Direct synthesis of plugged SBA-15 type mesoporous silica using alcoholamines

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Supporting Information

1. Experimental

- Synthesis of plugged SBA-15 using monoethanolamine by microwave and thermal treatment

The plugged SBA-15 by using four kinds of alcoholamines: monoethanolamine (TCI), propanolamine (TCI), N-methylethanolamine (TCI) and triethanolamine (Aldrich) was synthesized according to following procedure;

All of plugged SBA-15 were prepared with poly (ethylene oxide)-poly (propylene oxide)-poly (ethylene oxide) triblock copolymer template ($EO_{20}PO_{70}EO_{20}$, Pluronic P-123, Aldrich) as a template and sodium metasilicate nonahydrate ($Na_2SiO_3.9H_2O$, Aldrich) as a silica source. 5g of P123, 13.67g of sodium metasilicate were dissolved in 128g of H_2O with vigorously stirring to get clear solution. Then, 6.27g of monoethanolamine was added to solution and 40.5g of c-HCl was directly injected (propanolamine: 7.71g, N- (methyl) ethanolamine: 7.71g, triethanolamine: 15.31g, SMS: alcoholamine = 1: 2.1 molar ratio of alcoholamine). After stirring at the 293~323K during 1 hour, the obtained gel was subjected into microwave digestion system at 373 K during 2 hr or conventional thermal treatment for 24 hr at 373K under static condition. After filtration and drying, the surfactant was removed by using Soxhlet extraction with ethanol for 24 hours and calcined at 823K in flowing air.

2. Results and discussions

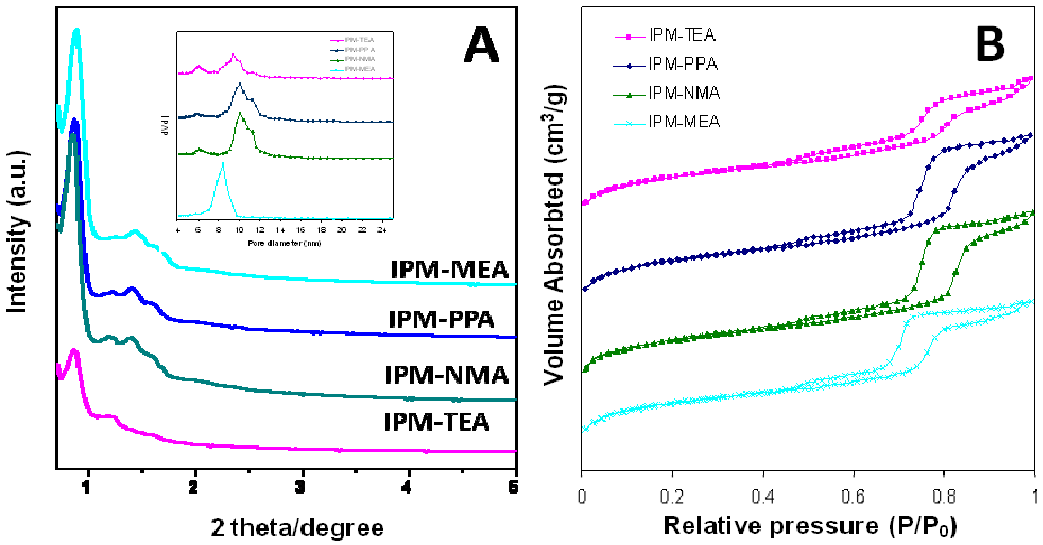

Figure S1. The low angle range of XRD powder patterns, (A) pore size distributions calculated by NLDFT method (inset) and nitrogen adsorption-desorption isotherms (B) of plugged SBA-15 by using monoethanolamine (MEA), propanolamine (PPA), N-methylethanolamine (NMA) and triethanolamine (TEA)

