Communication

Recyclable magnetic Cu/$CuFe_2O_4$ nanocomposites for the rapid degradation of 4-NP

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Abstract: Magnetic Cu/$CuFe_2O_4$ nanocomposites were prepared by the one-pot thermal decomposition of acetylacetone compounds. Adjusting the molar ratios of Fe to Cu was used to control the content of Cu in the synthetic process. XRD, TEM, XPS and UV-Vis were employed to reveal detailed structural and catalytic activities of Cu/$CuFe_2O_4$ nanocomposites. Magnetic measurements demonstrated that Cu/$CuFe_2O_4$ nanocomposites possessed a considerable magnetic saturation. Cu/$CuFe_2O_4$ nanocomposites showed superb efficiency in the degradation of 4-nitrophenol (4-NP) to 4-aminophenol (4-AP). 4-NP could be reduced by Cu/$CuFe_2O_4$ nanocomposites within 40 s in the attendance of $NaBH_4$. Cu nanocrystals played an indispensable rose in the enhancement of catalytic performance. The synergistic effect of Cu and $CuFe_2O_4$ nanocrystals achieved the high-efficiency catalytic reduction for 4-NP. After six recycling experiments, the efficiency of Cu/$CuFe_2O_4$ nanocomposites was almost stable. Our work advances a straightforward strategy to synthesize efficient and recoverable Cu/$CuFe_2O_4$ nanocomposites, which has promising utilizations in the purifying of nitrophenolic contamination.

Keywords: Cu/$CuFe_2O_4$ nanocomposites; 4-nitrophenol; magnetic materials; catalytic reduction

Materials and Methods

Chemicals used in this work included copper (II) acetylacetonate ($Cu(acac)_2$), iron (III) acetylacetonate ($Fe(acac)_3$), diphenyl ether ($C_{12}H_{10}O$), oleylamine ($C_{18}H_{37}N$), sodium borohydride ($NaBH_4$), 4-nitrophenol (4-NP). All chemical reagents and solvents were obtained from Sinopharm Chemical Reagent Co., Ltd (Shanghai, China) and used without further purification.

Figure S1

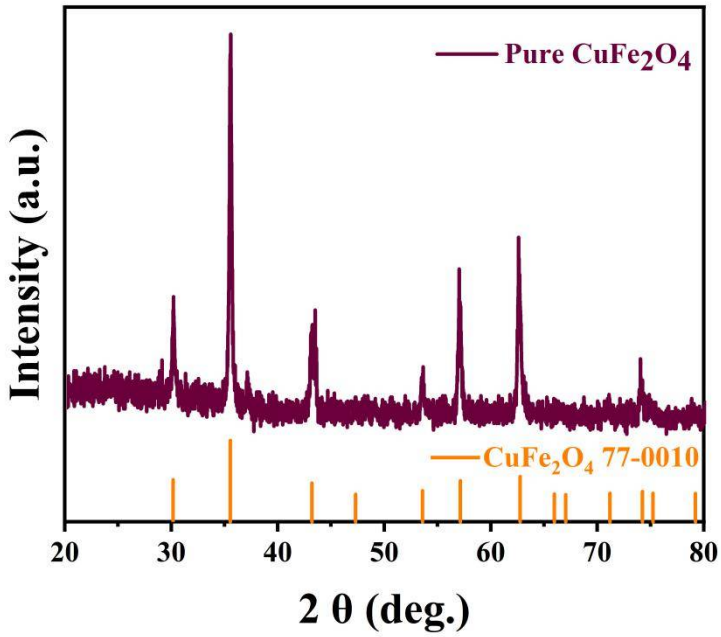

Figure S1. XRD pattern of pure $CuFe_2O_4$ nanocrystals.

Figure S2

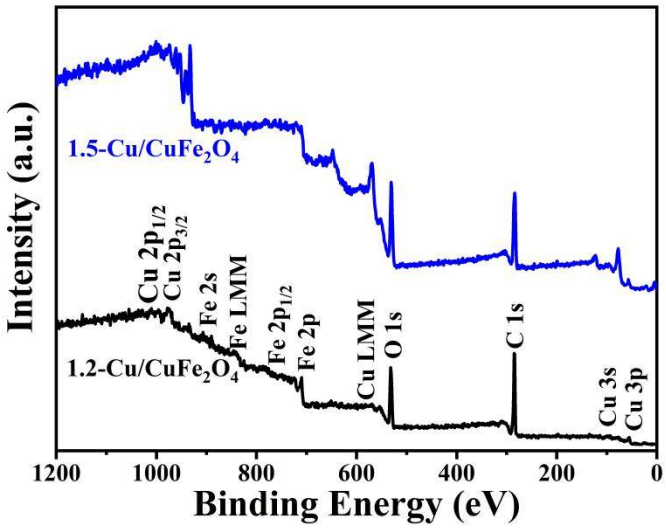

Figure S2. XPS full survey spectra of FC-1.2 and FC-1.5.

