Electronic Supplementary Information

Facile synthesis of low-cost biomass-based γ-Fe_2O_3/C for efficient adsorption and catalytic degradation of methylene blue in aqueous solution

Tao Chen,YuhaoXiong, Yuemei Qin, Haiguan Yang, Peng Zhang and Fanggui Ye*

State Key Laboratory for the Chemistry and Molecular Engineering of Medicinal Resources, College of Chemistry and Pharmaceutical Science of Guangxi Normal University, Guilin 541004, P. R. China.

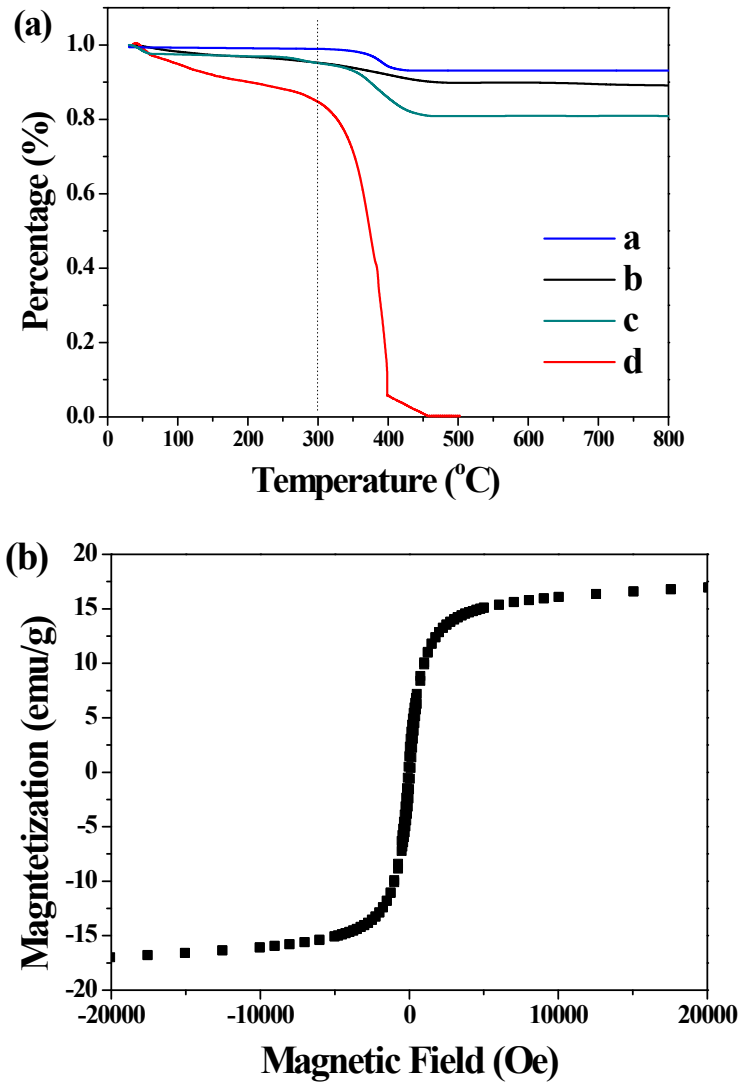

Fig.S1 (a) TGA curves of γ-Fe_2O_3/C, the $FeCl_3$ impregnation ratio was (a) 2:1; (b) 1.5:1; (c) 0.5:1; (d) 0:1;

(b) Magnetization curves of γ-Fe_2O_3/C (the $FeCl_3$ impregnation ratio=0.5:1; the carbonization time=4 min).

