Electronic Supplementary Material (ESI) for Inorganic Chemistry Frontiers.

Supporting informantion for

Simultaneously efficient adsorption and accelerated photocatalytic degradation of chlortetracycline hydrochloride over novel Fe-based MOGs under visible light irradiation cooperated by hydrogen peroxide

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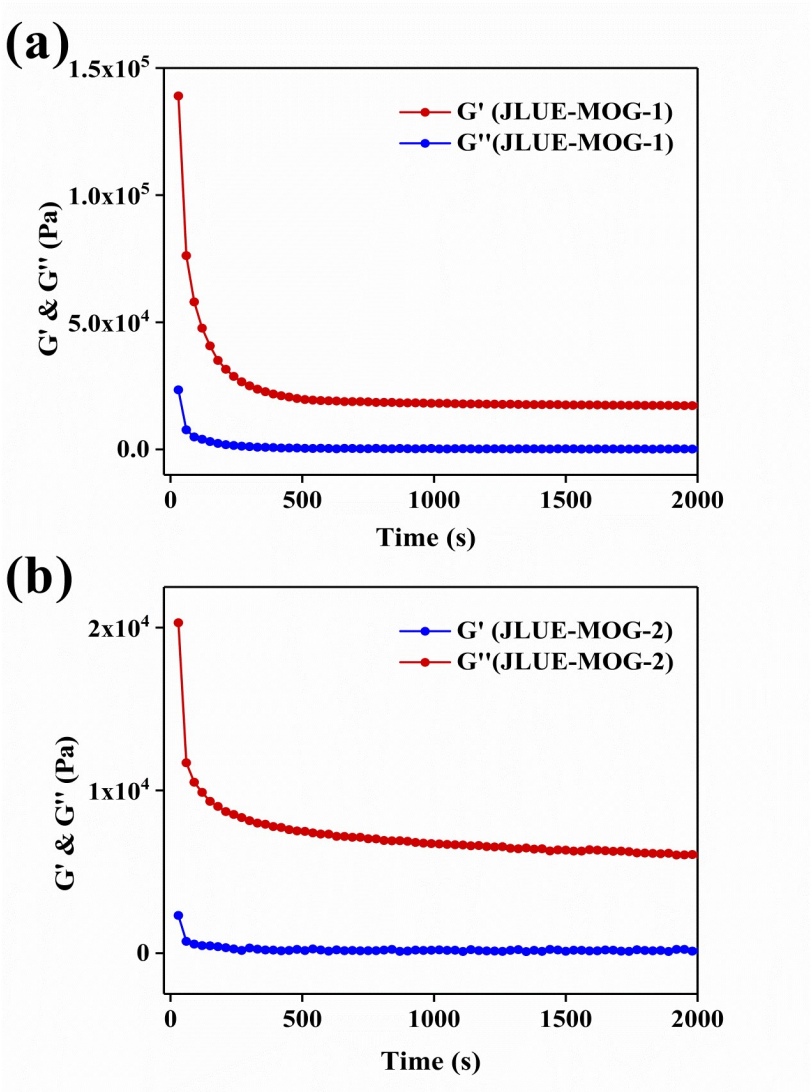

Fig. S1 The viscoelastic properties of (a) JLUE-MOG-1 and (b) JLUE-MOG-2.

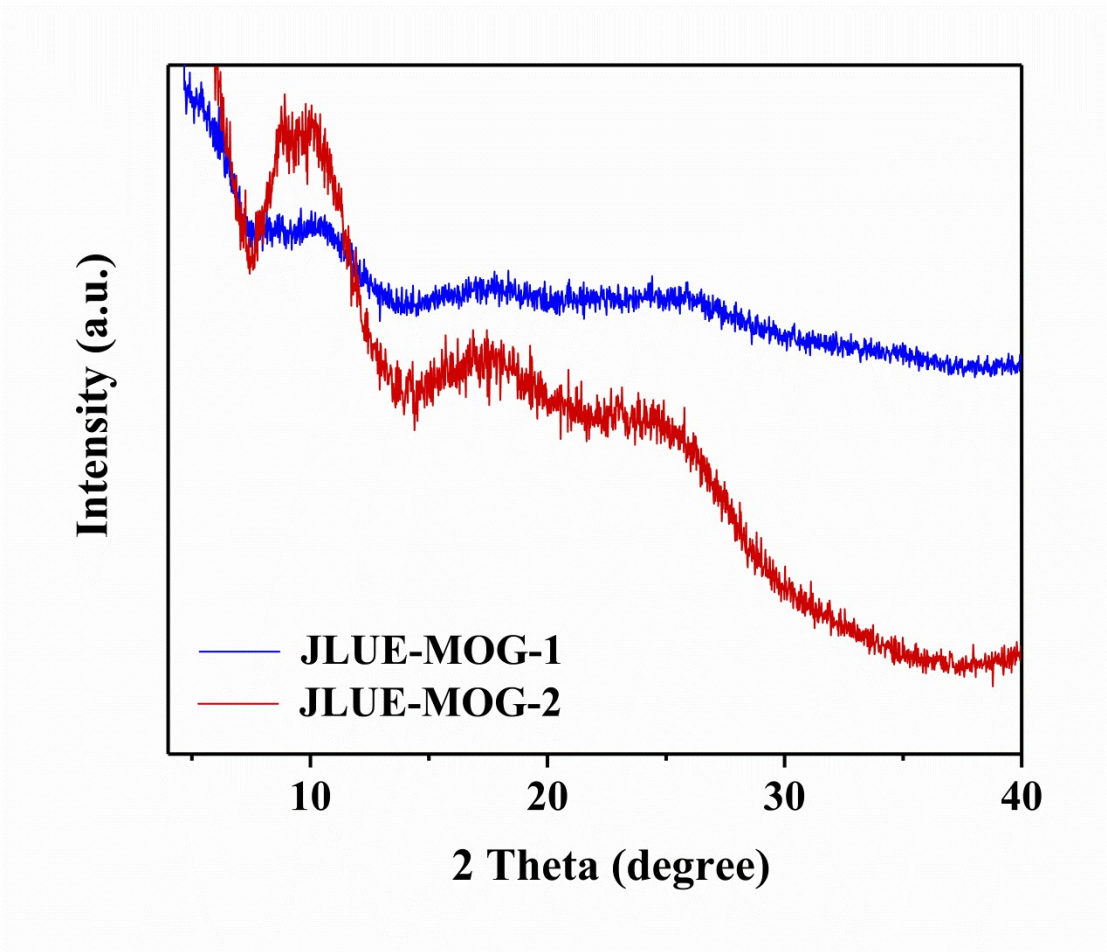

Fig. S2 The XRD patterns of JLUE-MOG-1 and JLUE-MOG-2.

