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SUPPLEMENTARY MATERIAL TO

ZnO/CdO/reduced graphene oxide and its high catalytic performance towards degradation of the organic pollutants

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Synthesis of ZnO/CdO nanoparticles

4 mL of 0.5 M solution of $Zn(CH_3COOH)_2.2H_2O$ and 4 mL of 0.5 M solution of $Cd(CH_3COO)_2.2H_2O$ were briefly added to a conical flask containing the mixed solution of 50 mL distilled water, 2.8 g NaOH, 10 mL of PEG (M_w = = 400), blended well by stirring for 15 min at 70 °C. Subsequently, the mixed solution was left for 4 days at room temperature. White crystalline products were collected, centrifuged, washed with distilled water and ethanol several times and dried at 60 °C in an oven, then calcinated at 400 °C for 1 h.

Evaluation of reactive oxygen specious (ROS)

In three volumetric flasks (marked 1–3), 5 ml of diphenylcarbazide (DPCI) solution (10^{-2} M) were added. Then 0.3 g ZnO/CdO/reduced graphene oxide (1.2 g/L) was added to 1 and 3, respectively. All of the three solutions were diluted to 25 mL with distilled water. The solutions 1 and 2 were put into an ultrasonic apparatus away from light, directly under ultrasonic irradiation, and solution 3 was placed away from light without ultrasonic irradiation, just under stirring. After 45 min, a 10 mL solution was taken from each sample and extracted with benzene-tetrachloride carbon (volume ratio =1:1), then the UV–Vis spectra of all solutions were determined.

Determination of the kind of ROS

Three 5 mL DPCI solution (10^{-2} M) were added into three volumetric flasks marked as a-c respectively. Then 1.2 g/L of ZnO/CdO/reduced graphene oxide was added to each one. 2.5 mL of ((L-His, thiourea and vitamin C (VC)) 5×10^{-3} M) was added into (a–c) flasks, respectively. All solutions were diluted to 25 mL

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with double distilled water. The solution was then divided into two conical flasks. One of the conical flasks was placed under the ultrasonic irradiation and the other was stored under stirring. After 45 min, a 10 mL of solution was taken from each sample and extracted with benzene-carbon tetrachloride mixture (volume ratio = 1:1), then the UV–Vis spectra of all solutions were recorded.

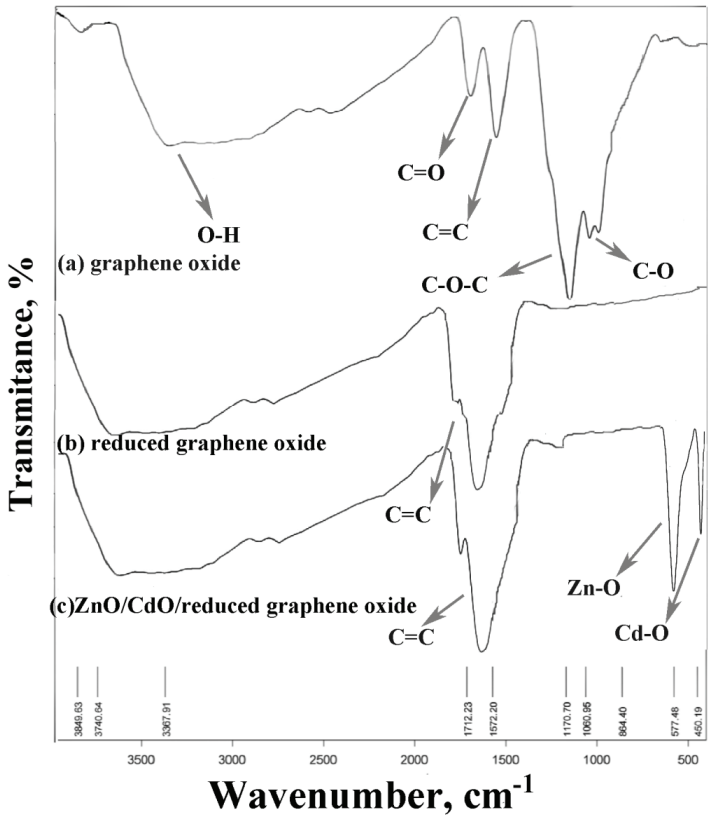

Fig. S-1. FTIR spectra of: a) graphene oxide; b) ZnO/CdO/reduced graphene oxide.

