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Preparation of MES@Fe_3O_4@SiO_2-PPy magnetic microspheres for highly efficient removal of Cr(VI)

Zhaoxing Hu [a], Liang Wang [a], Mengxin Liu [a], Ziqing Huang [a], Jinyan Yang [a], Wenhui Rao [a], Heng Wang [a], Yijun Xie [b,*] and Chuanbai Yu [a,*]

a. Key Laboratory of New Processing Technology for Nonferrous Metal & Materials, Ministry of Education/Guangxi Key Laboratory of Optical and b. Electronic Materials and Devices, Guilin University of Technology, Guilin 541004, China.

b. Institute of Nanochemistry and Nanobiology, School of Environmental and Chemical Engineering, Shanghai University, Shanghai 200444, China.

1. Text S1 experimental details

1.1 Preparation of monodispersed emulsion sphere

The monodispersed emulsion sphere (MES) microspheres were synthesized according to the previous study with several modifications.[1] Styrene (St), Methyl methacrylate (MMA), and Acrylic acid (AA) were stirred evenly in ultra-pure water. Then $NH_4 \cdot HCO_3$ and Sodium dodecyl benzene sulfonate (SDBS) were added while stirring with magnetic force at 70 °C for 30 min. Finally, Ammonium persulfate (APS) was added and the reaction continued for 10 h to prepare MES, which was sealed and stored.

1.2 Preparation of MES@Fe_3O_4 composites

MES@Fe_3O_4 (MF) was synthesized by chemical co-precipitation method. MES, $FeCl_2 \cdot 4H_2O$, and $FeCl_3 \cdot 6H_2O$ were dispersed in ultra-pure water and mixed in N_2 atmosphere for 15 min. After that, $NH_3 \cdot H_2O$ was added and the reaction continued for 1 h. The product was repeatedly washed with ultra-pure water until the filtrate was neutral, and then recycled with magnets. Finally, it was dried at 60 °C until constant weight.

1.3 Preparation of MES@Fe_3O_4@SiO_2 composites

MES@Fe_3O_4@SiO_2 (MFS) was synthesized by the Stöber method. Firstly, MES@Fe_3O_4 was dispersed in dilute hydrochloric acid solution for ultrasonic activation for 15 min. Then the activated MES@Fe_3O_4 was added to the mixed solution of absolute ethanol, ultra-pure water, and $NH_3 \cdot H_2O$, and mechanically stirred for 30 minutes. TEOS was slowly added to the above dispersion under stirring. Finally, the sample was recovered by magnet and washed with anhydrous ethanol and ultra-pure water three times each, and dried at 60 °C for 10 h to obtain MFS.

2. Table S1

Table S1 Synthesis conditions of MES@Fe_3O_4@SiO_2-PPy

Sample	MES@Fe_3O_4@SiO_2 (g)	Py(g)	$FeCl_3 \cdot 6H_2O$(g)
MFSP-I	1.0	0.10	0.926
MFSP-II	1.0	0.20	1.852
MFSP-III	1.0	0.30	2.778
MFSP-IV	1.0	0.40	3.704
MFSP-V	1.0	0.50	4.630
MFSP-VI	1.0	0.60	5.556
MFSP-VII	1.0	0.70	6.428

MFSP-VIII	1.0	0.80	7.408
MFSP-IX	1.0	0.90	8.334

3. Figure S1

Fig. S1 showed the DTG plots of PPy, MFS, and MFSP. Obviously, MFS was thermally stable until the temperature of 439 °C. After functionalization of PPy, the decomposition of MFSP nanocomposite occurs at 245 °C. The thermal stability of MFSP was slightly lower than that of MFS in the low temperature region, which might be PPy was easy to volatilize and decompose [2].

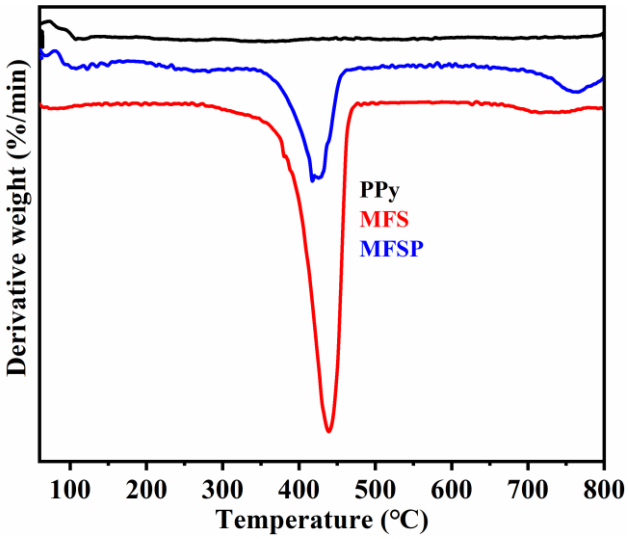

Fig. S1 DTG curves of PPy, MFS, and MFSP.

Notes and references

1 L. L. Du, P. Gao, Y. D. Meng, Y. L. Liu, S. W. Le and C. B. Yu, *Acs Omega*, 2020, **5**, 6651-6660.

2 M. Wysocka-Zolopa, I. Zablocka, E. Gradzka, J. Goclon and K. Winkler, *Microporous Mesoporous Mat.*, 2021, **317**, 110954.