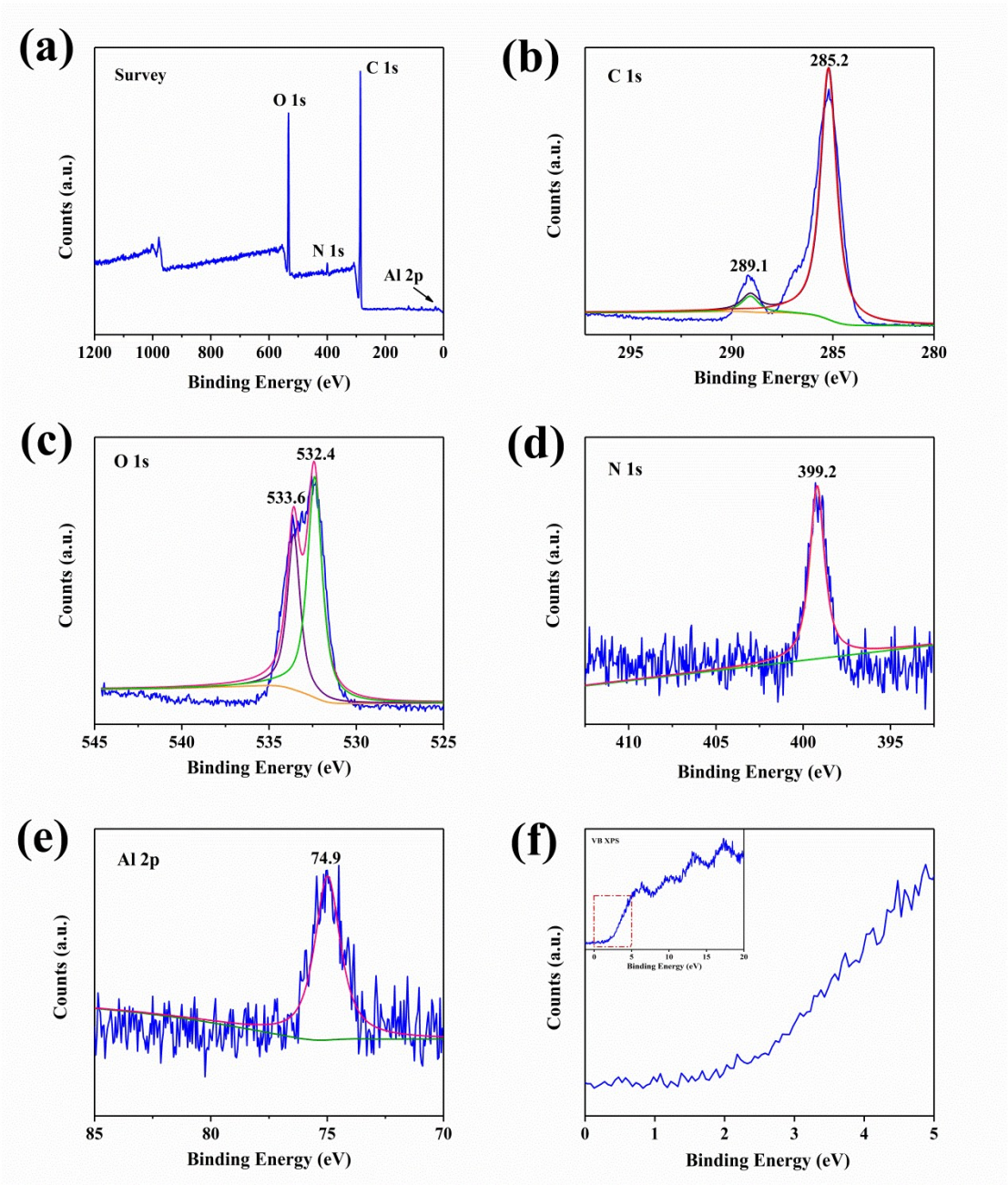

Fig. S3 XPS spectra of JLUE-MOG-2: (a) Survey spectrum; (b) High-solution spectrum of C 1s; (c) High-solution spectrum of O 1s; (d) High-solution spectrum of N 1s; (e) High-solution spectrum of Al 2p; (f) Valence band XPS spectrum.

