Supporting Information

Metal-Organic Framework MIL-68(Ind)-NH₂ on the Membrane Test Bench for Dye Removal and Carbon Capture

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DOI: 10.1002/cite.202100117

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S1  Modified Procedures for Preparation of MIL-68(In)-NH₂

To obtain uniform or monodispersed MOF particles, further optimization of the reaction parameters was necessary. Therefore, a simple approach was chosen, commonly used for the generation of nanoparticles. Therefore, the reaction time, temperature, concentration was varied and a modulator was used, which led to different morphologies of MIL-68(In)-NH₂.

As modulators in this project, pyridine and sodium acetate were used. These modulators typically act as space-filling molecules, counter ions for charge balance, or templates to control crystal growth, which determines the structure, size, and shape of the final products. Some SEM images of synthesized MIL-68(In)-NH₂ after modification are shown below.

Table S1. Components for MIL-68(In)-NH₂.

| Morphology          | Reactants            | solvent (ml) | Modulators              | Time (h) | Temp. °C |
|---------------------|----------------------|--------------|-------------------------|----------|----------|
| Large needle        | (NO₃)₃·X H₂O NH₂-BDC | 0.645        | -                       | 5        | 125      |
| Small needle        | 1.92mmol             | 0.161        | 0.225                   | 0.5      | 125      |
| Spherical shape     | 0.96mmol             | 0.322        | 0.225                   | 0.5      | 125      |
| Ceramic shape       | 1.92mmol             | 0.645        | 0.225 0.0125            | 5        | 125      |
Figure S1. SEM images of MIL-68(In)-NH$_2$ particles with different synthesis methods to yield different particles shapes. The conditions can be found in Tab. S1.
S2  SEM-EDX Mapping Results of MIL-68(In)-NH$_2$

The spatial distributions of In, C, N, S, and O in PES@MIL-68(In)-NH$_2$ MMMs were shown by element mapping results and EDX spectrum (Fig. S2), demonstrating the presence of these elements in the final product. Platinum was used for sputtering the nanofiber membrane.

Figure S2. SEM image of the scanning area and corresponding EDX mapping on the top, EDX spectroscopy elemental analysis taken from the scanning area of the PES@MIL-68(In)-NH$_2$ MMM.
### Table S2. Comparison of experimental parameters and methylene blue dye uptake with other adsorbents.

| Adsorbents                                | Dye | Max. Uptake (mg/g) | Contact time (hr) | Reference  |
|-------------------------------------------|-----|--------------------|-------------------|------------|
| Graphene oxide                            | MB  | 243                | 5                 | [36]       |
| Multi-walled CNT                          | MB  | 196                | 5                 | [36]       |
| MIL-101(Al)-NH<sub>2</sub>               | MB  | 762                | 12                | [37]       |
| NH<sub>2</sub>-MIL-101(Cr)-SO<sub>3</sub>H| MB  | 141                | 12                | [38]       |
| UiO-66                                    | MB  | 90                 | 2.5               | [39]       |
| NH<sub>2</sub>-UiO-66                     | MB  | 96                 | 2.5               | [39]       |
| PES/Banana peel MMM                       | MB  | 325                | 8                 | [40]       |
| PES/Tea waste MMM                        | MB  | 294                | 8                 | [40]       |
| PES/Shaddock peel MMM                    | MB  | 340                | 8                 | [40]       |
| 4A-zeolite/PVA MMM                       | MB  | 41                 | 3                 | [41]       |
| Keratin nanofiber                         | MB  | 170                | 6                 | [42]       |
| PAN/β-CD nanofiber                        | MB  | 113                | 10                | [43]       |
| Sericin/β-CD/PVA nanofiber                | MB  | 187                | 4                 | [44]       |
| CMC-β-CD                                  | MB  | 57                 | 5                 | [45]       |
| PBST- β-CD                                | MB  | 91                 | 24                | [46]       |
| MIL-68(Al)                                | MB  | 666                | 0.83              | [47]       |
| ZIF-8                                     | MB  | 1667               | 4                 | [48]       |
| ZIF-8@GO                                  | MB  | 2034               | 4                 | [48]       |
| ZIF-8@CNT                                 | MB  | 3300               | 4                 | [48]       |
| PES/MIL-68(In)-NH<sub>2</sub> MMM (15 wt-% MOF) | MB  | 2822               | 1                 | This work |
Table S3. Comparison of experimental parameters, materials and dyes in cross-flow filtration, adapted from [16] with slight changes.

