Electronic Supplementary Material (ESI) for RSC Advances.

Supplementary Material

Folic Acid-Maltodextrin Polymers Coated Magnetic Graphene Oxide as NIR-responsive Nano-drug Delivery System for Chemo-photothermal Synergistic Inhibition of Tumor Cell

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1. Synthesis of MGO and MGO-APTES

According to our previous reported work[1], GO nanosheets were prepared by a modified Hummer's method with natural graphite powder. $FeCl_3 \cdot 6H_2O$ and $FeCl_2 \cdot 4H_2O$ (mol ratio of 2:1) were dissolved into 100 mL deionized water with dispersed appropriate amount of GO nanosheets. After injection of $NH_3 \cdot H_2O$ (25%), the reaction was kept stirring with vigorous mechanical agitation under a nitrogen environment for 4 h at 80 °C to yield magnetic black precipitate. The mixture was magnetically separated and washed with DI water and anhydrous ethanol three times, and freeze-dried overnight for further use.

The obtained MGO powder (200 mg) was dispersed in ethanol (200 mL, 99.5%) by ultrasonic. APTES (300 μL) was added to the mixture with a mechanical agitation for 8 h at room temperature under N_2 protection. The precipitate was magnetically separated and washed with ethanol and deionized water three times. Finally, it was freeze-dried for 24 h to get amino-MGO.

2. Lagergren's pseudo-first-order kinetic model (Eq (1)) and Ho's pseudo-second-order model (Eq (2))

$$\ln(q_e - q_t) = \ln(q_e) - k_1 t, \quad (1)$$

$$\frac{t}{q_t} = \frac{1}{k_2 q_e^2} + \frac{t}{q_e}, \quad (2)$$

where, in equation (1) and (2): q_e (mg/g) is equilibrium adsorption capacity; q_t (mg/g) is the drug loading at different time points; t (min) is the drug loading time; k_1 and k_2 are kinetic constants.

3. Langmuir model (Equ (3)) and Freundlich model (Equ (4))

$$\frac{C_e}{q_e} = \frac{C_e}{q_m} + \frac{1}{q_m K_L}, \quad (3)$$

$$\ln q_e = \ln K_f + \frac{1}{n} \ln C_e, \quad (4)$$

where, in equation (3) and (4): C_e (mg/L) is the mass concentration at the time of drug loading equilibrium; q_m (mg/g) is the drug load in the saturated state; q_e (mg/g) is the drug load at equilibrium; K_L (L/mg) is the dissociation constant; K_f is the Freundlich constant; 1/n is the Freundlich component factor.

Reference

[1] Liang W, Huang Y, Lu D, et al. β-Cyclodextrin-Hyaluronic Acid Polymer Functionalized Magnetic Graphene Oxide Nanocomposites for Targeted Photo-Chemotherapy of Tumor Cells, Polymers. (2019), 11(1): 133.

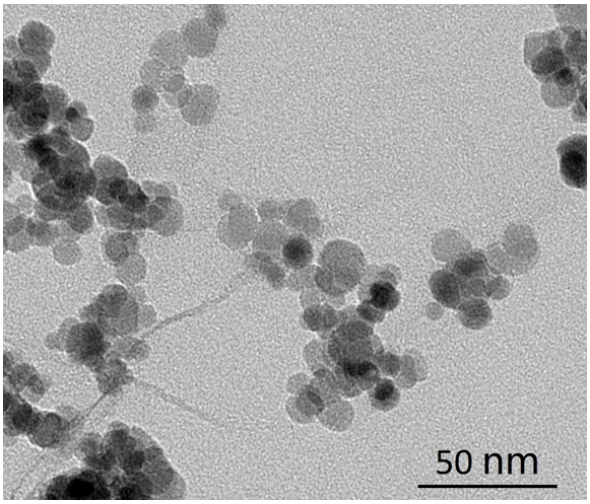

Figure S1. TEM images of MGO.