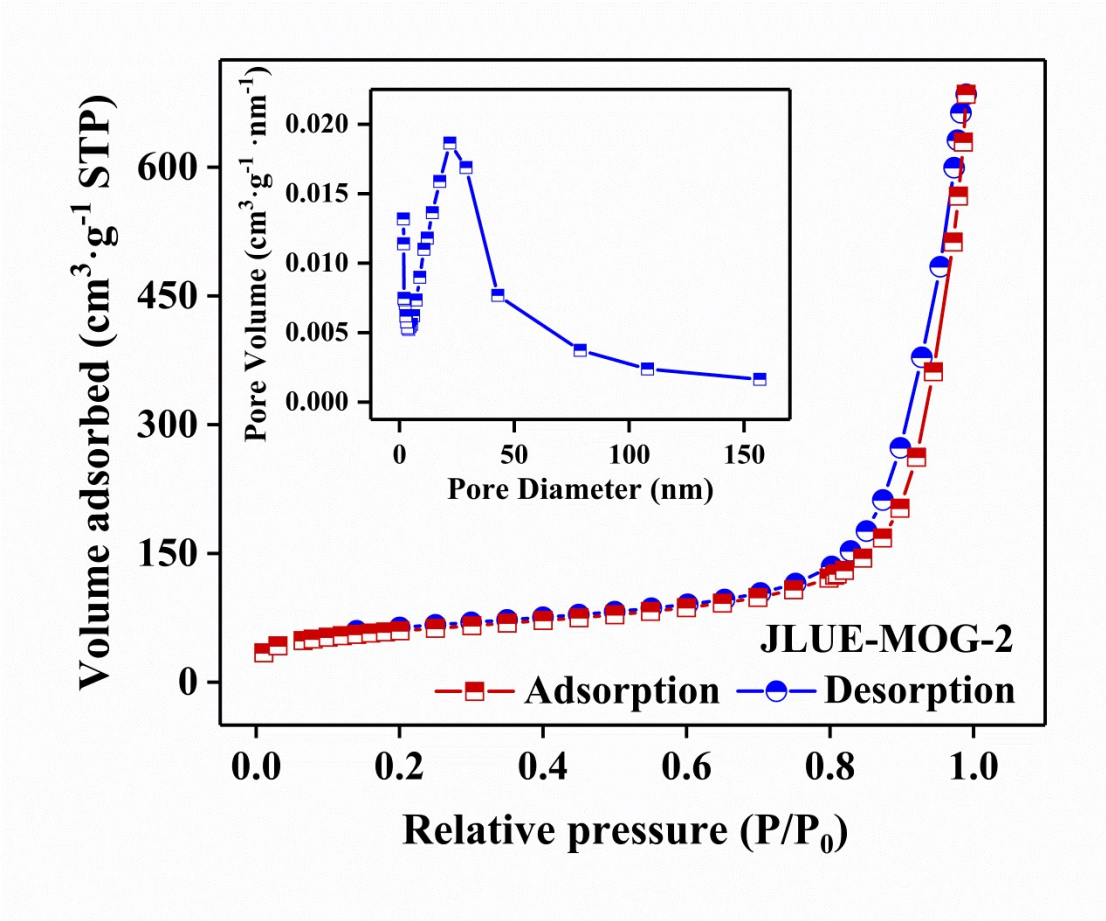

Fig. S4 The BET results of JLUE-MOG-2.

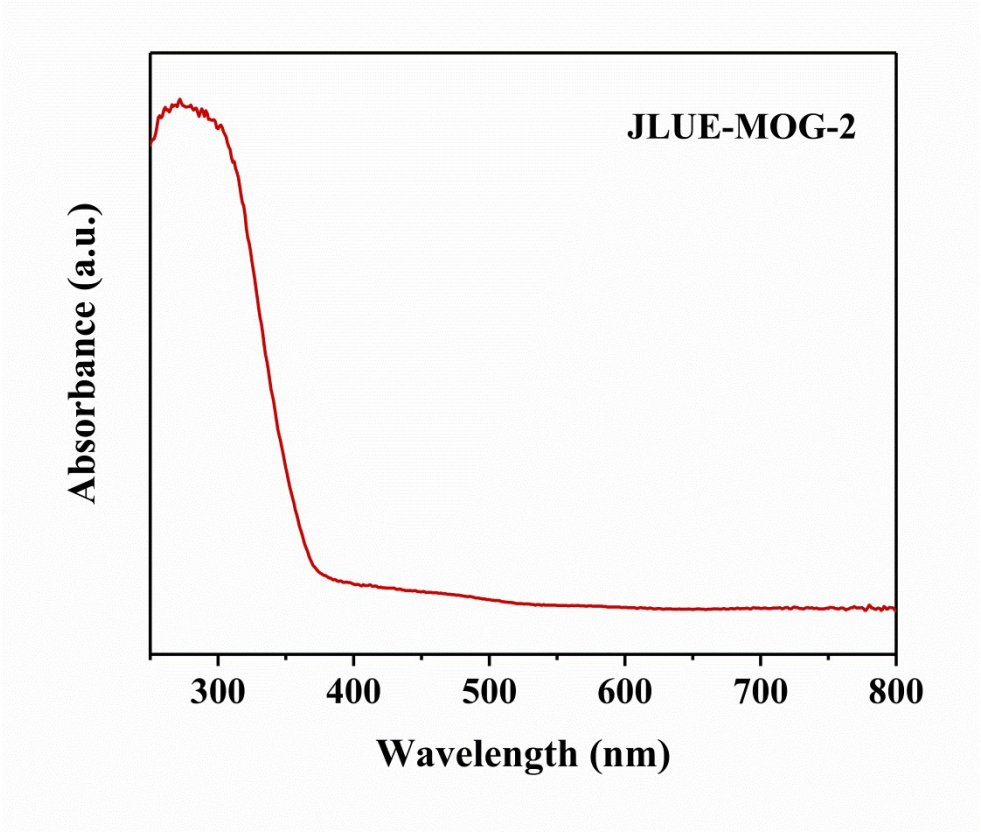

Fig. S5 The UV-vis diffuse reflectance spectra of JLUE-MOG-2.

