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Integrated with MoO_3 microrods as precursors to hierarchical polyaniline microtubes and composites for anionic dye removal in water treatment

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Preparation of PANI@ Fe_3O_4 microtubes

100 mg of PANI nanotubes and 150 mg of the iron precursor $Fe(acac)_3$ were immersed into 60 mL triethylene glycol by sonication for 15 minutes. Afterwards, the mixture was heated to 278°C and stirred vigorously under N_2 protection and kept refluxing at 278°C for 30 min. After being cooled to room temperature, the resulting composites were collected with a magnet and washed with deionized water and ethanol for several times to remove impurities. Finally the products were dried in a vacuum at 50°C for 24 h.

Preparation of PANI@ MnO_2 microtubes

In a typical procedure, 40 mg of the as-synthesized PANI nanotubes were dispersed in 20 mL of distilled water. Then 20 mL of 0.015 M $KMnO_4$ aqueous solution was added into the above suspension under stirring for 20 min. After that, the mixed solution was transferred to a 30 mL Teflon-lined stainless steel autoclave. The autoclave was sealed and put in an electric oven at 120 ℃ for 2 h.The resulting product was isolated from the suspension by centrifugation at 6000 rpm and washed three times with deionized water. And finally the composites were placed in a vacuum under 50℃ for

24 h.

Preparation of NCMTs@ Ni microtubes

100 mg of the as-synthesized PANI nanotubes were dispersed in 20 mL of $NiCl_2.6H_2O$（20mg/mL）.The resulting product was isolated from the suspension by centrifugation at 6000 rpm and washed three times with deionized water. It was carbonized under N_2 atmosphere at 500 ℃ for 5 h to get the NCMTs@Ni nanotubes.

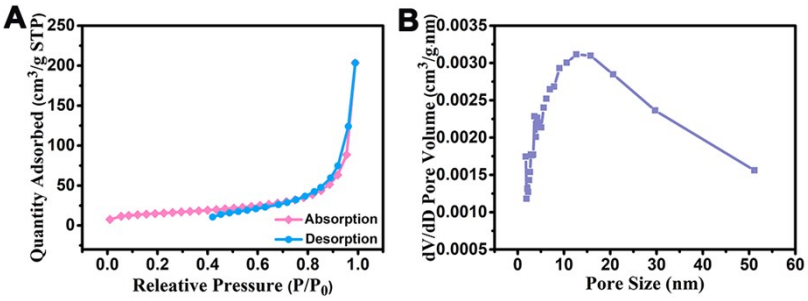

Fig. S1. Adsorption–desorption isotherms of N_2 on PANI microtubes determined at 77.35 K(A), pore size distribution calculated from the adsorption data by the BJH method(B)

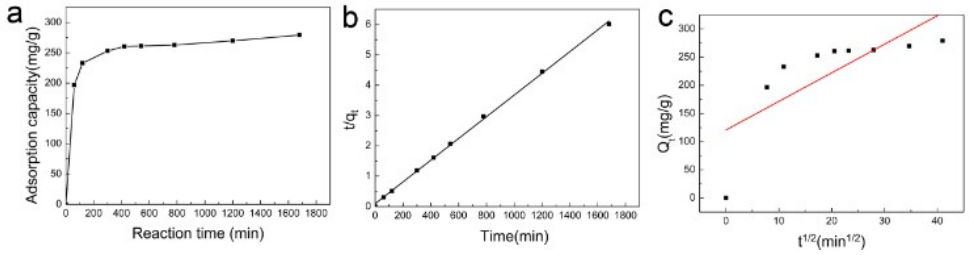

Fig. S2 (a) Effect of contact time on the adsorption of CR on PANI hollow microtubes and the pseudo-second-order kinetics plots(b), and Intra-particle diffusion model(c) of CR adsorption on PANI hollow microtubes.

Table S1 Kinetics parameters for the adsorption of CR on the PANI hollow microtubes.

Models		PANI microtubes
Pseudo-second order	K_2	0.00014
	Q_e	279.32
	R^2	0.9989
Intraparticle diffusion	K_3	5.07
	C	120.67
	R^2	0.51

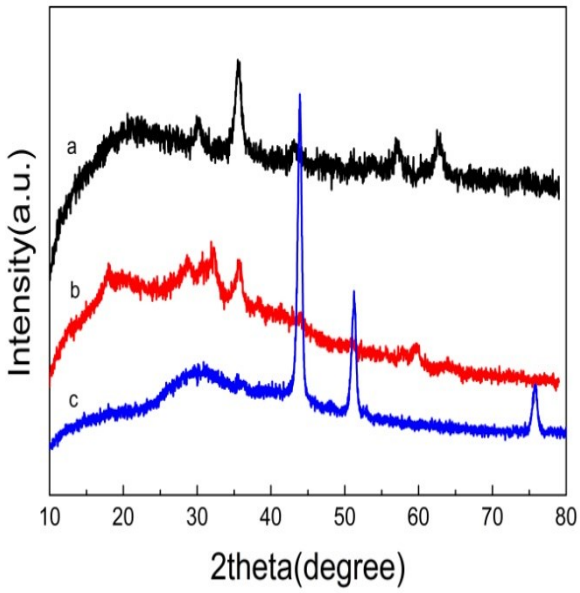

Fig.S3 X-Ray diffraction patterns of PANI/Fe_3O_4(a),PANI/MnO_2(b) and NCMTs/Ni(c)