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Qingxiang Yang, ShuangShuang Ren, Qianqian Zhao, Ran Lu, Hang Cheng, Zhijun Chen, Hegen Zheng

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Selective separation of methyl orange from water using magnetic ZIF-67 composites

Qingxiang Yang,[a] ShuangShuang Ren,[a] Qianqian Zhao,[a] Ran Lu, [a] Hang Cheng, [b] Zhijun Chen[a*] and Hegen Zheng[b*]

[a] *School of Chemical Engineering and Material Science, Henan Provincial Key Laboratory of Surface and Interface Science, Zhengzhou University of Light Industry, Zhengzhou 450002, People, R. China*

[b] *State Key Laboratory of Coordination Chemistry, School of Chemistry and Chemical Engineering, Collaborative Innovation Center of Advanced Microstructures, Nanjing University, Nanjing 210093, P. R. China. E-mail: zhenghg@nju.edu.cn*

Email: chenzj@zzuli.edu.cn ; zhenghg@nju.edu.cn

ABSTRACT:

Efficacious and convenient removal of organic dye contaminants from wastewater is a challenge for public health and ecosystem protection. Here we fabricate a novel type of Fe_3O_4@MOFs (Metal-organic frameworks) magnetic porous composite materials. ZIF-67 (Zeolitic imidazolate framework-67) nano-crystals as an attractive subfamily of MOF was selected to fabricate Fe_3O_4-PSS@ZIF-67 composites (defined as MZIF-67). MZIF-67 composites are core-shell structure, for which the aggregation core of Fe_3O_4 nanoparticles is coated with petal-like ZIF-67 crystals, in which Co^{2+} firstly combines with SO_3^{2-} provided by PSS (poly (styrenesulfonate, sodium salt)) to form nucleation. MZIF-67 composites perform well on methyl orange (MO) adsorption, which could be attributed to the highly porosity and the nature of Lewis base of coordinated Co^{2+} centrals. The results show that the equilibrium adsorption capacity for MO is up to 738 $mg \cdot g^{-1}$ (when pH =8.0, contact time is 7 h, adsorbent dose is 5 mg and initial MO concentration is 400 $mg \cdot L^{-1}$). In addition, MZIF-67 composites could selectively separate MO from the mixture solution of MO and MB (methylene blue). The removal rate of MO is up to 92%. The concentration ratio of MO/MB is 0.04. And the separation efficiency is up to 96%. The results suggest MZIF-67 composites could be a good candidate for