A solid-state chemical means to synthesize MgO nanoparticles with superior adsorption property

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Tab. S1. Comparison of specific surface areas about MgO.

MgO adsorbent	Specific surface area ($m^2 \cdot g^{-1}$)	Reference
MgO nanoparticles	213	This paper
Mesoporous MgO	151	1
Porous hierarchical MgO	148	2
Lamellar MgO nanostructures	132	3
Rod-like MgO	115	4
MgO-GO microspheres	108	5

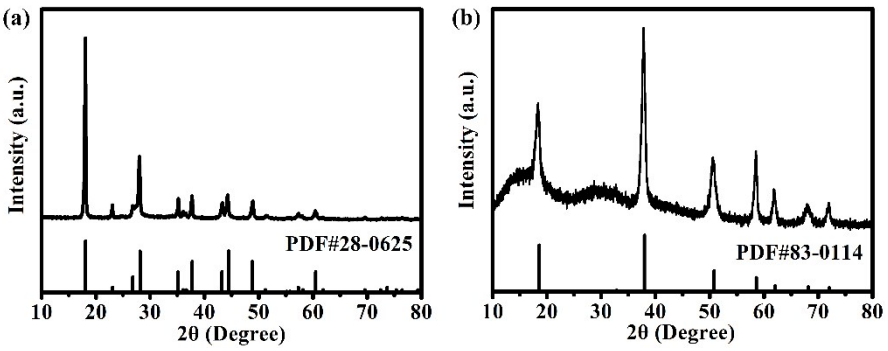

Fig. S1. The precursors of MgO nanoparticles synthesized with (a) $H_2C_2O_4 \cdot 2H_2O$ and (b) NaOH.

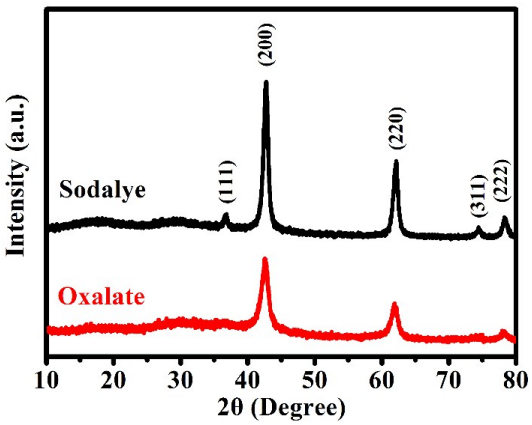

Fig. S2. The XRD patterns of MgO nanoparticles prepared with different materials.

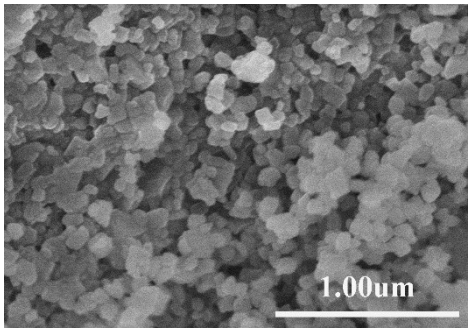

Fig. S3. The SEM image of MgC_2O_4 prepared with $Mg(OAc)_2 \cdot 4H_2O$ and $H_2C_2O_4 \cdot 2H_2O$.

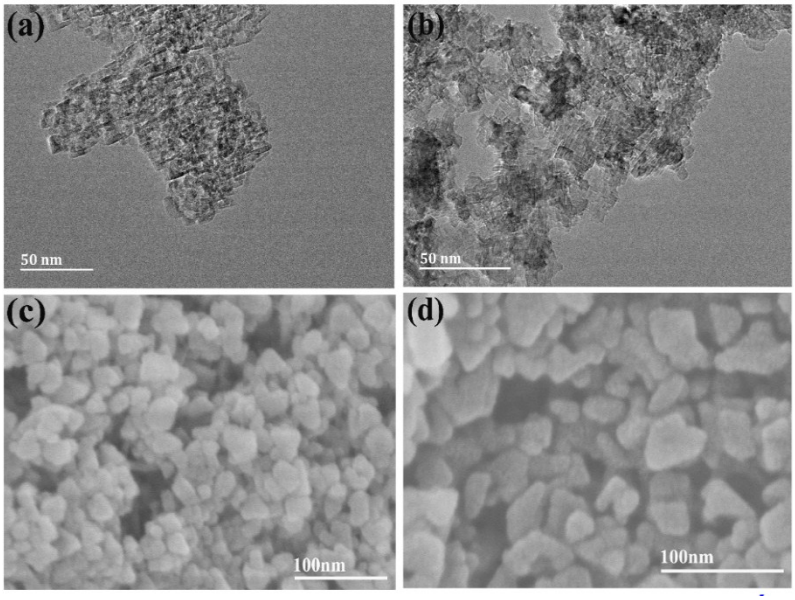

Fig. S4. (a) TEM and (c) SEM of MgO nanoparticles synthesized with $H_2C_2O_4 \cdot 2H_2O$; (b) TEM and (d) SEM of MgO nanoparticles generated with NaOH.

