Supplementary Information

Novel molecularly imprinted malachite green bifunctional imprinted microspheres through pickering emulsion polymerization

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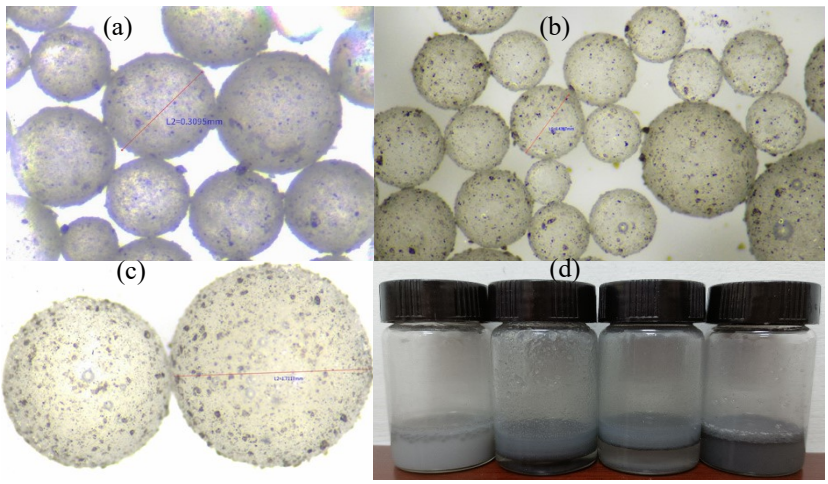

Fig. S1 Optical picture of a series of Pickering emulsions prepared with various oil/water ratios (1/6 (a), 2/6 (b), and 3/6 (C), v/v, the volume of deionized water was 6 mL) at KABT concentration of 5 mg mL^{-1} (6 mL deionized water); Picture(d) of MG Pickering emulsion stabilized byKABT at different concentration(30,50, 60, 80 mg, from left to right).

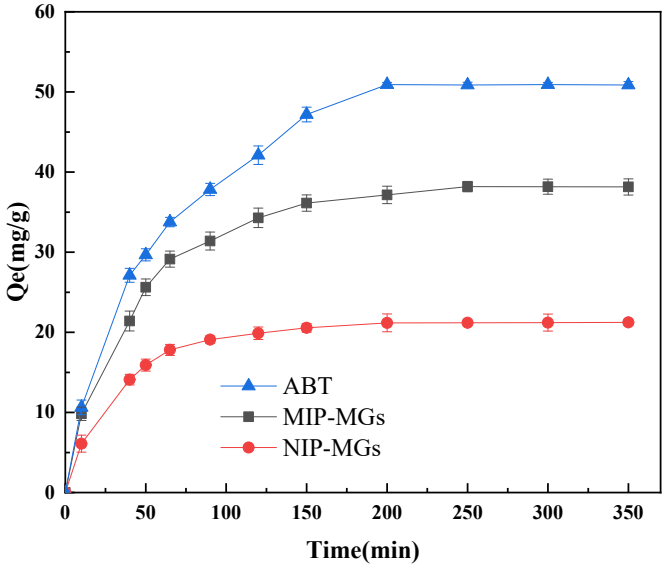

Fig. S2 Adsorption properties of MIP-MGs/NIP-MGs

Table S1 Optimization of the ratio of functional monomers to crosslinker

MIP-MGs	MG (mg)	MAA (mmol)	EDGMA (mmol)	AIBN (mg)	Adsorption capacity (mg g^{-1})
MIP-MG 1	10	0.06	0.20	20	18.33
MIP-MG 2	10	0.10	0.20	20	22.86
MIP-MG 3	**10**	**0.08**	**0.20**	**20**	**38.12**
MIP-MG 4	10	0.08	0.16	20	23.12
MIP-MG 5	10	0.08	0.24	20	17.29

Table S2 Pore structural parameters of the prepared catalysts

Sample	Surface area （m^2/g）	Pore volume（cm^3/g）	Average aperture（nm）
Bi-Ti	137.2223	0.001026	10.64444
KABT	165.6655	0.018812	9.25256

Table S3 Fitting parameters of adsorption kinetics for MG

		Pseudo-first-order			Pseudo-second-order		
	Q_m ($mg \cdot g^{-1}$)	Q_e ($mg \cdot g^{-1}$)	k_1 (min^{-1})	R^2	Q_e ($mg \cdot g^{-1}$)	k_2 ($g \cdot mg^{-1} \cdot min^{-1}$)	R^2
MIP-MGs	38.1995	37.4529	0.02267	0.9614	43.8167	0.04054	0.9863
NIP-MGs	21.2813	21.06651	0.03058	0.9647	22.9848	0.04359	0.9751

