Electronic Supplementary Information (ESI)

Multiphase surface growth of hydrophobic ZIF-8 on melamine

sponge for excellent oil/water separation and effective catalysis in a

knoevenagel reaction

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Experimental Section

Materials

Melamine sponge is purchased from GreenCARE International Ltd. Dopamine hydrochloride is obtained from Sigma, Tris (hydroxymethyl) methyl aminomethane is achieved from Shanghai Yuanju Bioscience Technology limited Company. Sodium formate is provided by Tianjin Fuchen Chemical Reafents Factory. 2-methylimidazole Benzaldehyde, Dodecane and Malonltrile come from Aladdin Industrial Corporation. Zinc chloride, Methanol and Ethanol are provided by Guangzhou Chemical Reagent Factory.

Preparation

Poly dopamine coated melamine sponge (MF-PDA sponge)

Dopamine hydrochloride was dispersed into the water/ethanol solution (1:1 v/v, 10 mL) by ultrasonication at pH of 8.5 which was controlled by the usage of Tris (hydroxymethyl) methyl aminomethane. Followed by an immersion of clean melamine sponge (1x1x1 cm³) into the mixture solution under 400 rpm/min magnetic stirring for 10 hours, then the poly dopamine coated melamine (MF-PDA) sponge was obtained after washing with water and drying at 60 °C in vacuum oven.

ZIF-8 coated melamine sponge (MF- ZIF-8 sponge)

MF-PDA sponge was immersed into the homogeneous mixture methanol solution (30 mL) containing Zinc chloride (0.2228 g), 2-methylimidazole (0.3888 g) and Sodium formate (0.1608 g). Then the resulting solution was placed in a Teflon-lined stainless steel autoclave to finish solvothremal reaction at 100 $^{\circ}$ C for 12 hours. Finally the ZIF-8 coated melamine (MF-ZIF-8) sponge was successfully achieved after cooling to room temperature, washing by methanol for three more times and drying at 100 $^{\circ}$ C.

Catalytic reaction

The Knoeveagel reaction was performed between benzaldehyde and malononitrile with catalysts at room temperature. Benzaldehyde (0.4 mL) and dodecane (0.4 mL) were dissolved into toluene (8 mL), and then another toluene solution (2 mL) containing malononitrile (1.0 g) was added to this resulting solution under magnetic stirring. Finally, a certain amount of catalyst was added to start this reaction for 4 hours. This Knoeveagel reaction was also performed under flow conditions as that the 10 mL toluene solution containing Benzaldehyde (0.4 mL), dodecane (0.4 mL) and malononitrile (1.0 g) circularly flowed through a column (1.5 cm x 30 cm) with a bottom strainer which the solid catalysts were placed on. The obtained liquid from reaction mixture was characterized by gas chromatographic analysis after centrifugal separation.

Characterization

The surface topography of samples can be observed by scanning electron microscopy (SEM Zeiss EVO18) at 10 KV after gold coating. The surface elements of samples can be obtained by X- ray photoelectron spectroscopy (XPS, ESCA Axis Ultra DLD). The wettability of samples can be measured by contact angle analysis system (OCA20LHT-TEC700-HTFC1500, Dataphysics, Germany). The object photographs could be captured by the digital camera (Canon IXUS 220 HS). The thermal curves of samples can be characterized by thermogravimetric analysis (NETZSCH TG 209) with a heating from 40 °C to 800 °C at 10 °C/min. X-ray diffraction (XRD) measurement is carried on a powder X-ray diffractometer (D8 Advance, Bruker, Germany) working with Cu-K radiation (1.5406 A) at 40 mA and 40 kV. The organic reaction is analyzed through Gas chromatography-mass spectroscopy (GC-MS) spectrometry, which is recorded on Shimadzu Model GCMS-QP5050A system equipped with a 0.25 mm×30 m DB-WAX capillary column. Dodecane is chosen as the internal standard to calculate reaction conversions.

Elements	MF-PDA	MF – ZIF-8
Zn (wt %)	0	63.74
C (wt %)	63.29	26.63
N (wt %)	36.71	9.63

Table S1. The surface elements content of MF-PDA and MF-ZIF-8 sponges obtained by EDX.



Fig. S1. Nitrogen sorption isotherms and hydrophobic property of ZIF-8.



Fig. S2. SEM images and EDX plots of MF-PDA and MF-ZIF-8 sponges.

It is well known that the analysis thickness of EDX can reach a few microns. Compared with MF-PDA sponge, the appearance of a large number of Zn elements of MF-ZIF-8 sponge after a solvothermal method indicates that the micron-scale coating on MF-PDA sponge almost consists of ZIF-8 by different types including particles and rhombic crystals.



Fig. S3. The wettability of MF, MF-PDA and MF-ZIF-8 sponges.



Fig. S4. XPS spectra of MF(a), O1s of MF(b) and MF-PDA sponges.



Fig. S5. XPS spectra of N1s of MF-PDA (b) and MF-ZIF-8 (c) sponges.



Fig. S6. TG curves of MF, ZIF-8 and Dopamine.



Fig. S7. The compressibility of MF- ZIF-8 sponge.



Fig. S8. The combustion process of MF-ZIF-8 sponge.



Figure S9. The toluene solution containing benzaldehyde and malonoitrile showed no obvious change in color after four hours without catalyst.