Tab. S2. Comparison of specific surface areas about MgO fabricated with two raw materials.

Raw material	Specific surface area ($m^2 \cdot g^{-1}$)
$H_2C_2O_4 \cdot 2H_2O$	213
NaOH	122

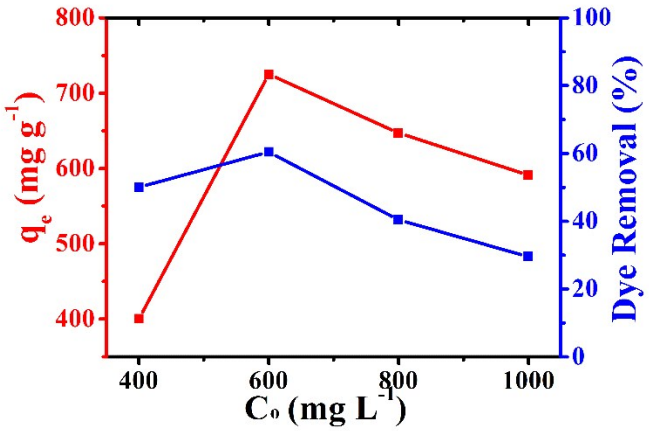

Fig. S5. The adsorption isotherm of the MgO nanoparticles fabricated with NaOH.

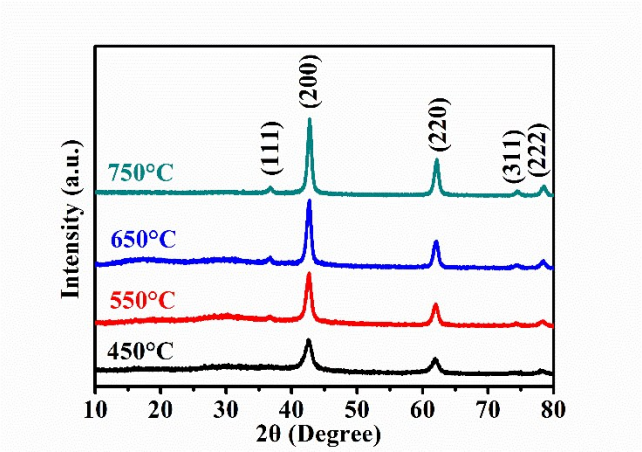

Fig. S6. The XRD pattern of the MgO nanoparticles acquired from calcination with different temperatures varying from 450°C to 750°C.

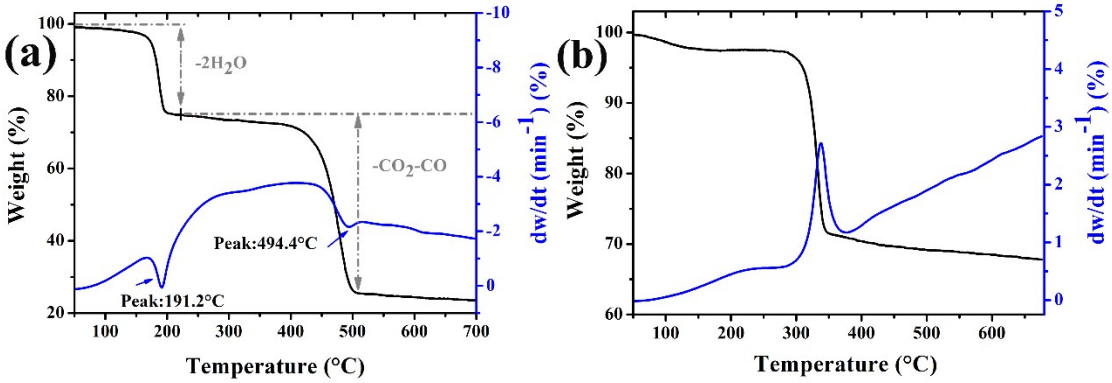

Fig. S7. TGA and DSC curves of the precursors synthesized with (a) $H_2C_2O_4 \cdot 2H_2O$ and (b) NaOH.