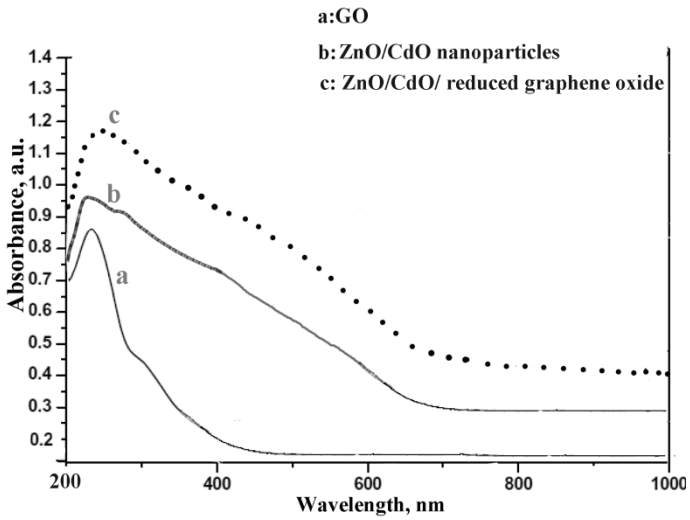

Fig. S-2. UV-Vis spectra of: a) graphene oxide, b)ZnO/CdO nanoparticles and c)ZnO/CdO/reduced graphene oxide.

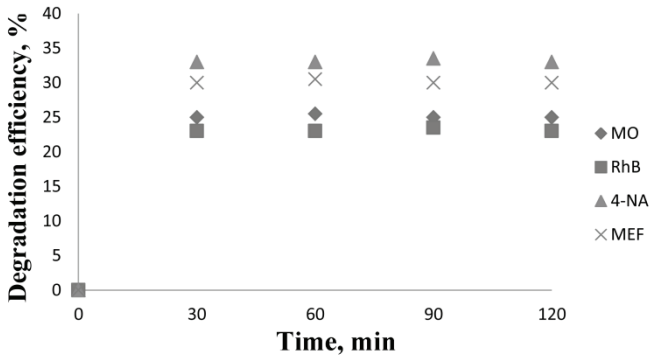

Fig. S-3. Percentage removal of the organic pollutants at first 30 min without ultrasonic (adsorption study).

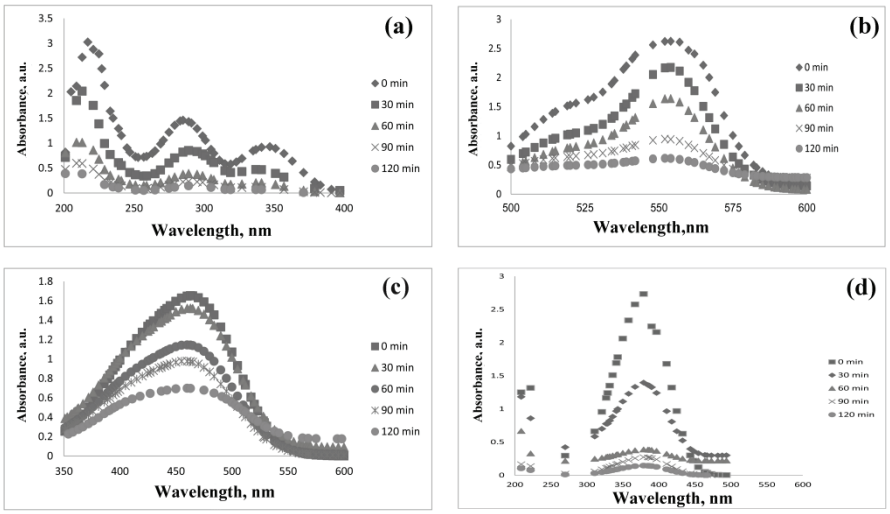

Fig. S-4. UV–Vis spectra of: a) MEF, b) RhB, c) MO and 4-NA; reaction conditions: catalyst: 1.2 g/L, initial concentration of MEF, 4-NA and azo dyes 10 mg/L, and ultrasonic power 1200 W/L.