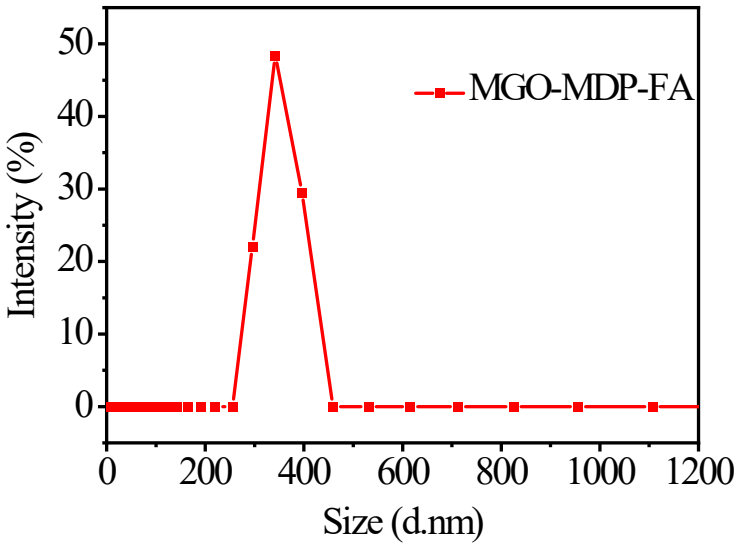

Figure S2. Size distribution of MGO-MDP-FA measured by DLS.

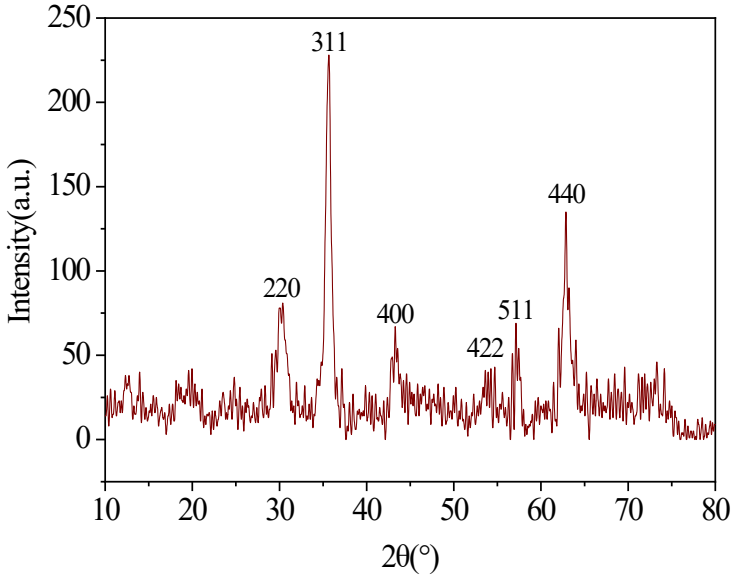

Figure S3. XRD of MGO.

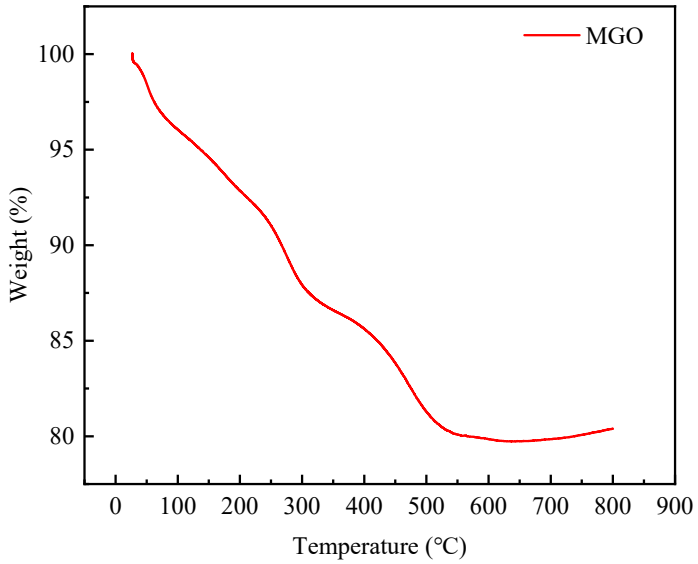

Figure S4. TGA curves of MGO in air.