Tab. S3. Comparison of specific surface sreas about MgO prepared at different calcination temperatures.

Calcination temperature	Specific surface area ($m^2 \cdot g^{-1}$)
450°C	213
550°C	119
650°C	110
750°C	87

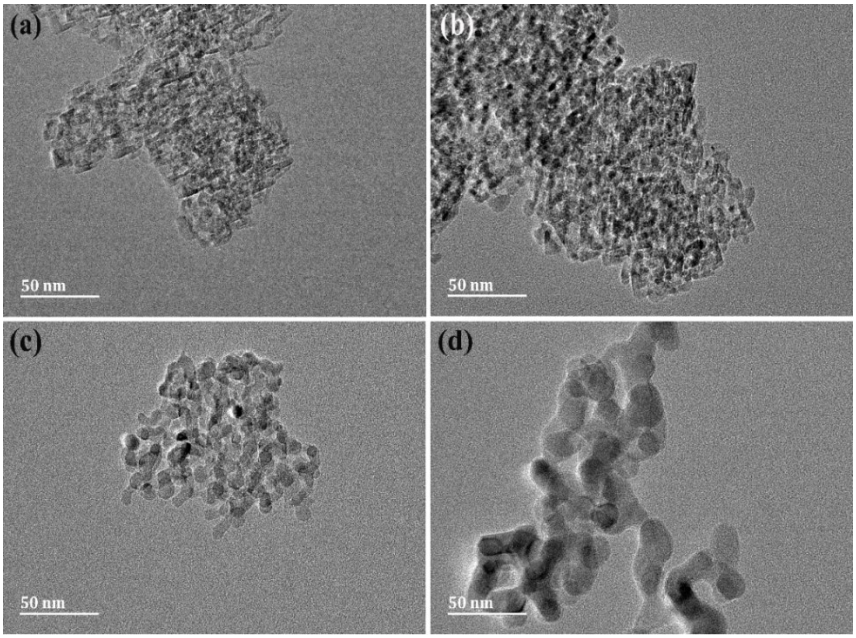

Fig. S8. TEM images of MgO nanoparticles acquired from calcination at (a) 450°C, (b) 550°C, (c) 650°C and (d) 750°C.

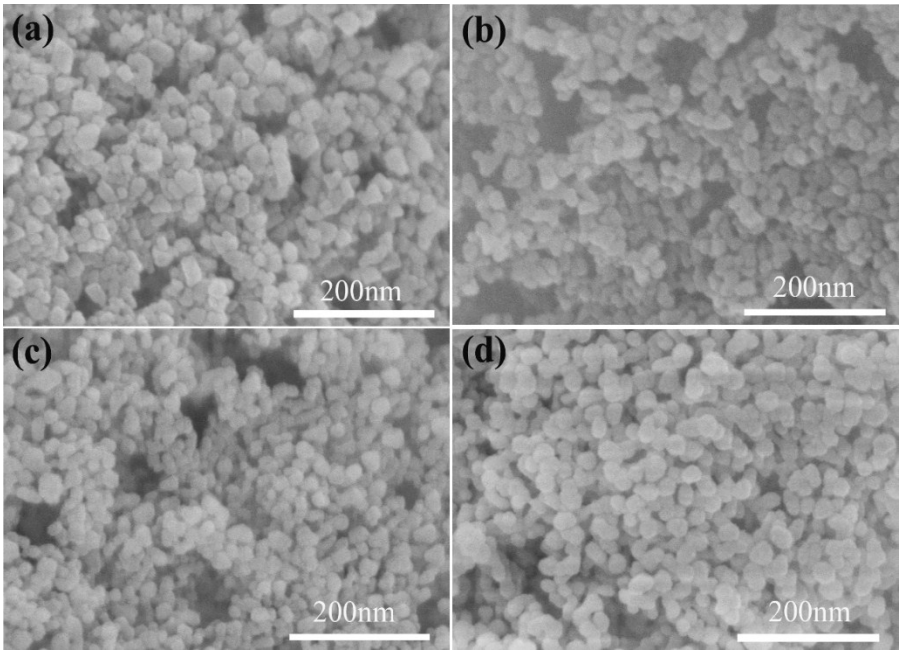

Fig. S9. SEM images of MgO nanoparticles acquired from calcination at (a) 450°C, (b) 550°C, (c) 650°C and (d) 750°C.