Figure S3

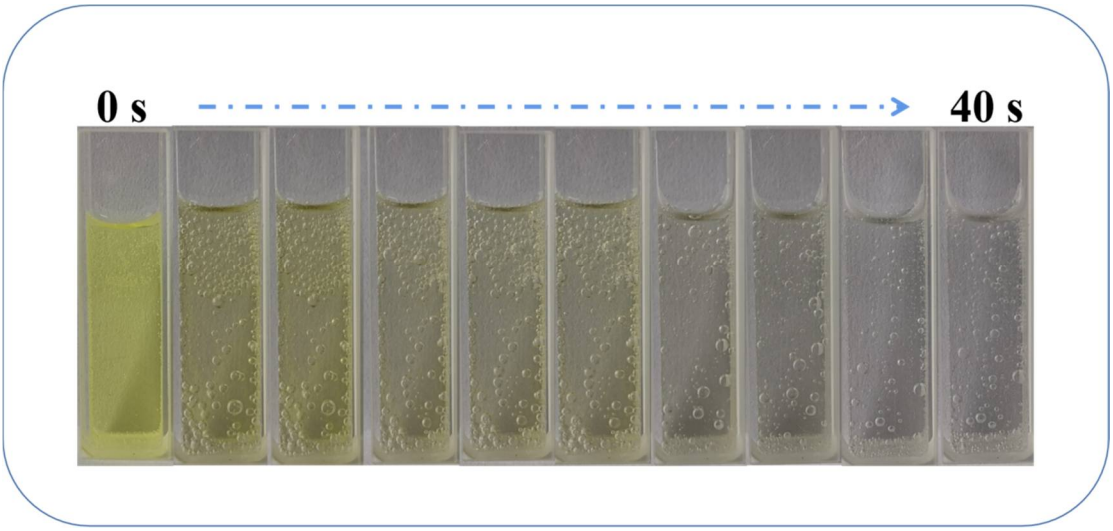

Figure S3. Photographs of the degradation of 4-NP solution catalyzed by FC-1.5 within 40 s in the attendance of $NaBH_4$.

Figure S4

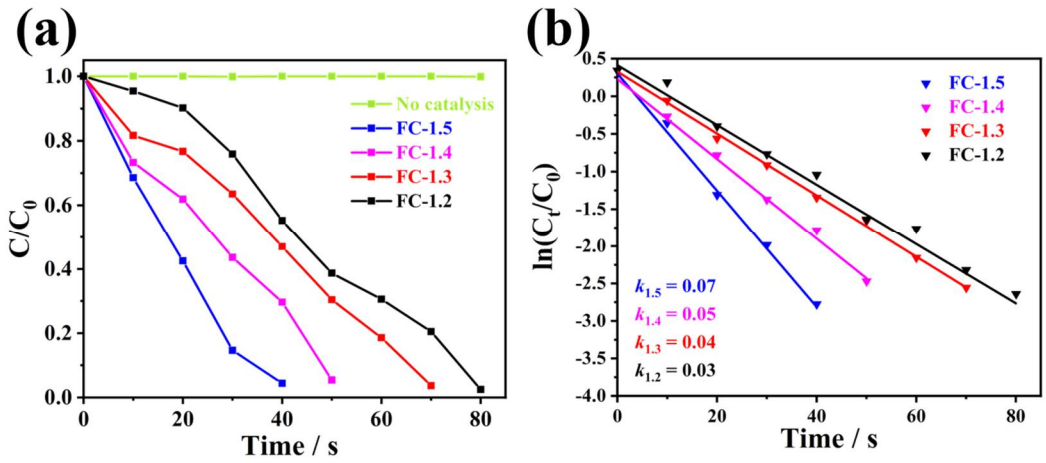

Figure S4. (**a**) *C*/*C*$_0$ versus reaction time during 4-NP reduction by FC-1.5, FC-1.4, FC-1.3, FC-1.2 (every 10 s). (**b**) Relationship of the ln[*C*/*C*$_0$] and the reaction time t for the reduction of 4-NP to 4-AP over FC-1.5, FC-1.4, FC-1.3, FC-1.2.

Figure S5

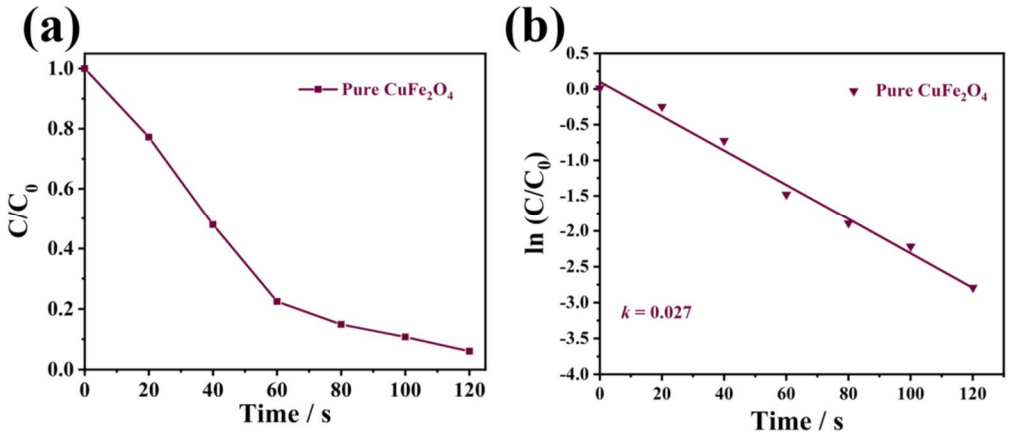

Figure S5. (**a**) C/C_0 versus reaction time during 4-NP reduction by pure $CuFe_2O_4$ nanocrystals (every 20 s). (**b**) Relationship of the $\ln[C/C_0]$ and the reaction time t for the reduction of 4-NP to 4-AP over pure $CuFe_2O_4$ nanocrystals.