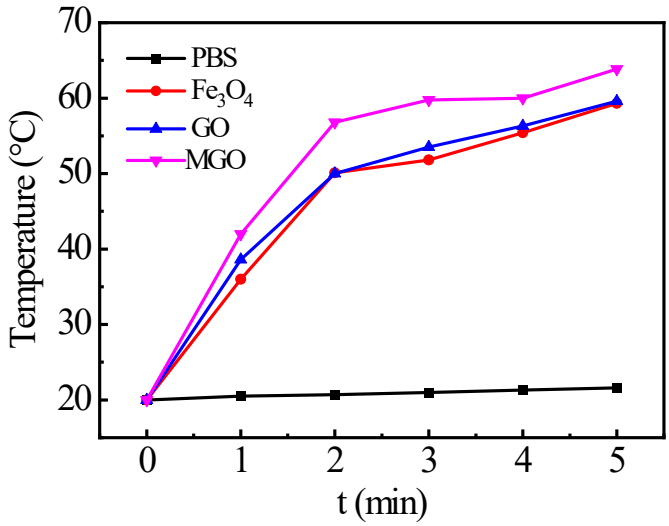

Figure S5. Temperature change curves of Fe_3O_4, GO and MGO solution with the concentration of 1.0 mg mL^{-1} under NIR laser irradiation (808 nm, 2.0 W cm^{-2}) for 0-5 min recorded by the thermal camera.

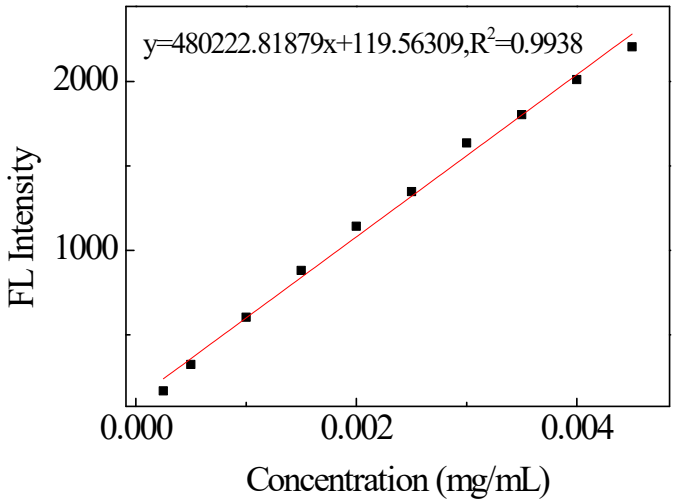

Figure S6. Plot of calibration curves for DOX solution with different concentration.

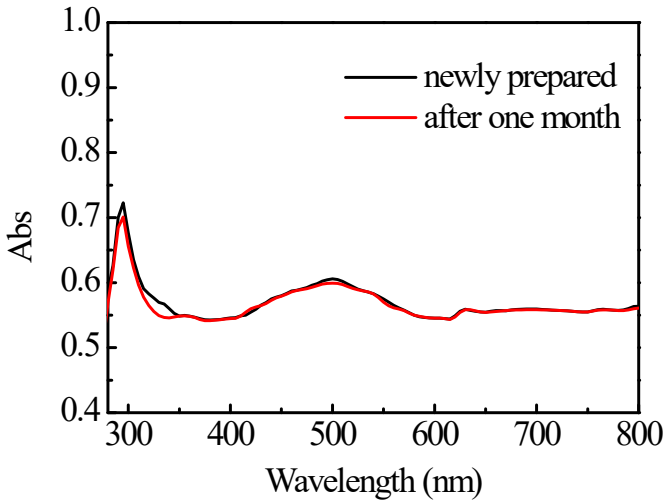

Figure S7. UV-Vis spectra of newly prepared MGO-MDP-FA@DOX aqueous solution placed for one month.

Table S1. The drug adsorption kinetic parameters for DOX on MGO-MDP-FA corresponded with Lagergren's pseudo-first-order model and Ho's pseudo-second-order model

Lagergren's pseudo-first-order kinetic model			Ho's pseudo-second-order kinetic model		
q_e (mg/g)	k_1 (h^{-1})	R^2	q_e (mg/g)	k_2 ($g(mg \cdot h)^{-1}$)	R^2
2.701	0.00434	0.9113	33.85	0.005788	0.9999

Table S2. Relevant parameters of Langmuir isotherm and Freundlich isotherm adsorption models for DOX by MGO-MDP-FA

Langmuir isotherm Model			Freundlich isotherm Model		
q_m (mg/g)	K_L (mg/mL)	R^2	n	K_f (mL/g)	R^2
657.9	0.2603	0.9983	3.295	192.9	0.9222