Tuning the size and morphology of zeolitic imidazolate framework-8 in a membrane dispersion reactor

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Characterization

Scanning electron micrographs of PES ultfiltration membranes and as-synthesized ZIF-8 were taken with HitachiS4800scanningelectron microscope (SEM) instrument. X-ray power spectra were recorded using a Bruker D8-Advance diffractometer with Cu-Ka radiation. Each XRD pattern was acquired from 3° to 45° at a rate of 1°/min. Nitrogen physisorption isotherms were measured at 77 K on an automatic volumetric adsorption apparatus (ASAP 2020). Dynamic light scattering (DLS) measurements were performed on ALV/DLS/SLS-5022F.

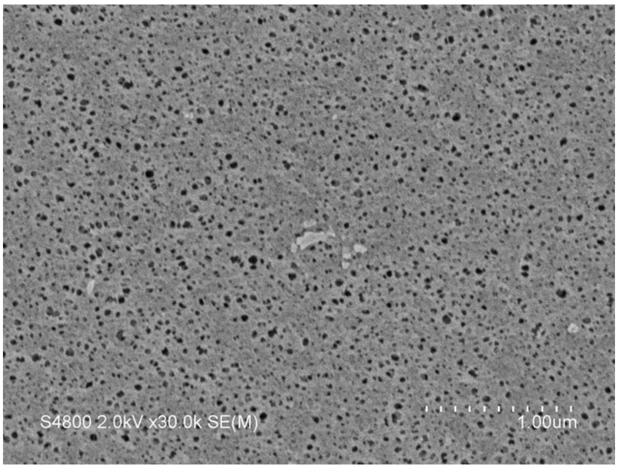

Figure S1. SEM image of the surface of PES membrane. The pore size and thickness of the PES ultfiltration membrane: 25 nm.

Tab.S1 BET of as-synthesized ZIF-8 prepared by MDR method under different trans-membrane pressure

Sample	BET Surface Area (m^2/g)	Langmuir Surface Area (m^2/g)	t-Plot micropore volume (cm^3/g)
T 0.02	883	1142	0.40
T 0.04	966	1252	0.43
T 0.06	1365	1790	0.61
T 0.08	1146	1473	0.51

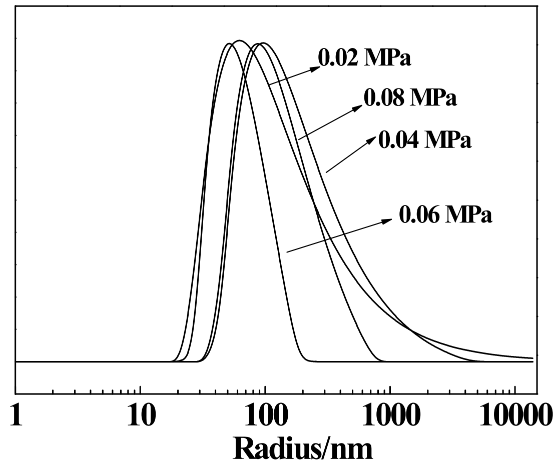

Fig. S2 Size distribution of as-synthesized ZIF-8 prepared by MDR method under different trans-membrane pressure

Table S2 Hydrodynamic radius and hydrodynamic radius distribution of as-synthesized ZIF-8 prepared by MDR method under different trans-membrane pressure

Sample	hydrodynamic radius /nm	hydrodynamic radius distribution
T 0.02	92.00	1.132
T 0.04	108.50	0.878
T 0.06	79.80	0.365
T 0.08	98.29	0.696

The size distribution of as-synthesized ZIF-8 under different trans-membrane pressure was shown in Fig. S2 and Table S2. The nanocrystal dispersions were filtered through 0.45 μm syring filters before dynamic light scattering (DLS) measurements. Hydrodynamic radius distributions of ZIF-8 decreased initially and then increased with the increase of trans-membrane pressure. Only at the trans-membrane pressure of 0.06 MPa, ZIF-8 particles with small crystal size (~79.8 nm) and narrow size distribution (hydrodynamic radius distribution was about 0.36) was obtained. Although T 0.02 had small crystal size (~92 nm), it had broad size distribution (hydrodynamic radius distribution was about 1.1).

