

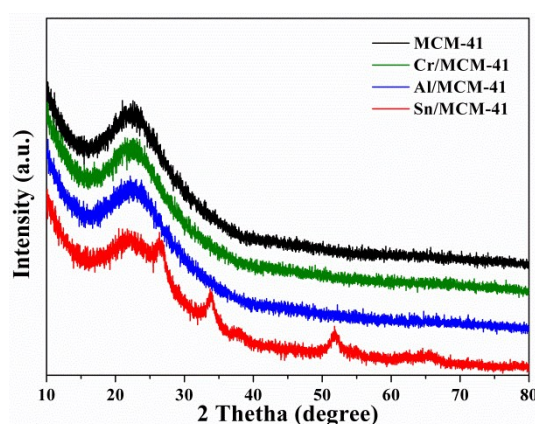


Fig. S1 XRD patterns of MCM-41 and MCM-41 supported metal catalysts.

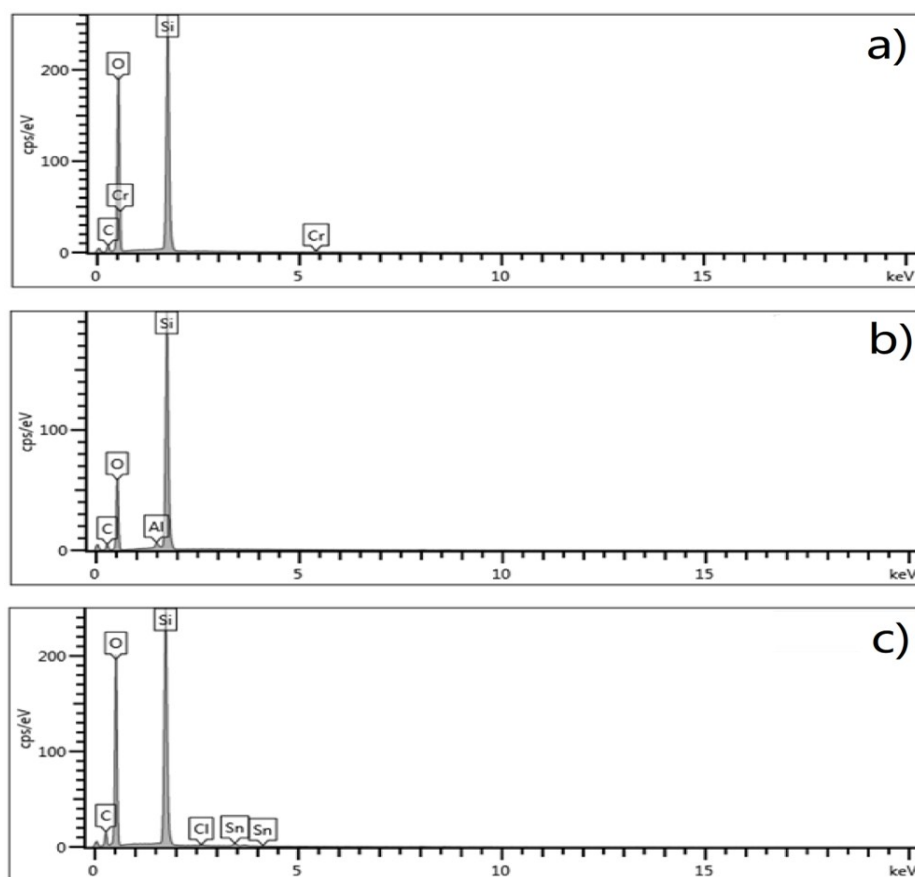


Fig. S2 EDX spectra of a) Cr/MCM-41, b) Al/MCM-41 and c) Sn/MCM-41 catalysts.
(Note: The peak of carbon is attributed to the carbon film of copper grid for sample preparation.)