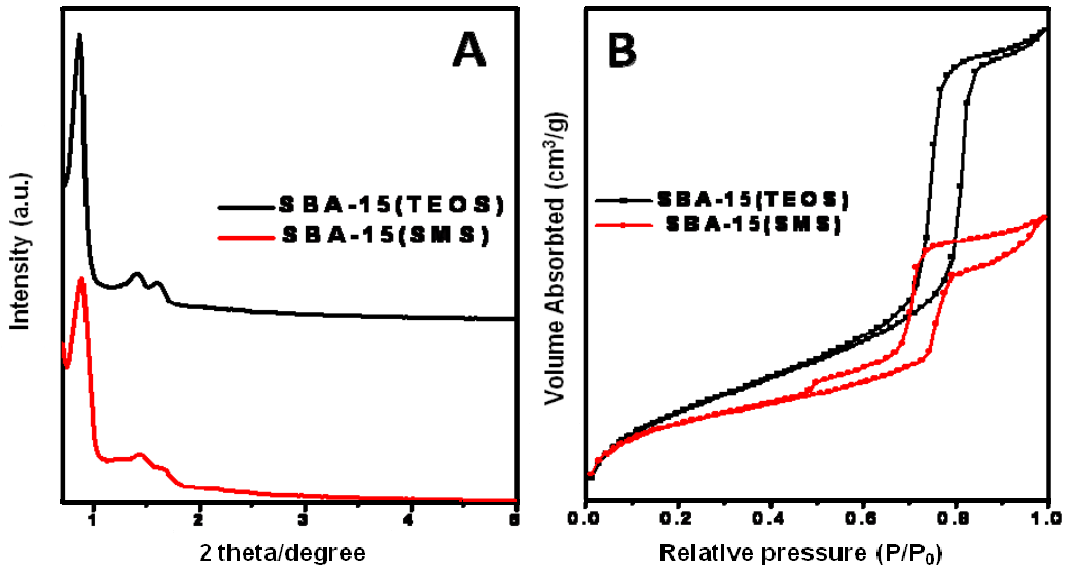

Figure S2. The low angle range of XRD powder patterns (A) and nitrogen adsorption-desorption isotherms (B) of SBA-15 synthesized by TEOS and SMS (sodium metasilicate)

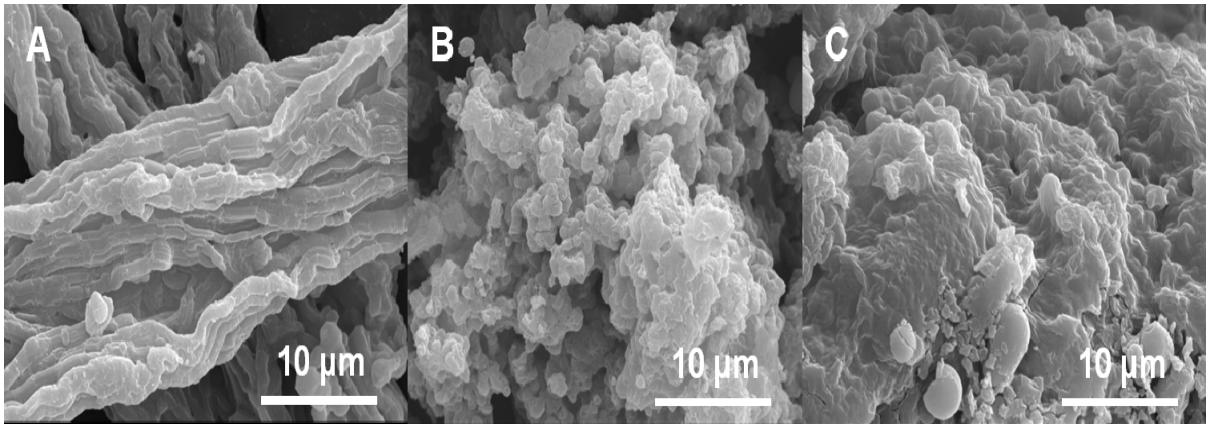

Figure S3. SEM images of IPM-MEA-2.1 with different stirring temperature (A:298K ; B:303K; C:323K)