| Material and Dye | Operation Pressure (MPa) | Permeance / (L m⁻² s⁻¹ MPa⁻¹) | Rejection / % | Ref |
|------------------|--------------------------|---------------------------------|--------------|-----|
| ZIF-8/PSS        | 0.5                      | 265                             | 98.6         | [16]|
| PEI-GO/PAA/PVA/GA | 0.5                      | 8.7                             | 99.3         | [49]|
| CMCNa/PP         | 0.8                      | 8.25                            | 99.75        | [50]|
| PVDF/nanoclay/chito | 0.1                     | 500                             | 75           | [51]|
| PDDA/PSS         | 0.6                      | 82.5                            | 92           | [52]|
| ZIF-8/PSS        | 0.5                      | 210                             | 98.6         | [53]|
| ZIF-12/PAN       | 0.2                      | 272                             | 99.4         | [54]|
| ZIF-8/PA         | 3                        | 22.6                            | 99.98        | [55]|
| PEI/CMCNa/PP     | 0.3                      | 57                              | 99.4         | [56]|
| PVDF-SAN-60      | 0.4                      | 95                              | 97.7         | [57]|
| PAA/PVA/GA       | 0.6                      | 42                              | 96           | [58]|
| DEA-Modified PA-TFC | 0.5                | 157.4                           | 99.6         | [59]|
| LM-3             | 0.4                      | 145.1                           | 98.9         | [60]|
| ZIF-8/PES        | --                       | 13                              | 98.95        | [61]|
| Ceramic NF       | 0.3                      | 247.5                           | >96.8        | [62]|
| F127/PES         | 0.2                      | 176.2                           | 95.7         | [63]|
| Tannic acid/TMC  | 0.2                      | 168                             | 99.7         | [64]|
| PES-TA(M-60)     | 0.5                      | 37.2                            | 99.9         | [65]|
| PES-SPMA         | 0.4                      | 145                             | 98           | [66]|
| (NaSS-AC)/PS     | 0.4                      | 58                              | 96           | [67]|
| PSF-PEG          | 0.4                      | 76                              | 98           | [68]|
| (PSS/PAH)7       | 0.48                     | 132                             | 86.2         | [69]|
| Alumina tube supported COF-LZU1 | 0.5 | 485.8 | 99.2 |
| Methyl blue      | 0.5                      | 534.3                           | 98.6         | [70]|
| Congo red        | 0.5                      | 580.5                           | 91.4         | |
| Acid Fuchsin     | 0.5                      | 390.8                           | 99.1         | |
| Rose Bengal      | 0.1                      | 159.3 ± 0.7                     | -            | This work |
| Blank α-Al₂O₃ support | water           | 0.1                             | 159.3 ± 0.7 | This work |
| Blank Al₂O₃ support | Acid Fuchsin  | 0.1                             | 159.3 ± 0.7 | 0 This work |
| Blank Al₂O₃ support | Rose Bengal   | 0.1                             | 159.3 ± 0.7 | 0 This work |
| MIL-68(In)-NH₂ on α-Al₂O₃ support | Acid Fuchsin | 0.1                             | 116.9 ± 0.8 | 60 ± 2 This work |
| MIL-68(In)-NH₂ on α-Al₂O₃ support | Rose Bengal | 0.1                             | 75.9 ± 0.3  | 75 ± 2 This work |
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