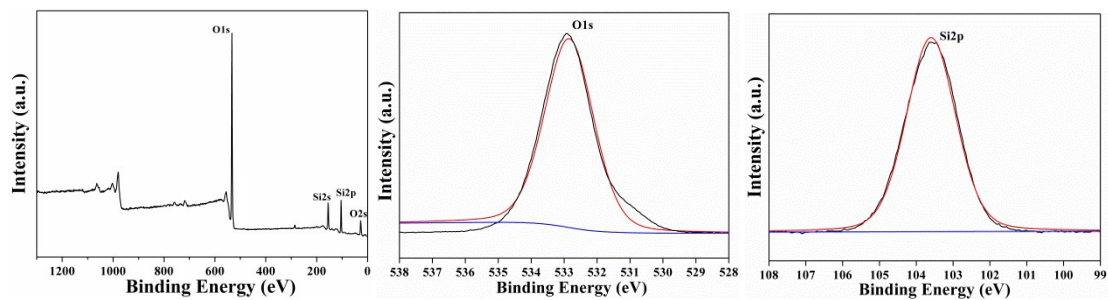


Fig. S3 XPS spectra of MCM-41.

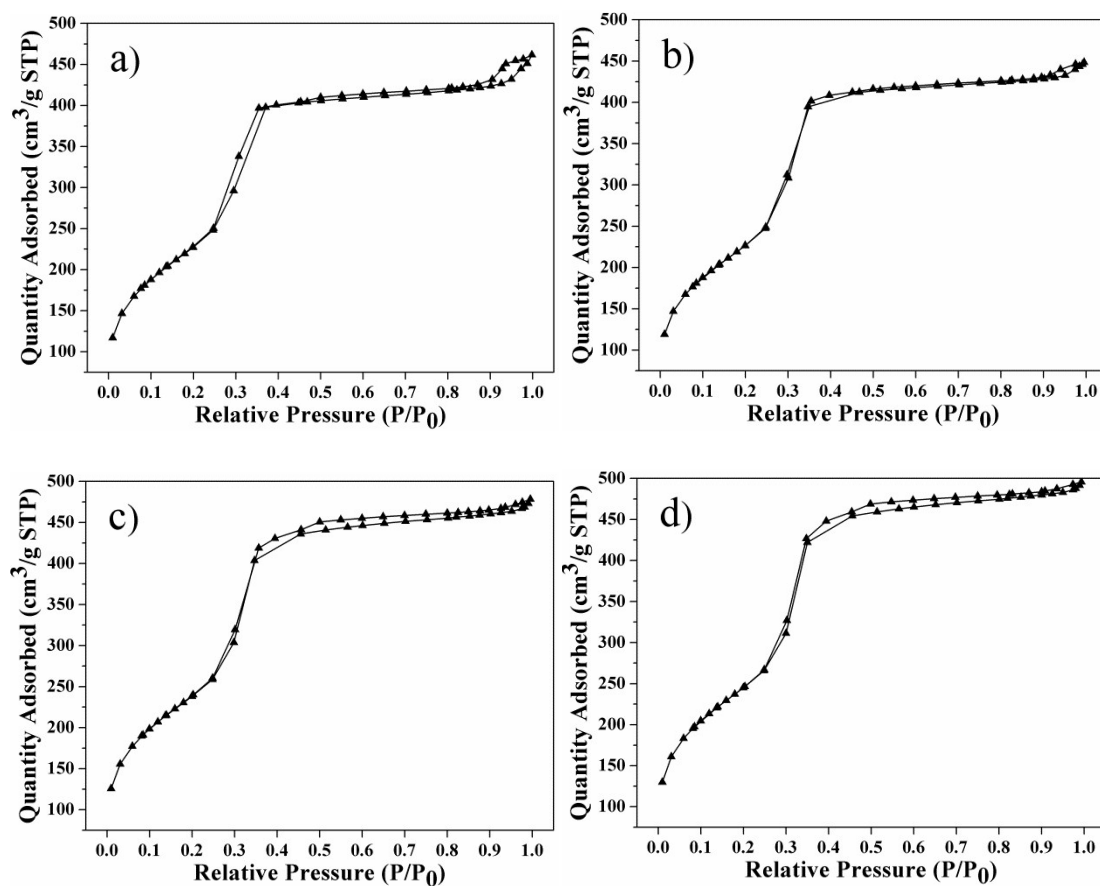


Fig. S4 N₂ adsorption/desorption isotherms of a) MCM-41, b) Cr/MCM-41, c) Al/MCM-41 and d) Sn/MCM-41.