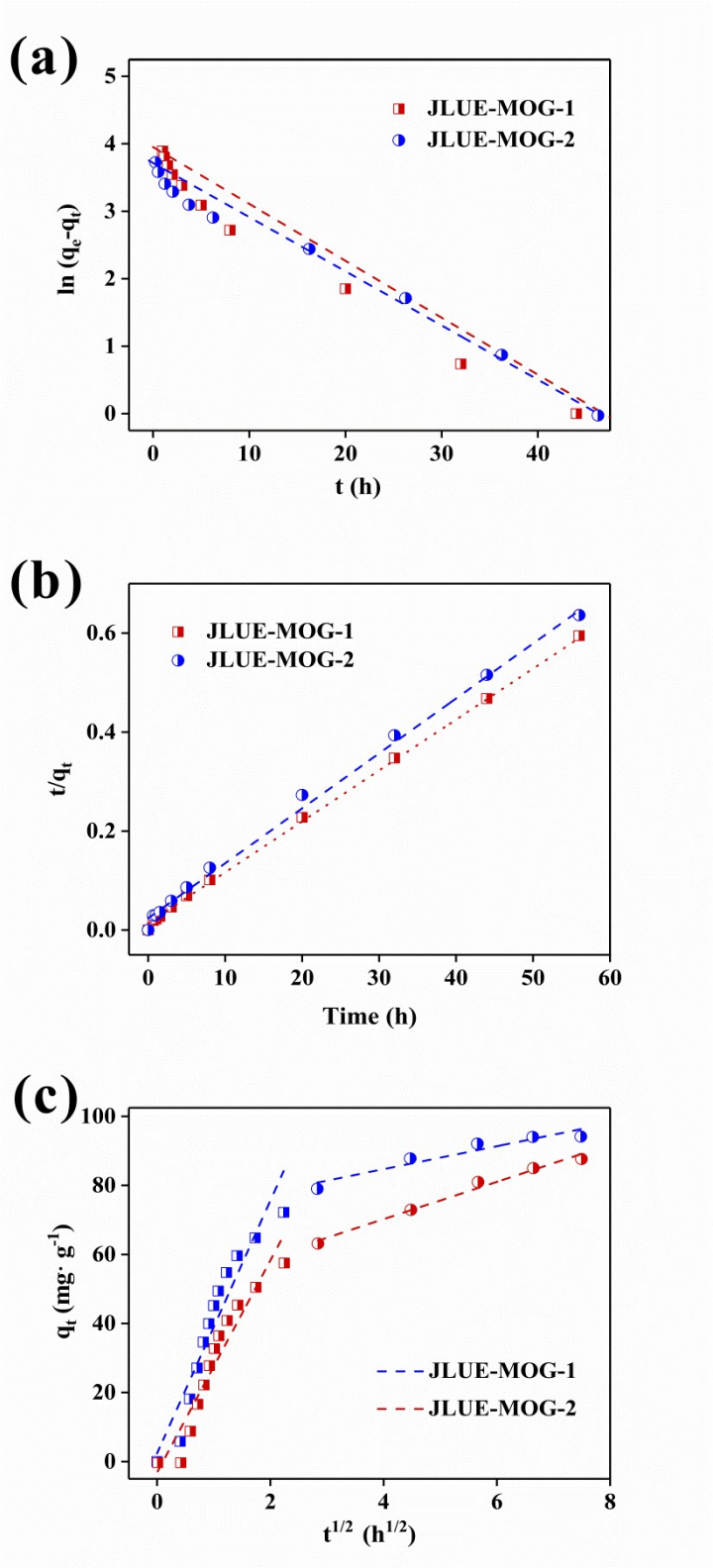

Fig. S6 (a) Pseudo-first-order kinetic model; (b) Pseudo-second-order kinetic model and (c) Intraparticle diffusion model fittings for the CTC adsorption by JLUE-MOG-1 and JLUE-MOG-2.

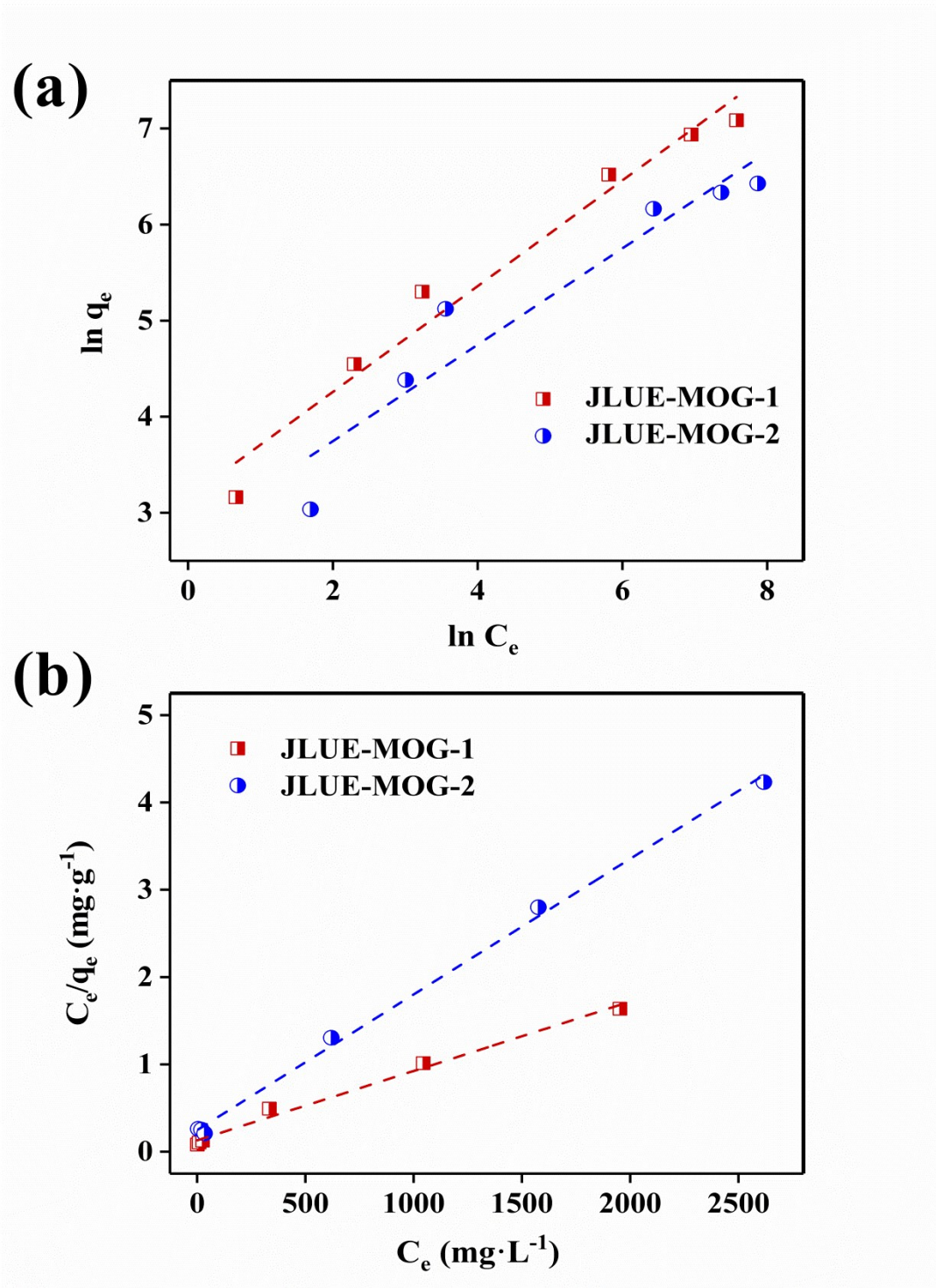

Fig. S7 (a) Freundlich and (b) Langmuir linear fittings for the CTC adsorption by JLUE-MOG-1 and JLUE-MOG-2.

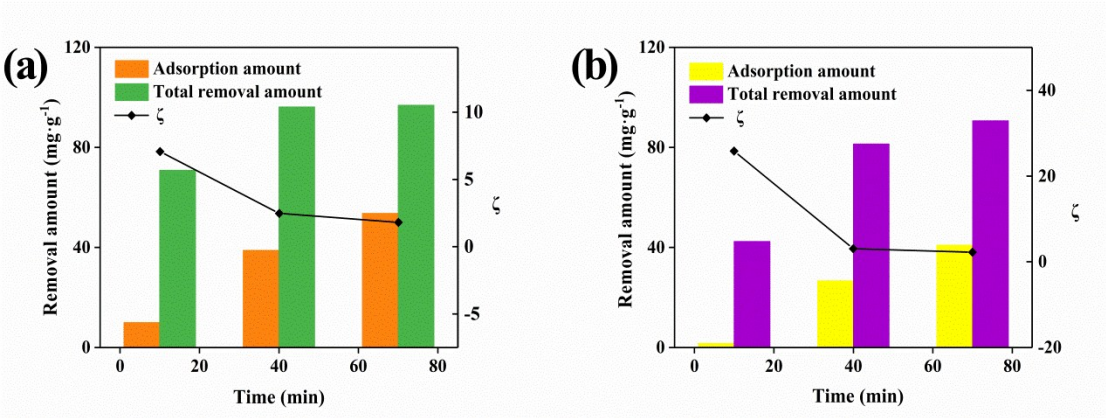

Fig. S8 The variances of adsorption amount, total removal amount and the value of ξ of (a) JLUE-MOG-1 and (b) JLUE-MOG-2 at different time.