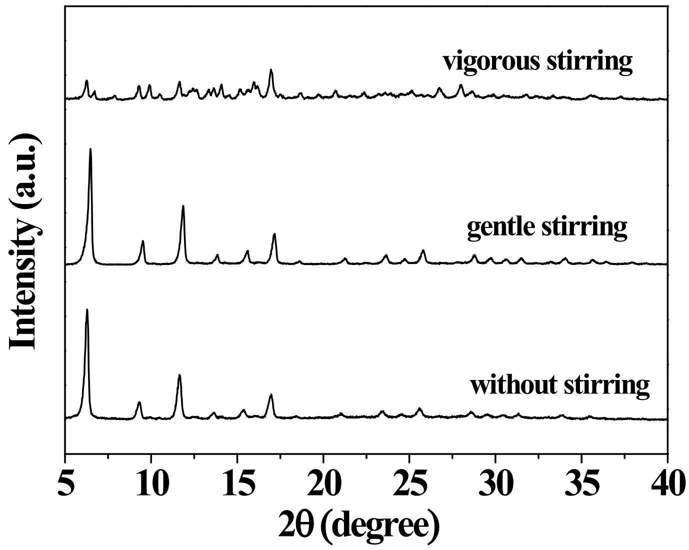

Fig. S3 XRD patterns of as-synthesized ZIF-8 prepared by MDR method under the trans-membrane pressure of 0.06 MPa

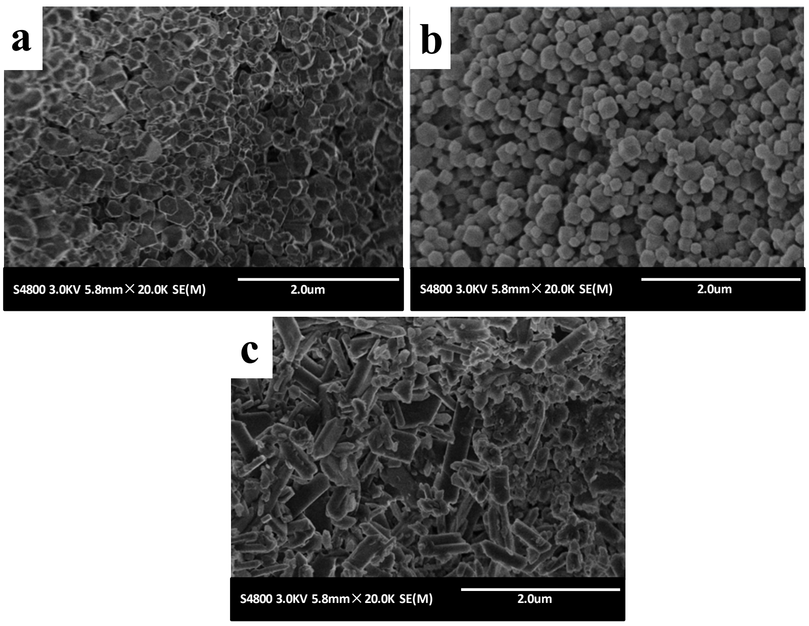

Fig. S4 SEM images of as-synthesized ZIF-8 prepared by MDR method under the trans-membrane pressure of 0.06MPa: (a) without stirring (b) gentle stirring (c) vigorous stirring

Table S3 BET of T 0.06 T 0.06 (a) without stirring (b) gentle stirring (c) vigorous stirring

	BET Surface Area (m^2/g)	Langmuir Surface Area (m^2/g)	t-Plot micropore volume (cm^3/g)
a	947	1222	0.42
b	1365	1790	0.61
c	58	81	0.02

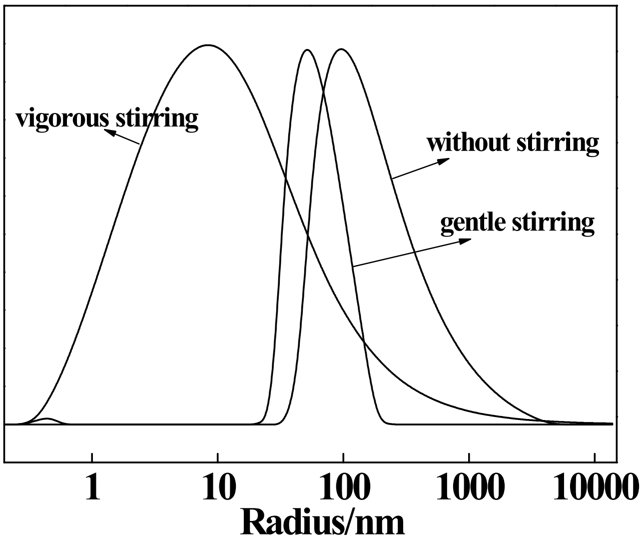

Fig. S5 Size distribution of as-synthesized ZIF-8 prepared by MDR method under the trans-membrane pressure of 0.06Mpa

Table S4 Hydrodynamic radius and hydrodynamic radius distribution of T 0.06 (a) without stirring (b) gentle stirring (c) vigorous stirring

	hydrodynamic radius/nm	hydrodynamic radius distribution
a	122.50	0.898
b	79.80	0.365
c	11.47	1.556

DLS (Fig. S5 and Table S4) showed that there was broader hydrodynamic radius distribution of ZIF-8 with vigorous stirring than others. The ZIF-8 samples with gentle stirring had the smallest hydrodynamic radius (79.80) and narrow hydrodynamic radius distribution (0.36).