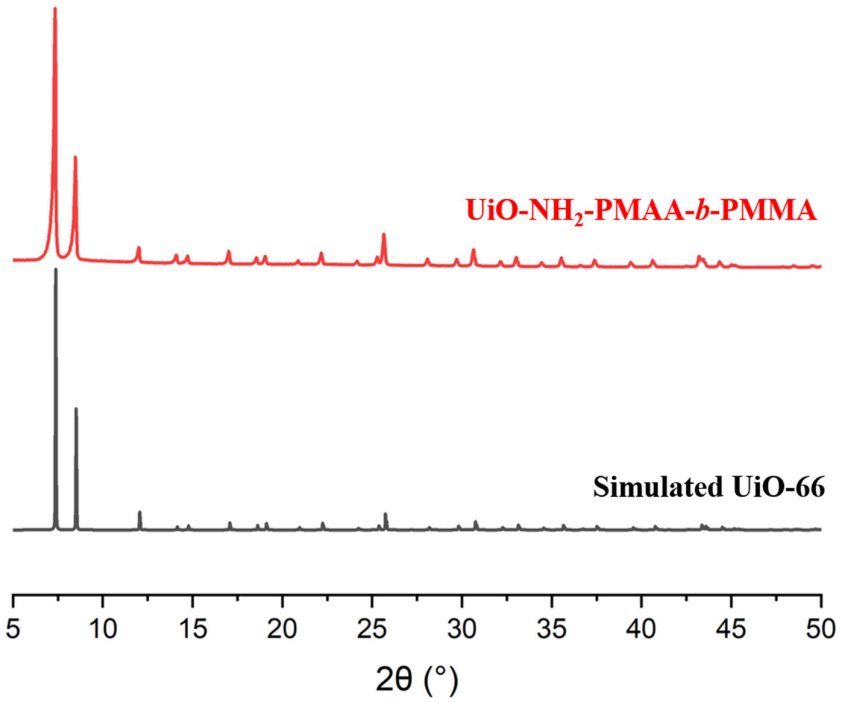

Figure S3. XRD patterns of UiO-NH_2-PMAA-*b*-PMMA powder (red) and simulated UiO-66 patterns (black) [1].

Powder XRD (Figure S3) of UiO-NH_2-PMAA-*b*-PMMA pattern show first two main peaks at 7.40° and 8.55° (2θ) charactering the formation of UiO-66 structure. The diffraction peaks are sharp and intense indicating that the presence of PMAA-*b*-PMMA NPs does not affect the crystalline phase growth of the UiO-66-NH_2.

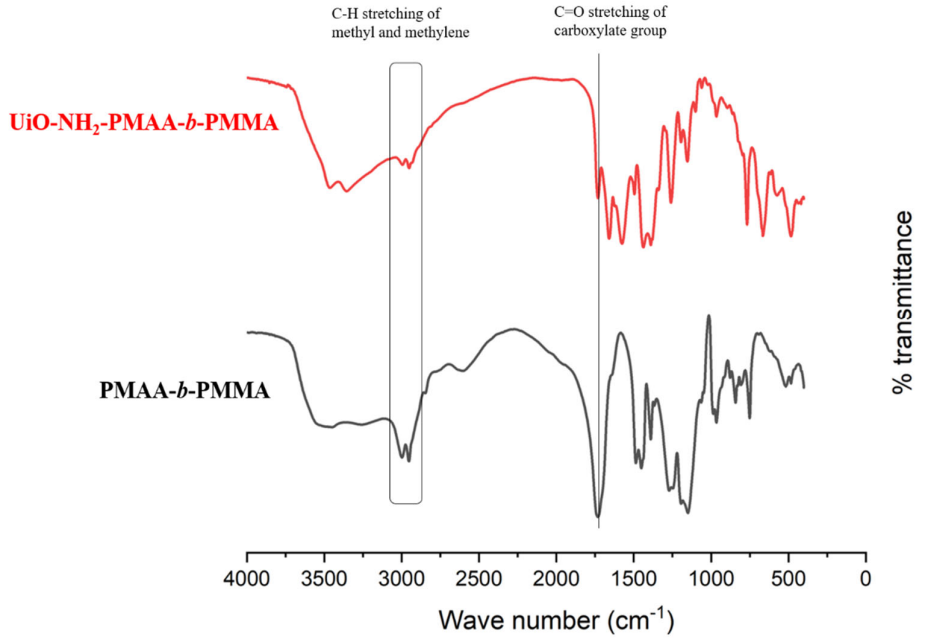

Figure S4. FT-IR spectrum for UiO-NH_2-PMAA-*b*-PMMA powder (red) and PMAA-*b*-PMMA (black).

The UiO-NH_2-PMAA-*b*-PMMA powder was further analyzed by FT-IR measurements (Figure S4). The broad and intense band between 3500 and 3300 cm^{-1} is related to the presence of N-H stretching of the amine group. C-H stretching of methyl and methylene groups between 2995 and 2955 cm^{-1} and an intense C=O stretching band of carboxylate group at 1730 cm^{-1} can be found. These signals prove that the PMAA-*b*-PMMA NPs were incorporated in UiO-NH_2-PMAA-*b*-PMMA samples.