In our study, the photocatalytic level coefficient "ξ" is defined as:[a]

$$\xi = \frac{\text{Total removal amount}}{\text{Adsorption amount}}$$

Where ξ is the photocatalytic level coefficient; total removal amount is the total removal amount of CTC during adsorption-photocatalytic process ($mg \cdot g^{-1}$); adsorption amount is the CTC adsorption amount in the dark environment ($mg \cdot g^{-1}$).

[a] Photocatalysis and adsorption should occur simultaneously.

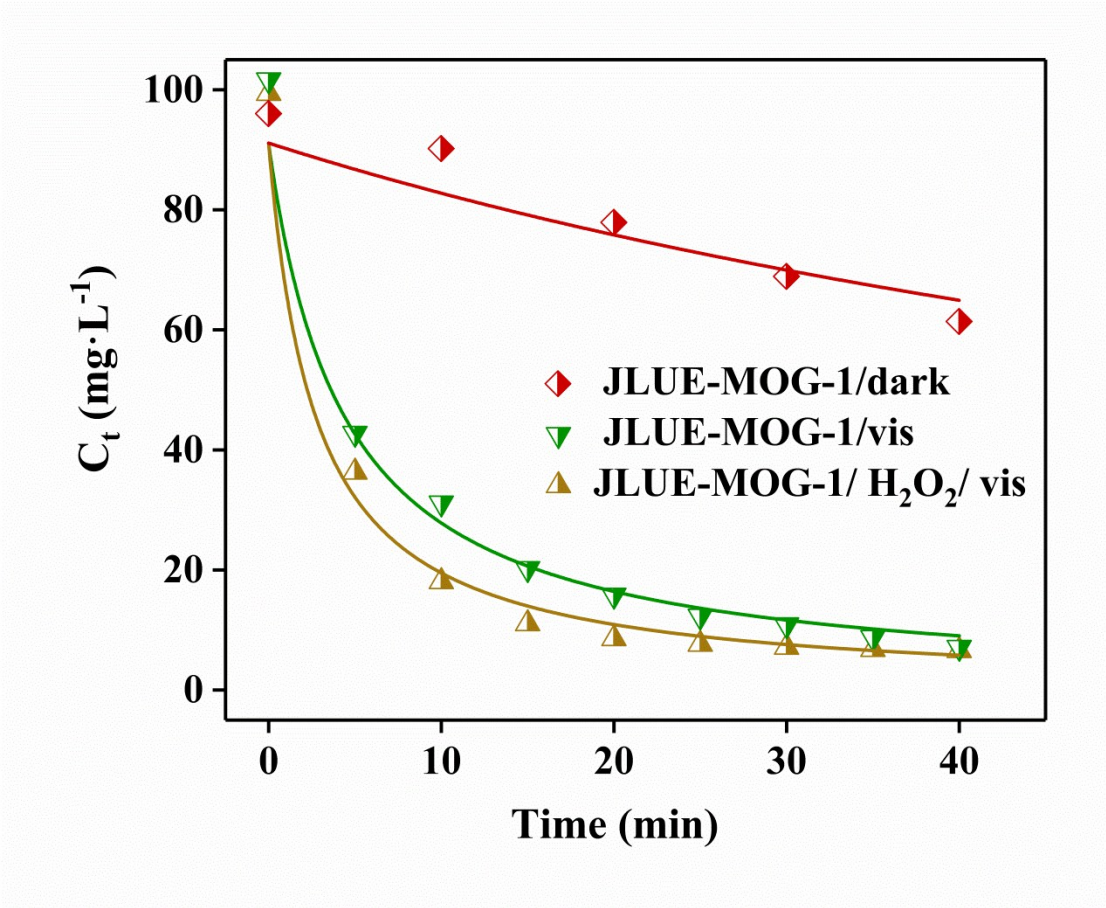

Fig. S9 Pseudo-second-order kinetic model fittings for the CTC degradation under various conditions.