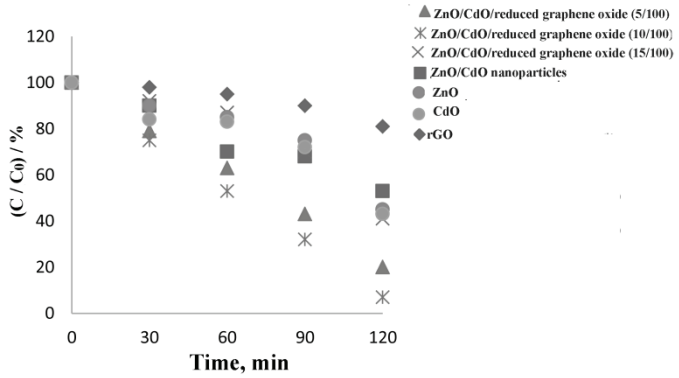

Fig. S-5. The sonocatalytic degradation of MEF under ultrasonic irradiation; experimental conditions: initial concentration of MEF: 10 mg/L, ultrasonic power: 1200 W/L, catalyst: 1.2 g/L, pH 7.5.

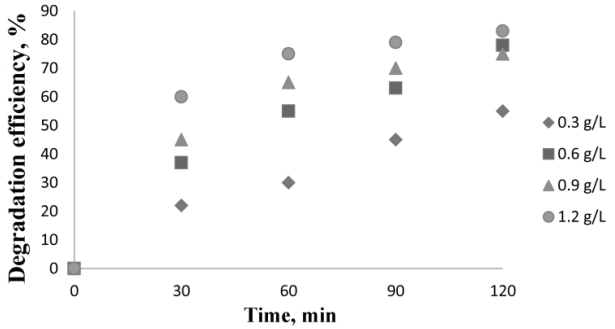

Fig. S-6. Effect of dosage of catalyst on sonocatalytic reaction; experimental conditions: initial concentration of MEF: 10 mg/L, ultrasonic power: 1200 W/L, catalyst: ZnO/CdO/reduced graphene oxide (10/100), pH 7.5.

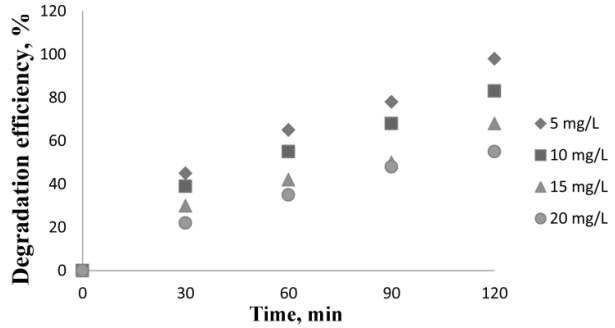

Fig. S-7. Effect of initial concentration of MEF on sonocatalytic reaction; experimental conditions: ZnO/CdO/reduced graphene oxide (10/100): 1.2 g/L, ultrasonic power: 1200 W/L pH 7.5.

