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Reversible Fluorescence Modulation of Spiropyrans-Functionalized Carbon Nanoparticles

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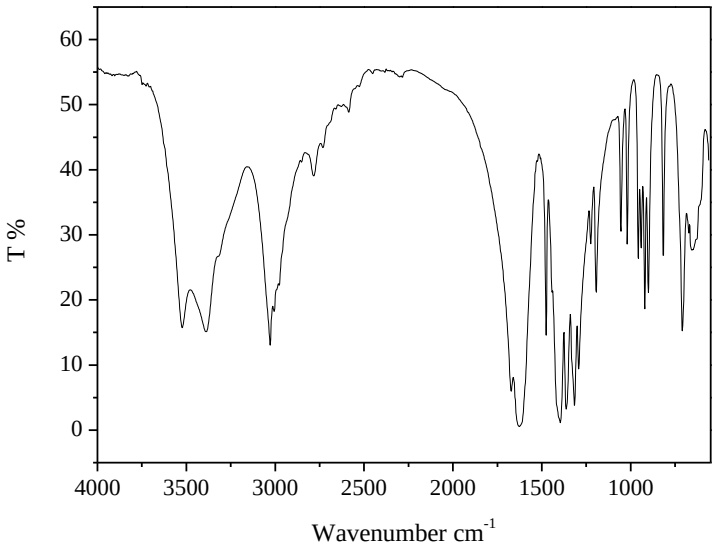

Fig.S1. The FTIR spectrum of EDTA.2Na

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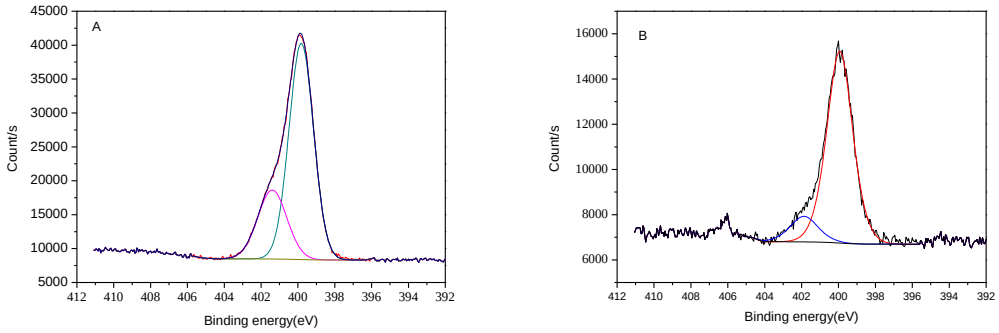

Fig. S2. The XPS spectra of N1s binding energy of CNPs-en (A) and CNPs-SP (B)

In the XPS spectra of N1s in CNPs-en and CNPs-SP, there exist two peaks located at 399.9 eV(1) and 401.8 eV (2). The former is from the N1s of amide and amine groups. The latter is from the N1s of protonated amine groups. This is reasonable because the matter was prepared in weak acid solution (pH=5). It is also found that the ratio of peak 1 to peak 2 in the CNPs-SP is higher than that in the CNPs-en. It is because the more amide groups exist in the CNPs-SP compared with that in the CNPs-en. It suggests that the new amide bonds were formed. Further, a weak peak at 406.1 eV occurs in the N1s of CNPs-SP as shown in Fig. S2 B, which is from the nitro group of CNPs-SP. While no peak at 406.1 eV occurs in CNPs-en. These results confirmed that the spiropyrans were bonded to the CNPs-en, which is consistent with the IR result discussed.

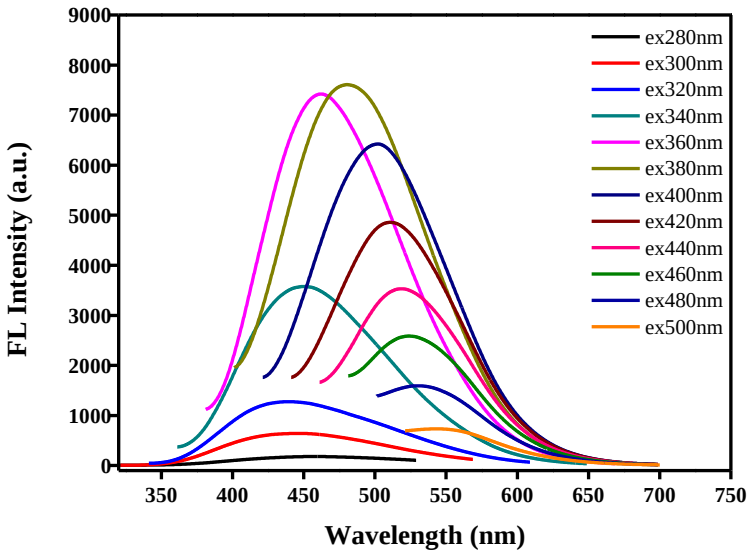

Fig. S3. The fluorescence emission spectra of the CNPs dispersed in water with different excitation wavelengths.