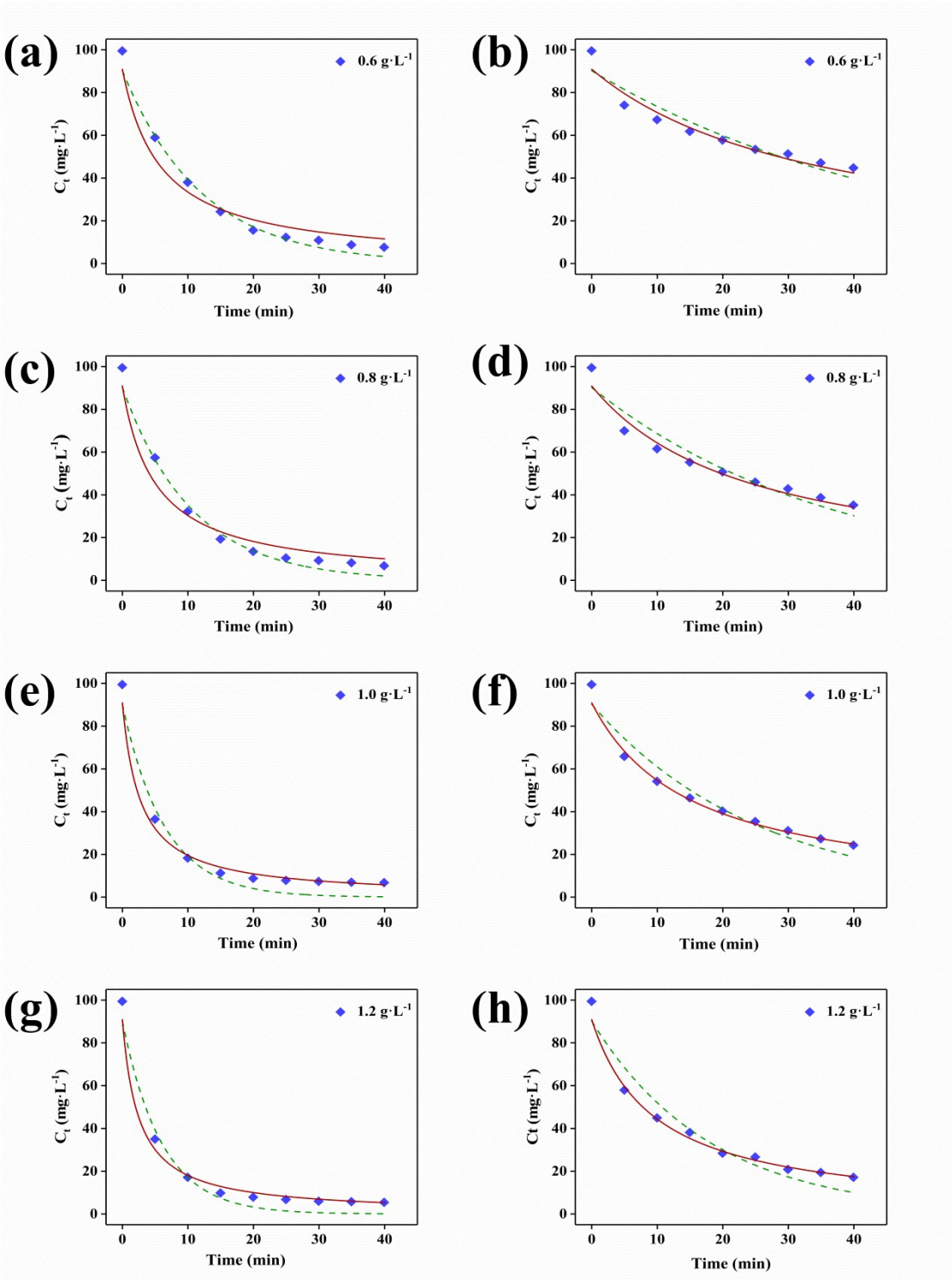

Fig. S10 Pseudo-first-order kinetic model (green dash line) and pseudo-second-order kinetic model (red solid line) fittings for CTC degradation with different dosages of (a, c, e, g) JLUE-MOG-1 and (b, d, f, h) JLUE-MOG-2. (pH=7, H_2O_2 concentration: 10 mM).

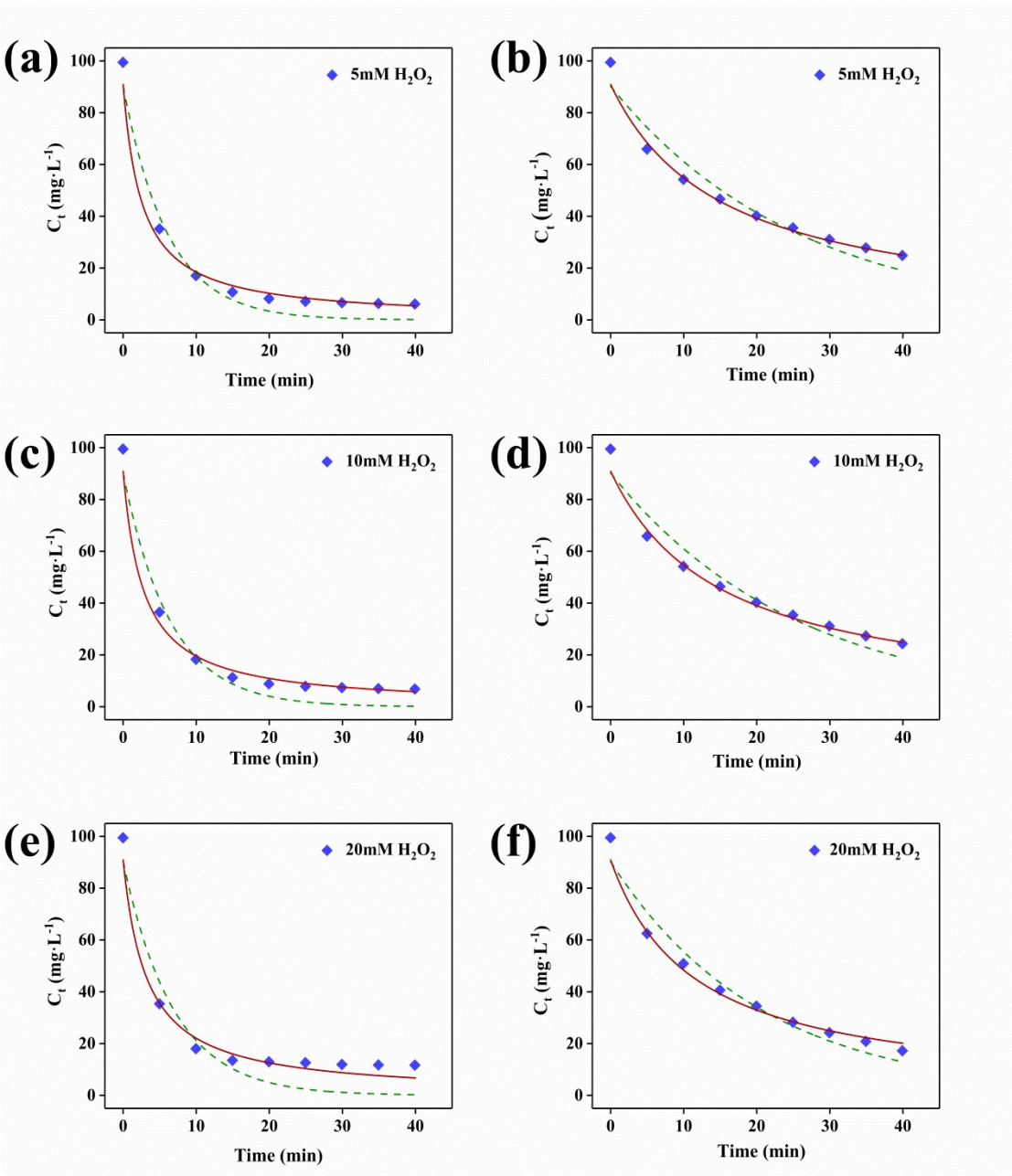

Fig. S11 Pseudo-first-order kinetic model (green dash line) and pseudo-second-order kinetic model (red solid line) fittings for CTC degradation with various H_2O_2 concentrations by (a, c, e) JLUE-MOG-1 and (b, d, f) JLUE-MOG-2. (pH=7, catalyst dosage: 1g·L^{-1}).