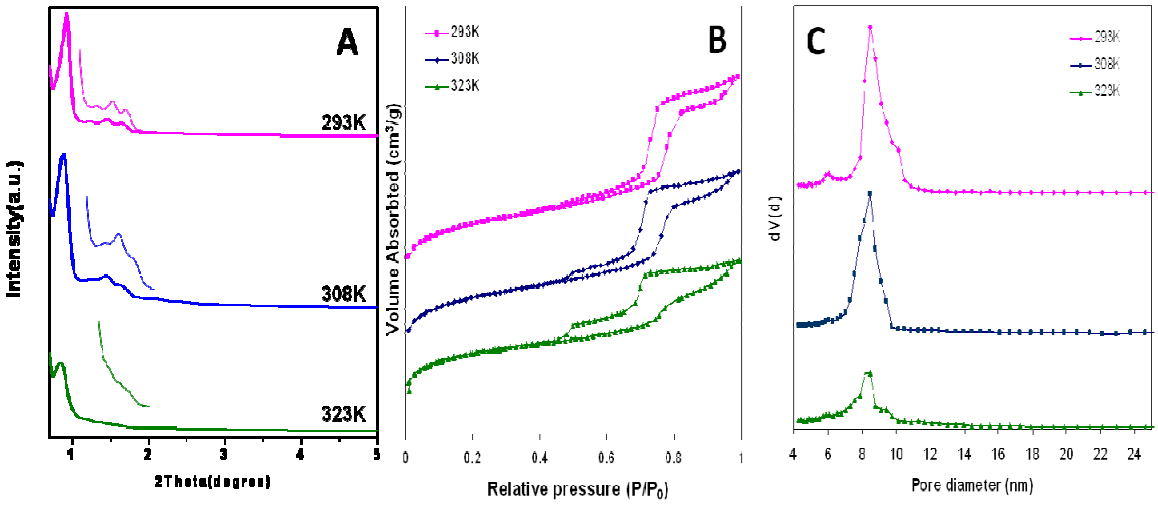

Figure S4. The low angle range of XRD powder patterns (A) and nitrogen adsorption-desorption isotherms (B) and pore size distributions by NLDFT calculation method (C) of IPM-MEA with different stirring temperature (molar ratio = SMS: monoethanolamine = 1: 2.1).

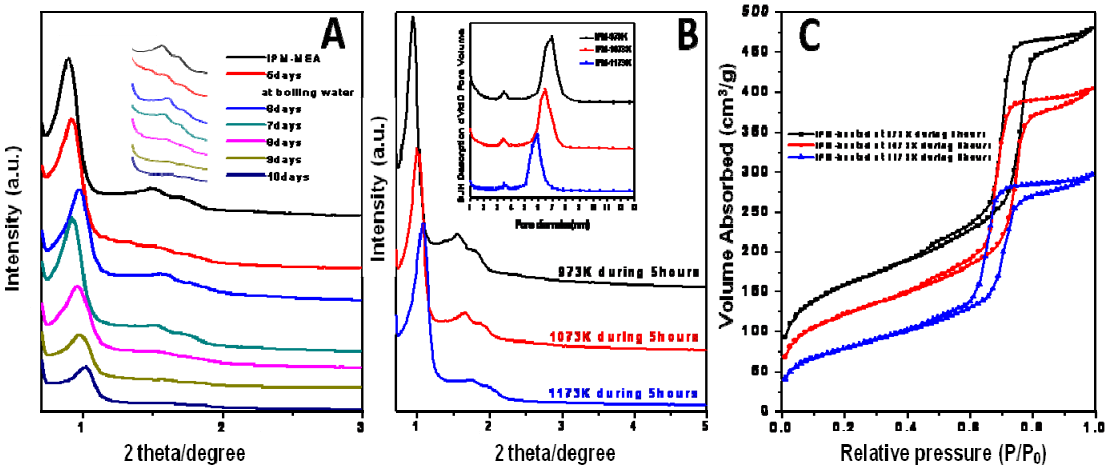

Figure S5. The low angle range of XRD powder patterns of IPM-MEA(2.1) during boiling water test at 373K (A), XRD patterns (B), pore size distributions (*inset*) and nitrogen adsorption-desorption isotherms (C) of IPM-MEA (2.1) during hydrothermal stability test at different temperature