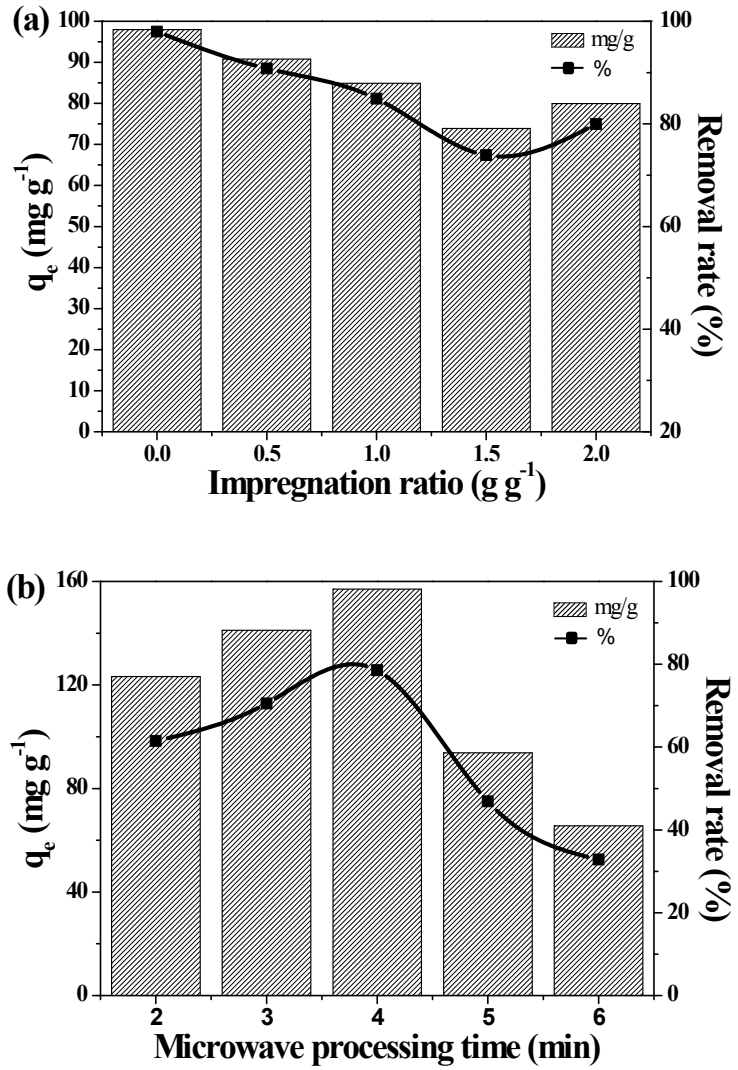

Fig.S2 a) Influence of the proportion of impregnation. b) Influence of the carbonization time. (C_{MB}: 50 mg L^{-1}; T: 30 ^{0}C; pH: 7; the dosages of adsorbent: 10 mg)

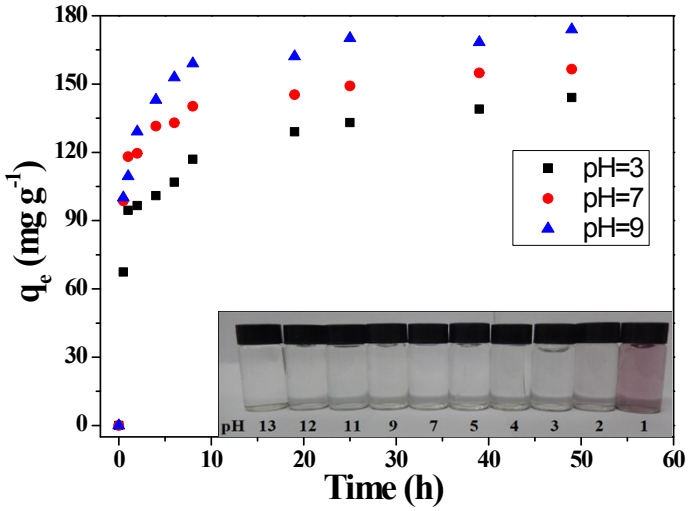

Fig.S3 Influence of pH value of the adsorption system. Insert: a series soak solution of different pH.(the dosages of adsorbent: 10 mg; C_{MB}: 200 mg L-1; T: 30 30 ^{0}C)

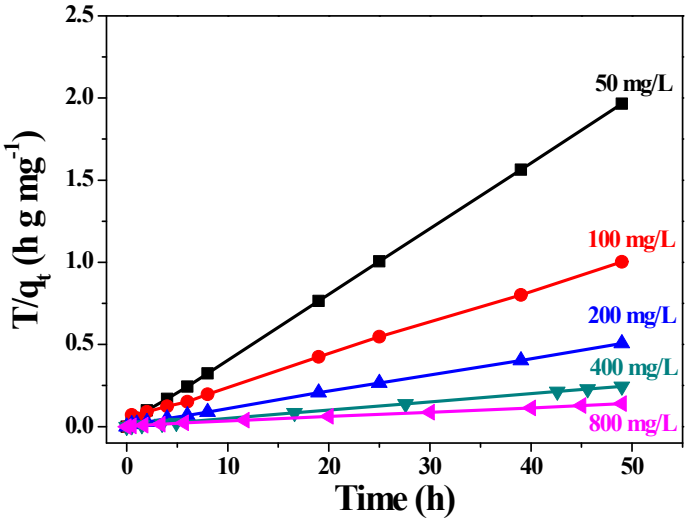

Fig.S4 The pseudo-second-order model of adsorption of MB at 30 ^{0}C.(pH: 7; the dosages of adsorbent: 10 mg)