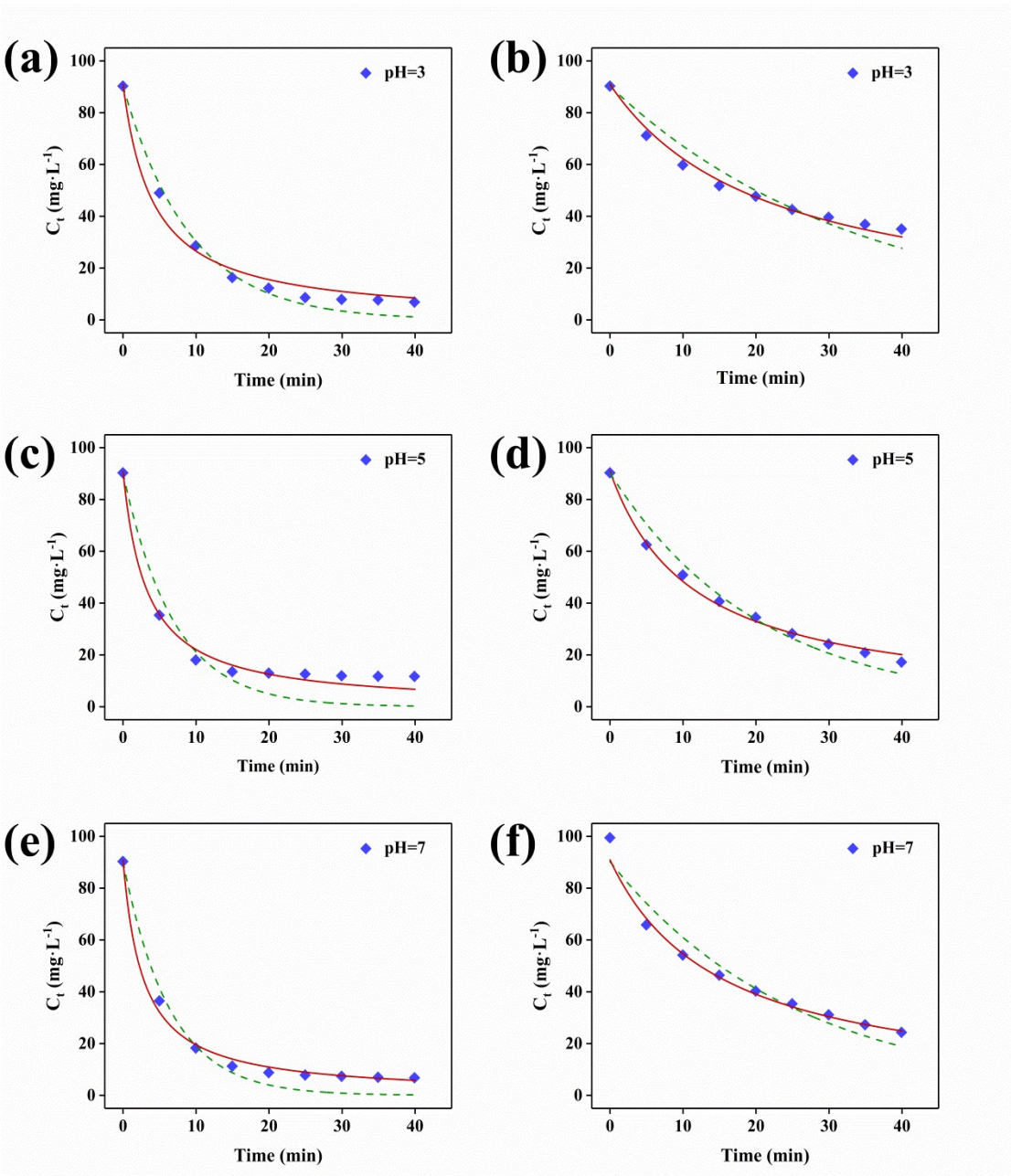

Fig. S12 Pseudo-first-order kinetic model (green dash line) and pseudo-second-order kinetic model (red solid line) fittings for CTC degradation under various pH by (a, c, e) JLUE-MOG-1 and (b, d, f) JLUE-MOG-2. (H_2O_2 concentration: 10mM, catalyst dosage: 1g·L^{-1}).

Tables

Table S1 Pseudo-first-order kinetic model parameters for CTC adsorption by JLUE-MOG-1 and JLUE-MOG-2.

JLUE-MOGs	$q_{e,exp}$ ($mg \cdot g^{-1}$)	Removal Efficiency (%)	Pseudo-first-order kinetics			
			k_1 (h^{-1})	$q_{e1,theor}$ ($mg \cdot g^{-1}$)	Δq_1 (%)	R^2
JLUE-MOG-1	**94.18**	**94.18**	**0.084**	**51.94**	**81.32**	**0.92**
JLUE-MOG-2	**88.00**	**88.00**	**0.073**	**61.56**	**42.95**	**0.97**

Table S2 Pseudo-second-order kinetic model parameters for CTC adsorption by JLUE-MOG-1 and JLUE-MOG-2.

JLUE-MOGs	$q_{e,exp}$ ($mg \cdot g^{-1}$)	Removal Efficiency (%)	Pseudo-second-order kinetics			
			k_2 ($g \cdot mg^{-1} \cdot h^{-1}$)	$q_{e2,theor}$ ($mg \cdot g^{-1}$)	Δq_2 (%)	R^2
JLUE-MOG-1	**94.18**	**94.18**	**0.010**	**97.56**	**3.46**	**1.00**
JLUE-MOG-2	**88.00**	**88.00**	**0.011**	**87.50**	**0.57**	**0.99**

Table S3 Intraparticle diffusion model parameters for CTC adsorption by JLUE-MOG-1 and JLUE-MOG-2.

JLUE-MOGs	Intraparticle diffusion model					
	$k_{i,1}$ ($mg \cdot g^{-1} \cdot h^{-1/2}$)	C_1 ($mg \cdot g^{-1}$)	R^2	$k_{i,2}$ ($mg \cdot g^{-1} \cdot h^{-1/2}$)	C_2 ($mg \cdot g^{-1}$)	R^2
JLUE-MOG-	36.60	2.36	0.90	3.33	71.42	0.89
JLUE-MOG-	30.73	2.52	0.91	5.40	49.03	0.98

Table S4 Freundlich and Langmuir adsorption isotherm model parameters for CTC adsorption by JLUE-MOG-1 and JLUE-MOG-2.