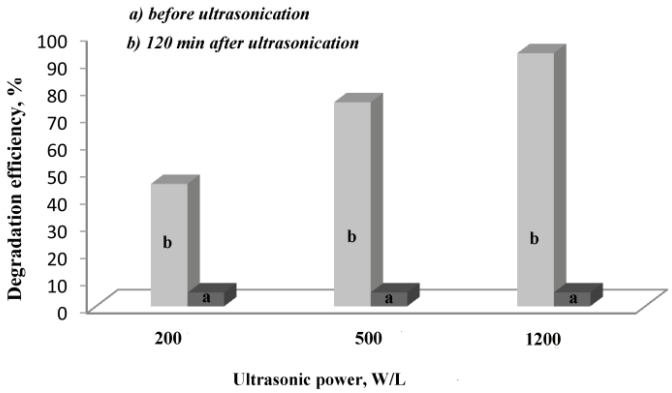

Fig. S-8. Effect of ultrasonic output power on degradation MEF; experimental conditions: ZnO/CdO/reduced graphene oxide (10/100): 1.2 g/L, initial concentration of MEF: 10 mg/L pH 7.5.

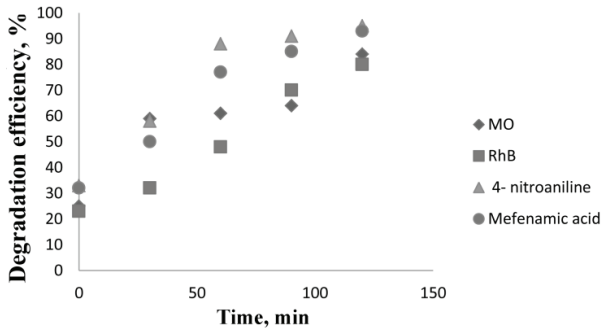

Fig. S-9. Removal efficiency of the as-synthesized nanocomposites with MEF, azo dyes and 4-NA; reaction conditions: ZnO/CdO/reduced graphene oxide (10/100): 1.2 g/L, initial concentration of MEF, azo dyes, 4-NA: 10 mg/L, ultrasonic power 1200W/L pH 7.5.

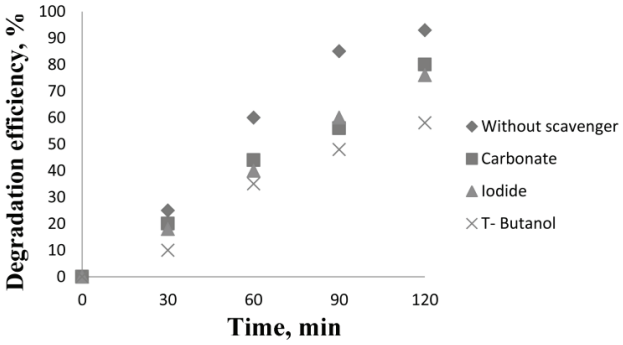

Fig. S-10. Effect of inorganic and organic scavengers on the sonocatalytic degradation of MEF in the presence of ZnO/CdO/reduced graphene oxide (experimental conditions: [ZnO/CdO/reduced graphene oxide (10/100)] = 1.2 g/L, [MEF] = 10 mg/L, [Scavenger] = 10 mg/L and US power = 1200 W/L, US time: 120 min). pH 7.5, systemic temperature = 25±0.2°C.

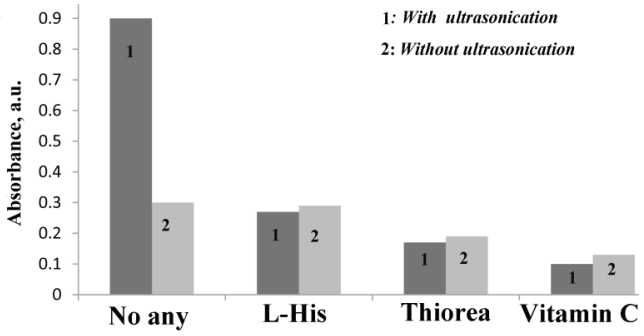

Fig. S-11. Absorbance of DPCO in DPCI + as-prepared nanocomposites solutions in the presence of various quenching reagents. Experimental condition: with and without ultrasonic irradiation, ([DPCI] = 10^{-2} M, [ZnO/CdO/reduced graphene oxide (10/100)] =1.2 g/L, [His] = [VC] = [Thiourea] = 5.0×10^{-3} M and US power = 1200 W/L. Ultrasonic time: 45 min.