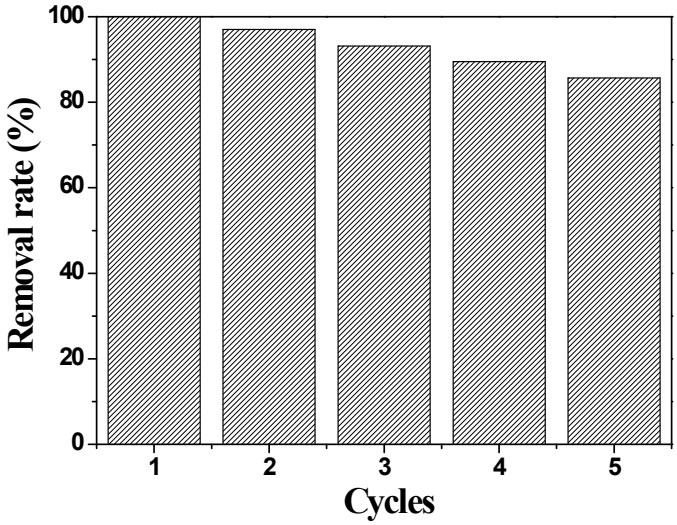

Fig.S5 The recycling performance of γ-Fe_2O_3/C. (C_{MB}: 50 mg L^{-1}; T: 30 ^{0}C; pH: 7; the dosages of adsorbent: 10 mg)

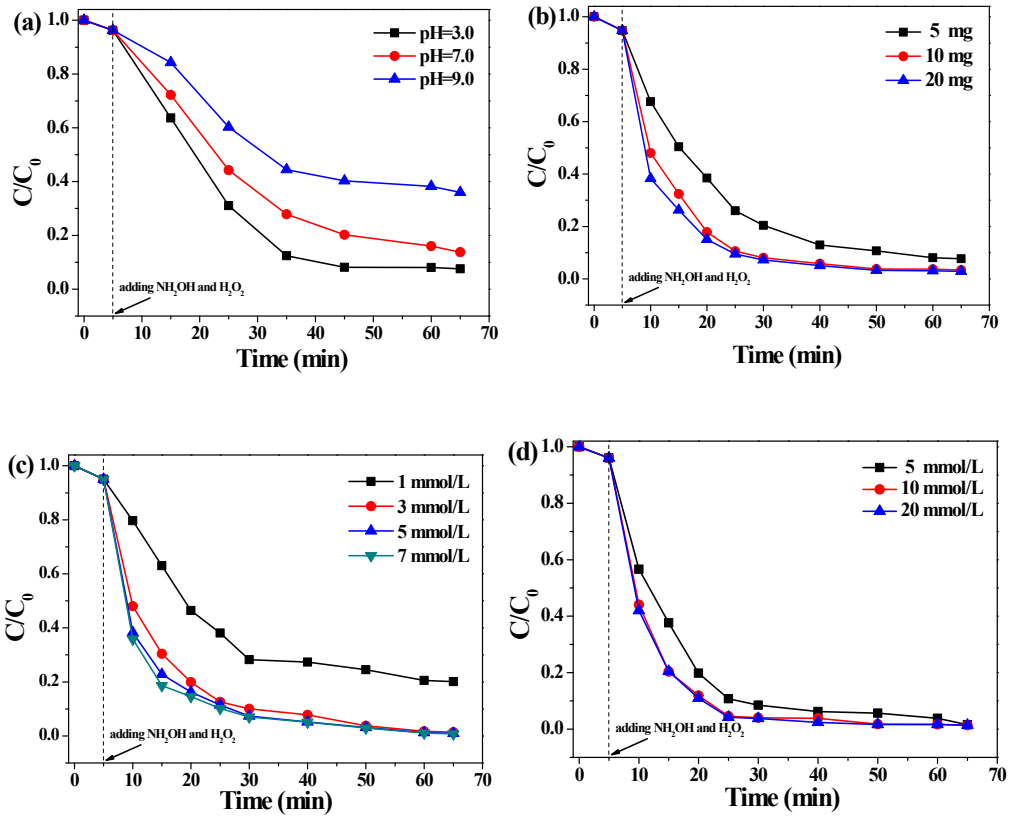

Fig.S6 Effect of different reaction conditions of degradation with MB (100 mg L^{-1}) at 30 ^{0}C:

a) pH (the dosages of catalyst: 5 mg; NH_2OH: 10 mmol L^{-1}; H_2O_2: 1 mol L^{-1});

b) the concentration of H_2O_2 (the dosages of catalyst: 5 mg; NH_2OH: 10 mmol L^{-1}; pH: 7);

c) the concentration of NH_2OH; (the dosages of catalyst: 5 mg; H_2O_2: 3 mol L^{-1}; pH: 7);

d) the dosages of catalyst (pH: 7; NH_2OH: 10 mmol L^{-1}; H_2O_2: 3 mol L^{-1})