Table S4 Fitting parameters of isothermal adsorption for MG

	Langmuir model			Freundlich model		
	Q_m ($mg \cdot g^{-1}$)	K_L ($L \cdot mg^{-1}$)	R^2	K_F ($mg \cdot g^{-1}$)	1/n	R^2
MIP-MGs	36.5813	0.0225	0.9804	18.2823	0.2336	0.9574
NIP-MGs	27.5027	0.0252	0.9097	9.7031	0.2766	0.7780

Table S4 Selectivity of MIPM and NIPM for MG

Comparison of components	MIP-MGs				NIP-MGs				K_0
	Ce (mg/L)	q_e (mg/L)	K_d (L/g)	K,	Ce (mg/L)	q_e (mg/L)	K_d (L/g)	K,	
MG	4.82	21.18	4.39		10.28	14.78	1.44		
RB	12.24	12.76	1.04	4.26	11.83	13.17	1.11	1.30	3.28
CV	11.18	13.82	1.17	3.75	11.21	13.79	1.23	1.17	3.21

Table S5 The degradation kinetic constants and regression coefficients of MG and CV degradation under different experimental conditions

	Parameters	MIP-MGs	NIP-MGs	ABT
MG degradation	k (min^{-1})	0.0225	0.0083	0.01213
	R^2	0.9472	0.9923	0.9097
	Parameters	MIP-MGs	NIP-MGs	BTC
CV degradation	k (min^{-1})	0.00834	0.00775	0.01277
	R^2	0.9159	0.9374	0.8965
	Parameters	6	7	8
solution pH	k (min^{-1})	0.00724	0.01115	0.01251
	R^2	0.91871	0.94254	0.92544
	Parameters	0.4g/L	0.8g/L	1.2g/L
MIP-MGs dosage	k (min^{-1})	0.00423	0.01113	0.01032
	R^2	0.93981	0.90675	0.92032
	Parameters	Cl^-	SO_4^{2-}	Not added
inorganic anions	k (min^{-1})	0.00744	0.00871	0.01176
	R^2	0.97444	0.9237	0.9373

Eq (S1)

The adsorption capacity Q (mg g^{-1}) was calculated using equation (1):

$$Q=\frac{(C_0-C_t)V}{m} \qquad (1)$$

where Q (mg g^{-1}), C_0 (mg L^{-1}), C_t (mg L^{-1}) ,m (g), V (mL) are the equilibrium adsorption amount are the equilibrium adsorption amount, initial MG concentration (mg/L), the concentration of MG after the adsorption for time (t) , the mass of the adsorbent (g), and the volume of the solution (L), respectively.

Eq (S2)

To evaluate the mass transfer and the rate-controlling process, the pseudo-first-order (PFO) and pseudo-second-order (PSO) expressed by Equation (2) and Equation (3) respectively, were used to analyze the kinetics data of MIP-MGs:

$$q_t = q_e \times (1 - e^{-k_1 t}) \qquad (2)$$

$$q_t = k_2 q_e^2 t / (1 + k_2 q_e t) \qquad (3)$$

where q_e (mg g^{-1}) is the equilibrium adsorption capacity, q_t (mg g^{-1}) is the binding quantity at different time t (min), and k_1 (min^{-1}) and k_2 (g $mL^{-1}min^{-1}$) are the rate constants of pseudo-first-order and pseudo-secondorder models, respectively.

Eq (S3)

The Langmuir and Freundlich isotherm adsorption models are given by Equation (4) and Equation (5):

$$q_e = q_{mL} k_L C_e / (1 + k_L C_e) \qquad (4)$$

$$q_e = k_F C_e^{1/nF} \qquad (5)$$

where q_e (mgg^{-1}) and Ce (mgL^{-1}) are equilibrium adsorption amount and equilibrium mass concentration respectively; q_{mL} (mgg^{-1}) is the saturated mono-layer maximum adsorption amount of the Langmuir model; K_L (Lmg^{-1}) is the adsorption constants of the Langmuir; K_F (Lmg^{-1}) and nF are the constant of adsorption capacity and adsorption density of Freundlich respectively.

Eq (S4)

Selectivity evaluation:

$$K_d = q_e / C_e \qquad (6)$$

$$k' = K_{d(MG)} / K_{d(x)} \qquad (7)$$

$$K_0 = k'_M / k'_N \qquad (8)$$

where K_d, q_e, and Ce represent distribution coefficient, equilibrium absorption capacity, and equilibrium mass concentration, respectively; K' and $K_{d(MG)}$ are selectivity and distribution coefficients for MG respectively; K_0, k'_M, and k'_N represent relative selectivity coefficient, selectivity coefficient for MIP-MGs, and selectivity coefficient for NIP-MGs, respectively.

Eq (S5)

The kinetics of the photocatalytic degradation of MG were fitted based on a pseudo-first-order kinetic model:

$$\ln C_0 / C_t = kt \qquad (9)$$

where C_0 (mg/L) is the initial concentration of MG (mg/L), C_t is the concentration at time t (min), and K (min^{-1}) is the pseudo-first-order rate constant