

Solvent-free synthesis of MnOx-FeOx/biochar for Hg⁰ and o-xylene removal from flue gas

Xiao Zhang^{a,b}, Kai Ren^{a,b}, Yuting Wang^{a,b}, Boxiong Shen^{a,b*}, Feng Shen^{c*}, Yewen Shang^{a,b}

a School of Energy and Environmental Engineering, Hebei University of Technology, No. 5340, Xiping Road, Beichen District, Tianjin 300401, China

b Tianjin Key Laboratory of Clean Energy and Pollution Control, Hebei University of Technology, No. 5340, Xiping Road, Beichen District, Tianjin 300401, China

c Agro-Environmental Protection Institute, Ministry of Agriculture and Rural Affairs, No. 31, Fukang Road, Nankai District, Tianjin 300191, China

*Corresponding authors

shenfeng@caas.cn (Feng Shen)

shenbx@hebut.edu.cn (Boxiong Shen)

Characterization details

In a typical H₂-TPR experiment, 150 mg of the catalyst was purged at room temperature for 30 min and then preheated at 200 °C for 30 min under N₂ to remove the moisture in the sample. After cooling the sample down to 60 °C, temperature programming was begun with a 10 °C /min heating rate under 40 mL·min⁻¹ H₂ (5 vol%)/N₂ atmosphere.

Acid site type and amount on the surface of the catalysts were determined by pyridine-adsorbed Fourier-transform infrared (py-FTIR) spectroscopy (Frontier™, PerkinElmer, Inc., USA). In a typical process, sample was heated under 400 °C for 1 h under vacuum to remove adsorbed water. After the sample cooled to room temperature, the IR spectrum was recorded as background. Pyridine was then introduced and adsorbed on the sample under room temperature until equilibrium was reached. The sample was then heated to 350 °C and kept for 1 h under vacuum. After the sample cooled to room temperature, the IR spectrum was recorded as second spectra. Py-FTIR spectra were obtained by subtracting the background spectra from the measured spectra.

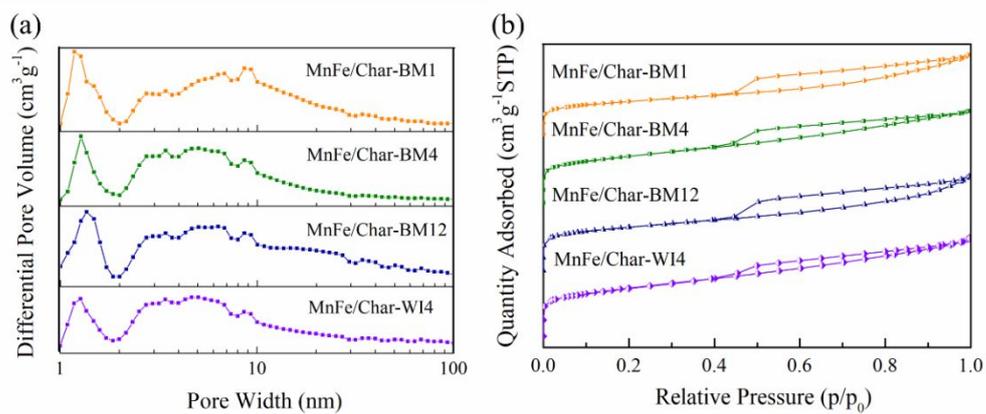


Figure S1. Pore size distributions (a) and N₂ adsorption–desorption isotherms (b) of Mn–Fe-oxides/biochar catalysts

Table S1 chemical composition of untreated fly ash

Composition	SiO ₂	Al ₂ O ₃	Fe ₂ O ₃	CaO	TiO ₂	K ₂ O	MgO	P ₂ O ₅	Na ₂ O	Others
Percentage (%)	53.80	36.71	3.28	1.91	1.31	1.15	0.87	0.42	0.33	0.48