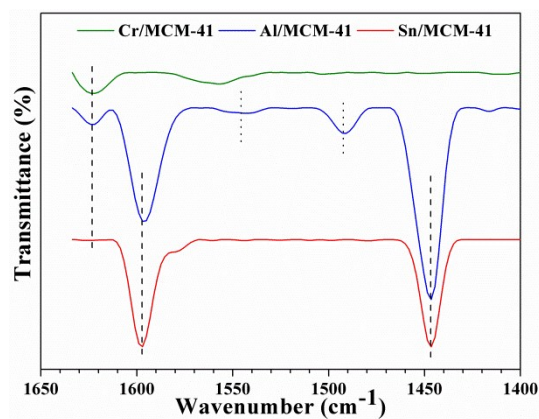


Fig. S5 The Py-IR spectra of Cr, Al and Sn/MCM-41 catalysts at the pyridine desorption temperature of 300 °C.

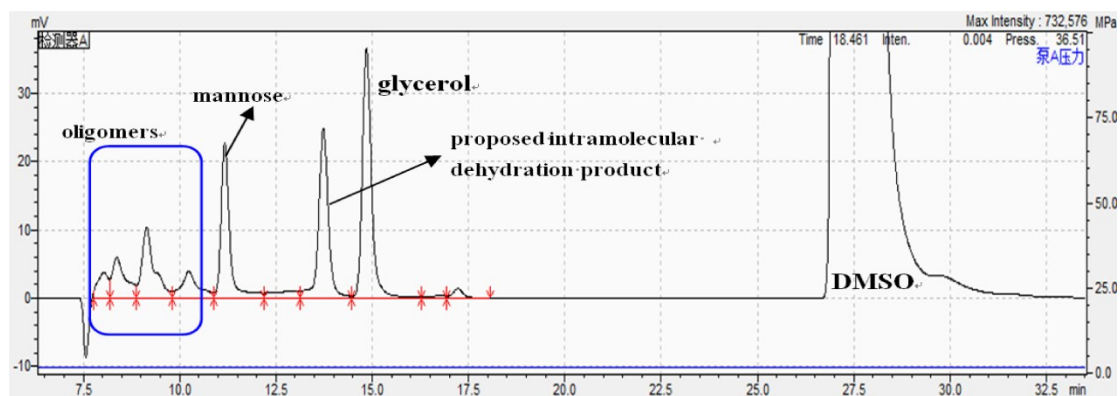


Fig. S6 The chromatogram on the conversion of mannose in DMSO at 150 °C for 60 min without catalyst.