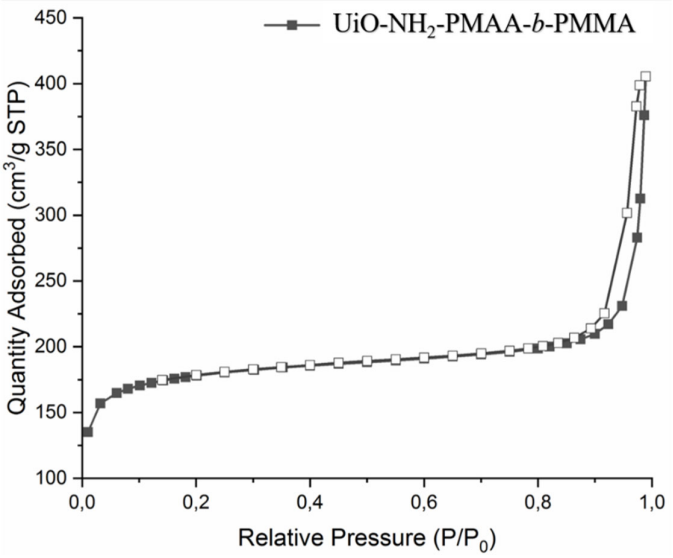

Figure S5. N_2 adsorption isotherms measured at 77 K for UiO-NH_2-PMAA-*b*-PMMA powder. Filled and empty symbols represent adsorption and desorption, respectively.

Nitrogen adsorption isotherms (Figure S5) of the UiO-NH_2-PMAA-*b*-PMMA powder, exhibited a mixture of type I and IV isotherm at 77 K with a Brunauer–Emmett–Teller (BET) surface area of 605 $m^2\ g^{-1}$ indicating the existence of microporous and mesoporous structure of UiO-NH_2-PMAA-*b*-PMMA NPs. This also corroborated that the presence of the polymer NPs did not affect the pore accessibility of the UiO-NH_2-PMAA-*b*-PMMA structure.

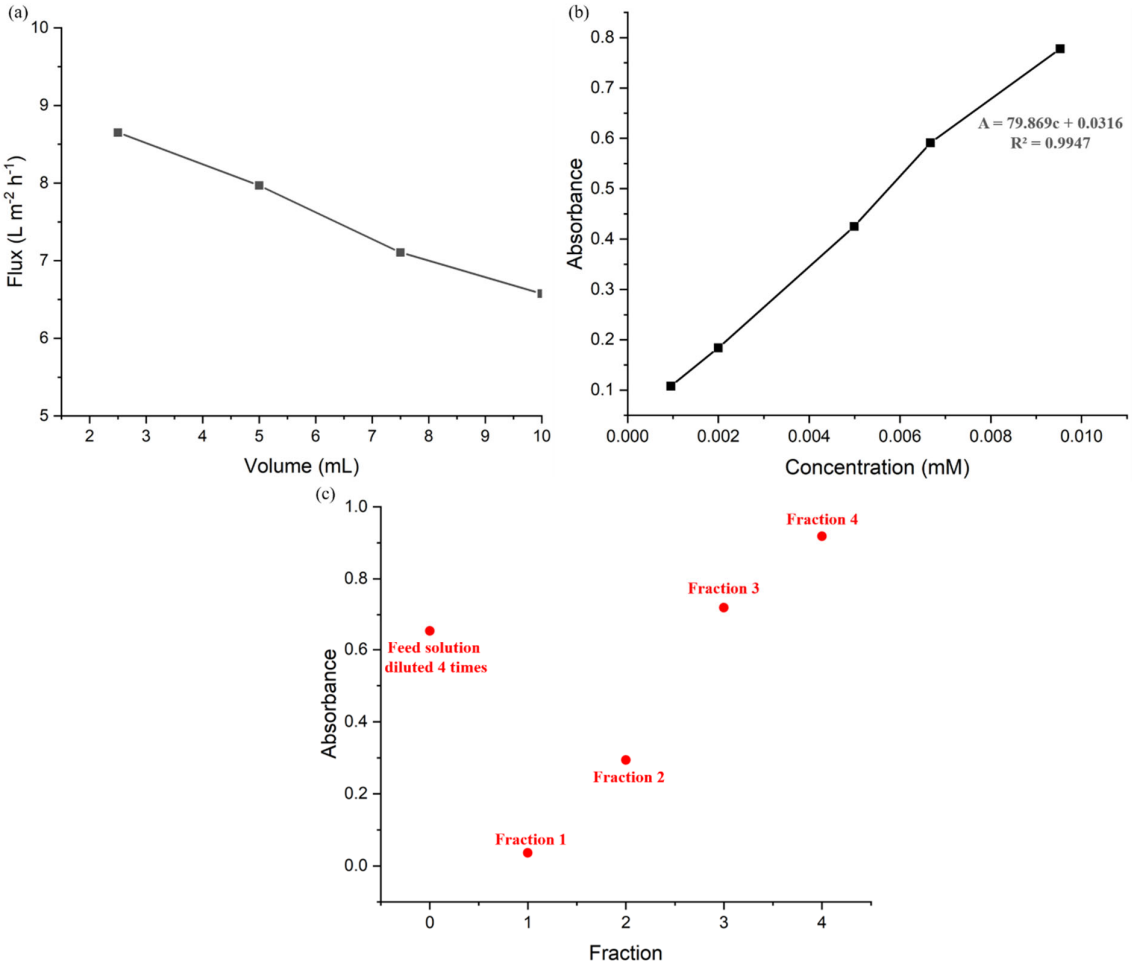

Figure S6. (**a**) Filtration flux of RhB solution versus filtration volume through UiO-66-NH_2 secondary growth membrane, (**b**) calibration line of UV absorbance at 554 nm versus RhB concentration, (**c**) UV absorbance of different fractions.

Reference

1. Øien, S.; Wragg, D.; Reinsch, H.; Svelle, S.; Bordiga, S.; Lamberti, C.; Lillerud, K.P. Detailed structure analysis of atomic positions and defects in zirconium metal-organic frameworks. *Cryst. Growth Des.* **2014**, *14*, 5370–5372, doi:10.1021/cg501386j.