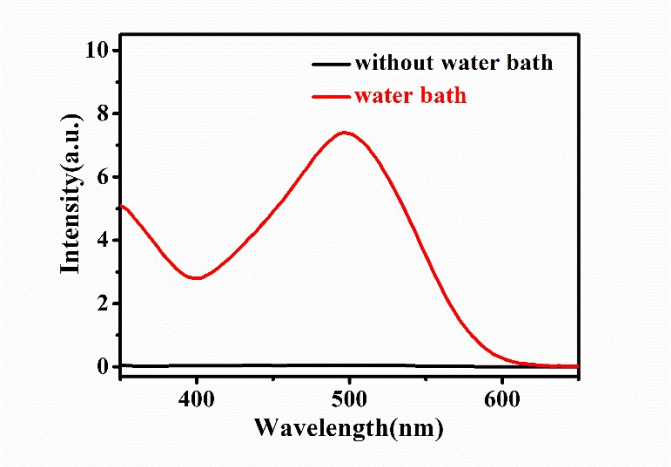

Fig. S10. UV-vis spectra of initial CR solutions (600 mg·L^{-1}) of the MgO nanoparticles.

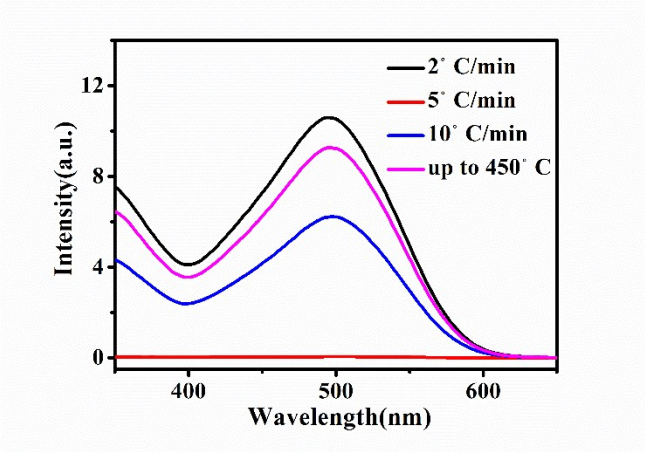

Fig. S11. UV-vis spectra of initial CR solutions (800 mg·L^{-1}) of the MgO nanoparticles acquired without water bath process at different heating rates.

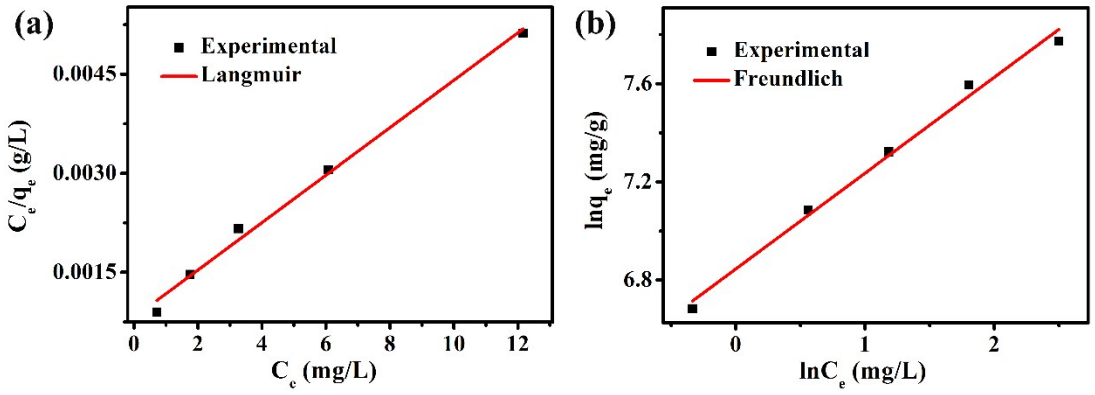

Fig. S12. Adsorption isotherm curves of Congo red on as-synthesized MgO nanoparticles.

Tab. S4. Adsorption isotherm parameters of Congo red on MgO nanoparticles.

	Langmuir			Freundlich		
	q_m (mg·g^{-1})	b	R^2	K_f	n	R^2
MgO	2785	0.4387	0.9916	939.35	2.56	0.9891

Tab. S5. Comparison of adsorption capacities towards CR on MgO.