JLUE-MOGs	Freundlich isotherm			Langmuir isotherm		
	n	K_F	R^2	Q_m ($mg \cdot g^{-1}$)	K_L	R^2
JLUE-MOG-1	1.82	23.57	0.98	1259.45	7.69	0.99
JLUE-MOG-2	2.00	15.49	0.96	625.00	4.00	0.99

Table S5 Pseudo-first-order kinetic model and pseudo-second-order kinetic model parameters for CTC degradation.

JLUE-MOGs	$C_{t,exp}$ ($mg \cdot L^{-1}$)	Removal Efficiency (%)	Pseudo-first-order kinetics			Pseudo-second-order kinetics		
			k_1 (min^{-1})	$C_{t,theor}$ ($mg \cdot L^{-1}$)	R^2	k_2 ($mg \cdot L^{-1} min^{-1}$)	$C_{t,theor}$ ($mg \cdot L^{-1}$)	R^2
JLUE-MOG-1	3.14	96.92	0.10	0.08	0.95	0.23×10^{-2}	5.81	0.98
JLUE-MOG-2	9.35	90.81	0.04	5.48	0.96	7.48×10^{-4}	15.78	0.97

Table S6 Comparison of CTC degradation by various catalysts.

Target pollutant	Catalysts	Reaction conditions	Average Reaction rate[a]	Degradation performance	wavelength	References
CTC	NH_2-MIL-53(Fe)	CTC: 20mg·L^{-1}; catalyst: 0.2 g·L^{-1};	5.3×10^{-4} mmol·L^{-1}·h^{-1}	around 32% 23.3h	dark	1
CTC	MWCNT/NH_2-MIL-53(Fe)	CTC: 20mg·L^{-1}; catalyst: 0.2 g·L^{-1};	6.7×10^{-4} mmol·L^{-1}·h^{-1}	around 40% 23.3h	dark	1
CTC	Ag/AgBr/$BiOIO_3$	CTC: 10mg·L^{-1}; catalyst: 0.5 g·L^{-1};	1.9×10^{-3} mmol·L^{-1}·h^{-1}	47.8 % 5h	λ>420 nm	2
CTC	Ppy-BiOI	CTC: 30mg·L^{-1}; catalyst: 1.0 g·L^{-1};	6.3×10^{-3} mmol·L^{-1}·h^{-1}	54 % 5h	λ>420 nm	3
CTC	JLUE-MOG-1	CTC: 100mg·L^{-1}; catalyst: 1.0g·L^{-1};	1.6×10^{-1} mmol·L^{-1}·h^{-1}	98.5% 1.17h	λ>420 nm	This work
CTC	JLUE-MOG-2	CTC: 100mg·L^{-1}; catalyst: 1.0g·L^{-1};	1.5×10^{-1} mmol·L^{-1}·h^{-1}	92.3% 1.17h	λ>420 nm	This work

[a] Average reaction rate for catalysts is defined as:

$$\upsilon_{average} = \frac{\Delta C_{pollutants}}{\Delta t} \quad (2)$$

Where $\upsilon_{average}$ is the average reaction rate (mmol·L^{-1}·h^{-1}); $\Delta C_{pollutants}$ is the variation of concentration of pollutants during a period of time (mmol·L^{-1}) and Δt is the photocatalytic reaction time (h).

Table S7 Pseudo-second-order kinetic model parameters under various conditions for CTC degradation by JLUE-MOG-1.

JLUE-MOG-1	pH	H_2O_2 (mM)	Catalyst ($g \cdot L^{-1}$)	$C_{t,exp}$ ($mg \cdot L^{-1}$)	Removal efficiency (%)	Pseudo-second-order kinetic		
						k_2 ($mg \cdot L^{-1} \cdot min^{-1}$)	$C_{t,theor}$ ($mg \cdot L^{-1}$)	R^2
dark	7	0	1.0	61.19	38.81	1.11×10^{-4}	64.77	0.88
λ>420nm	7	0	1.0	7.10	93.02	0.25×10^{-2}	9.01	0.98
	7	10	1.0	6.58	93.40	0.40×10^{-2}	5.85	0.99

Table S8 Pseudo-first-order kinetic model and pseudo-second-order kinetic model parameters for CTC degradation by JLUE-MOG-1 under various conditions.

pH	H_2O_2 (mM)	Catalyst ($g \cdot L^{-1}$)	$C_{t,exp}$ ($mg \cdot L^{-1}$)	Removal efficiency (%)	Pseudo-first-order kinetic		Pseudo-second-order kinetic	
					k_1 (min^{-1})	R^2	k_2 ($mg \cdot L^{-1} \cdot min^{-1}$)	R^2
3	10	1.0	6.67	92.61	0.11	0.98	0.27×10^{-2}	3
5	10	1.0	13.49	85.05	0.15	0.88	0.34×10^{-2}	5
7	5	1.0	5.94	94.04	0.16	0.96	0.43×10^{-2}	7
7	20	1.0	13.49	86.47	0.15	0.88	0.34×10^{-2}	7
7	10	0.6	7.40	92.58	0.08	0.98	0.19×10^{-2}	7
7	10	0.8	6.61	92.97	0.09	0.98	0.22×10^{-2}	7
7	10	1.0	6.58	93.40	0.16	0.96	0.40×10^{-2}	7
7	10	1.2	6.41	93.57	0.17	0.97	0.45×10^{-2}	7

Table S9 Pseudo-first-order kinetic model and pseudo-second-order kinetic model parameters for CTC degradation by JLUE-MOG-2 under various conditions.

pH	H_2O_2 (mM)	Catalyst ($g \cdot L^{-1}$)	$C_{t,exp}$ ($mg \cdot L^{-1}$)	Removal efficiency (%)	Pseudo-first-order kinetic		Pseudo-second-order kinetic	
					k_1 (min^{-1})	R^2	k_2 ($mg \cdot L^{-1} \cdot min^{-1}$)	R^2
3	10	1.0	34.92	59.56	0.03	0.92	5.06×10^{-4}	0.99
5	10	1.0	17.02	82.54	0.05	0.92	9.69×10^{-4}	0.99
7	5	1.0	24.69	74.67	0.04	0.94	7.24×10^{-4}	0.98
7	20	1.0	17.02	82.54	0.05	0.97	9.69×10^{-4}	0.99
7	10	0.6	44.60	54.24	0.02	0.89	3.16×10^{-4}	0.94
7	10	0.8	35.04	64.05	0.03	0.91	4.56×10^{-4}	0.96
7	10	1.0	24.14	75.23	0.04	0.94	7.31×10^{-4}	0.98
7	10	1.2	16.96	82.64	0.06	0.93	0.12×10^{-2}	0.98

Supporting references

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