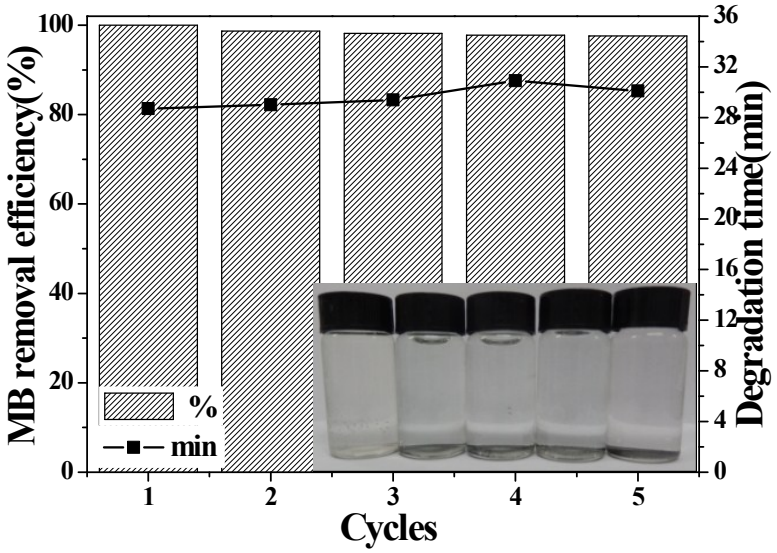

Fig.S7 The recycling performance of the catalytic. Insert: the stability of catalytic after 5 cycles. (C_{MB}: 50 mg L^{-1}; T: 30; pH: 7; the dosages of adsorbent: 10 mg; NH_2OH: 10 mmol L^{-1}; H_2O_2: 3 mol L^{-1})

Table S1 Porosity analysis of γ-Fe_2O_3/C

γ-Fe_2O_3/C	BET Surface area (m^2 g^{-1})	Average pore diameter (nm)	Total pore volumes (cm^3 g^{-1})
1	764.12	2.81	0.54
2	114.78	3.41	0.12

Notes: the $FeCl_3$ impregnation ratio and carbonization time of γ-Fe_2O_3/C-1 and 2 were 0.5:1, 2:1, and 4 min, 4min, respectively.

Table S2 Correlation coefficients of the dynamic equation at 30 °C and pH 7. (the dosages of adsorbent: 10 mg; the preparation condition of γ-Fe_2O_3/C: $FeCl_3 \cdot 6H_2O$ to bagasse ratio=0.5:1 (g g^{-1}); microwave processing time=4 min)

Pollutant	C_0 (mg L^{-1})	$q_{e(exp)}$ (mg g^{-1})	Pseudo-second-order kinetic model		
			$q_{e(cal)}$ (mg g^{-1})	k_2 (g mg^{-1} min^{-1})	R^2
MB	800	352.96	362.31	1.890×10^{-3}	0.998
	400	199.75	200.40	2.546×10^{-2}	0.999
	200	96.71	97.85	1.523×10^{-2}	0.999
	100	48.90	50.58	1.021×10^{-2}	0.997
	50	24.94	25.11	1.495×10^{-1}	0.999

Notes: C_0, initial concentration of MB; $q_{e(exp)}$, experimental adsorption capacity, $q_{e(cal)}$; calculated adsorption capacity; k_2, pseudo-second-order kinetic constant.

Table S3 Comparison of the adsorption capacity and degradation efficiency of various adsorbents for MB.

Sample	Adsorption capacity ($mg\ g^{-1}$)	Degradation efficiency	References
Mesoporous organosilicon (BC-60)	556	--	[13]
Porous functional carbon material (HPFCMS-5-1-800)	385.12	--	[15]
$ZnCl_2$-molten salt synthesis (MSS)	353.1	--	[18]
Peanut shell magnetic carbon (PMC-2)	--	90 % (Time ≤ 30 min; C_{MB} = 40 $mg\ g^{-1}$)	[19]
Manganese oxide (MO)	--	99 % (Time ≤ 10 min; C_{MB} = 100 $mg\ g^{-1}$)	[22]
Graphene oxide-iron(III) based cellulose nanofibril (30 % GO-Fe-CNF)	143.96	30.4 % (Time ≤ 24 h; C_{MB} = 100 $mg\ g^{-1}$)	[23]
Fe-based metal-organic framework (γ-Fe_2O_3/C)	303.95	--	[26]
Biomass-based γ-Fe_2O_3/C	352.96	99 % (Time ≤ 30 min; C_{MB} = 100 $mg\ g^{-1}$)	This work