MgO adsorbent	Adsorbent mass (mg)	Removal Capacity ($mg \cdot g^{-1}$)	Reference
MgO mesoporous nanofibers	30	4802	6
Rod-like Si-MgO	10	3236	7
Lamellar MgO nanostructures	50	2650	3
Porous hierarchical MgO	40	2409	2
MgO nanoparticles	10	2375	This paper
Porous MgO MoFs	10	1413	8
Hierarchical MgO	10	1205	9
Porous MgO	20	689	10
MgO-GO microspheres	10	237	5

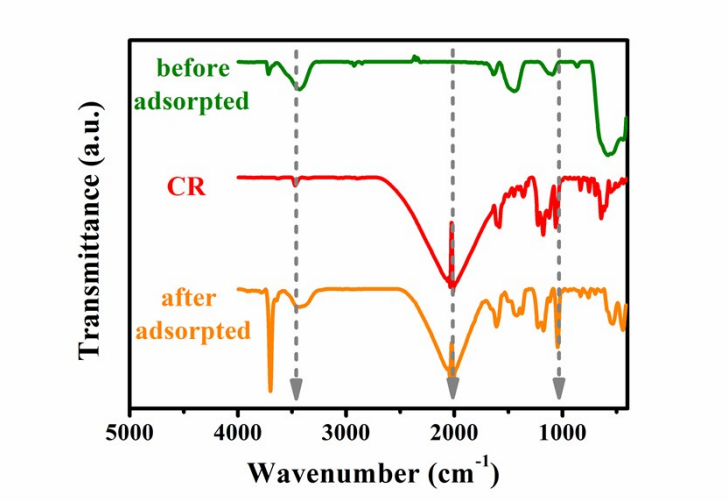

Fig. 13. FT-IR spectra of Congo red, MgO nanoparticles before and after adsorbed.

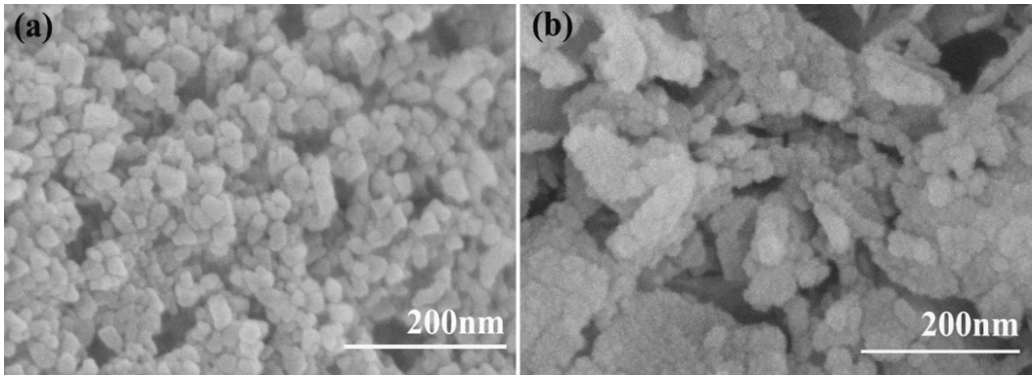

Fig. S14. The SEM images of (a) before reaction and (b) after reaction of the MgO nanoparticles acquired without water bath process.

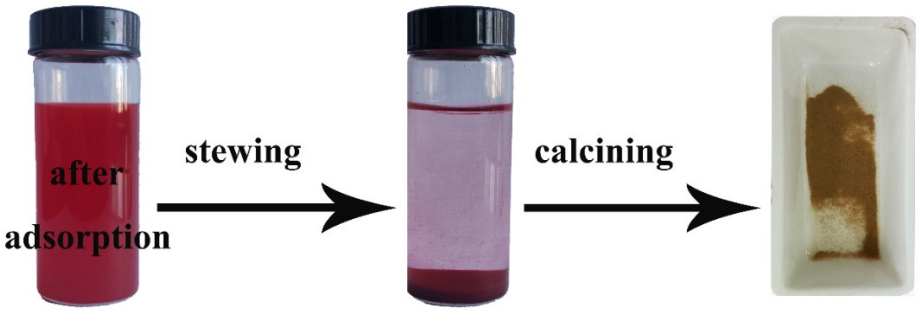

Fig. S15. Reusability illustration of the MgO nanoparticles without water bath process.

References

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