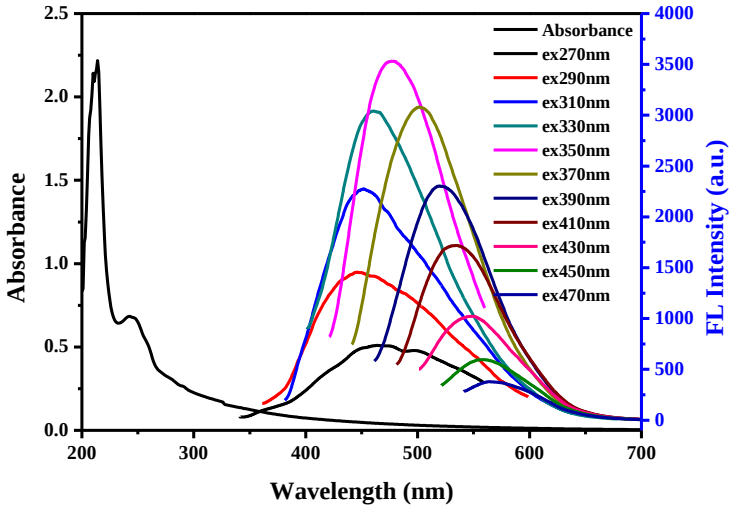

Fig. S4. Absorption spectrum the ethylenediamine-functionalized CNPs (CNPs-en) and its fluorescence emission spectra at different excitation wavelengths when dispersed in ethanol.

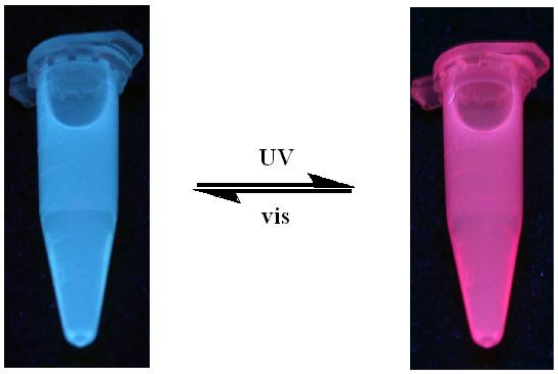

Fig. S5. The photograpghs of the spiropyrans-functionalized CNPs (CNPs-SP) under 365 nm lamp dispersed in ethanol after irradiated with visible (left) and UV (365 nm) light (right) respectively.

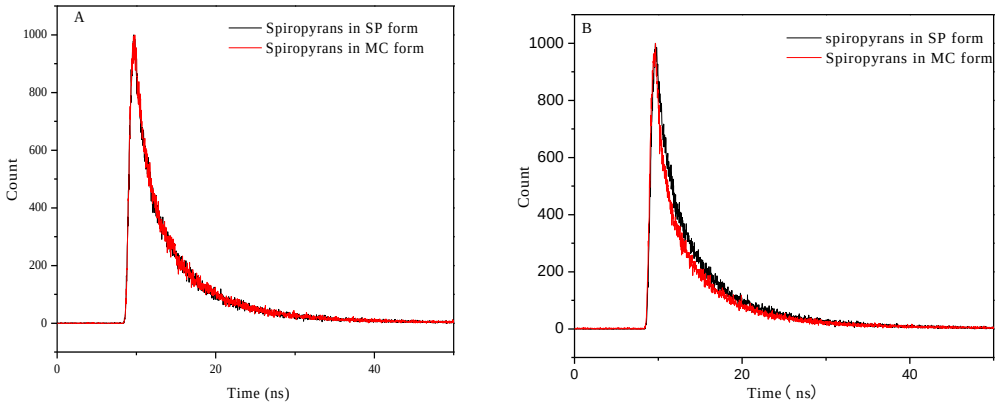

Fig. S6. The time-resolve fluorescence spectra of the physical mixture of CNPs-en and spiorpyrans (A) and CNPs-SP (B), when spiropyrans are in SP or MC form. (The excitation is 405 nm, the emission is 510 nm)

In the physical mixture of CNPs-en and spiorpyran, the two fluorescence decays are almost in same way (Fig. 6S A), the mean lifetimes are 5.345 ns (in SP form) and 5.341 ns (in MC form) respectively. However, in the CNPs-SP, the two fluorescence decays are in different ways (Fig. 6S B), and the mean lifetimes are 5.346 ns (in SP form) and 3.983 ns (in MC form) respectively. That is to say, in the CNPs-SP system, when the spiropyrans were in open-ring state, the lifetime became short. As result, it confirmed that the reversible fluorescence modulation of the CNPs-SP should be ascribed to FRET.