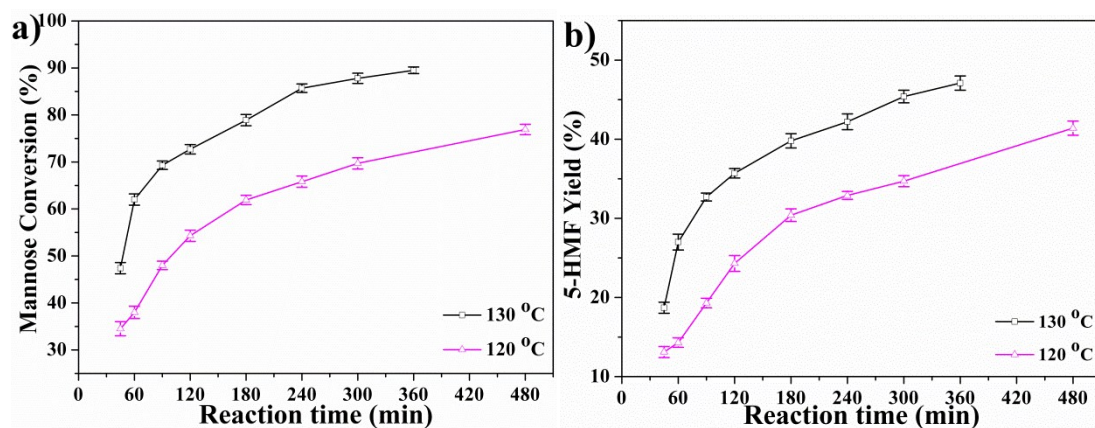


Fig. S7 The conversion of mannose at 120 °C and 130 °C for different time.

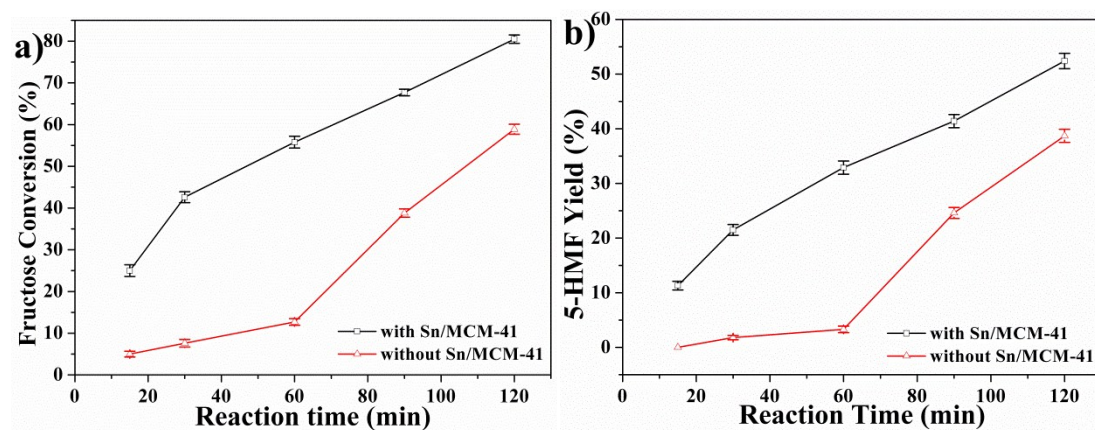


Fig. S8 Conversion of fructose into 5-HMF with and without Sn/MCM-41 at 110 °C.

Table S1 The metal contents of Cr, Al and Sn over different catalysts tested by XRF.

Catalyst	Metal content (wt%)
Cr/MCM-41	1.527
Al/MCM-41	1.935
Sn/MCM-41	0.536

Table S2 Acidities of MCM-41 and supported metal catalysts.^a

	Acidity (weak) ($\mu\text{mol/g}$)	Acidity (medium) ($\mu\text{mol/g}$)	Acidity (strong) ($\mu\text{mol/g}$)	Total acidity ($\mu\text{mol/g}$)
MCM-41	28.9	—	—	28.9
Cr/MCM-41	232.3	26.6	27.8	286.7
Al/MCM-41	373.1	68.2	95.3	536.6
Sn/MCM-41	331.9	—	187.8	519.7

^[a] The acidities of MCM-41 and catalysts were determined by NH_3 -TPD.

Table S3 Brönsted and Lewis acidities of MCM-41 supported metal catalysts.

	Brönsted acidity ($\mu\text{mol/g}$)	Brönsted and Lewis acidity ($\mu\text{mol/g}$)	Lewis acidity ($\mu\text{mol/g}$)
Cr/MCM-41	trace	trace	286.7
Al/MCM-41	9.6	33.4	493.6
Sn/MCM-41	trace	trace	519.7