Resonance Energy Transfer from β-Cyclodextrin Capped ZnO:MgO Nanocrystals to Included Nile Red Guest Molecules in Aqueous Media

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Supporting Information

1. X-ray diffraction patterns and TEM images of 15 day aged ZnO:MgO and ZnO.
2. EDAX spectrum of ZnO:MgO nanocrystals.
3. Elemental mapping of Zn and Mg in ZnO:MgO nanocrystals.
4. Infrared and Raman spectra and table for assignment of (a). CMCD and (b). CMCD capped ZnO: MgO nanocrystals.
5. ^{1}H-NMR of (a). CMCD and (b). CMCD capped ZnO:MgO nanocrystals in D_2O.
6. Fluorescence spectra of water-soluble CMCD capped ZnO:MgO nanocrystals recorded at different values of pH.
7. Determination of quantum yield for the CMCD capped ZnO:MgO nanocrystals in water.

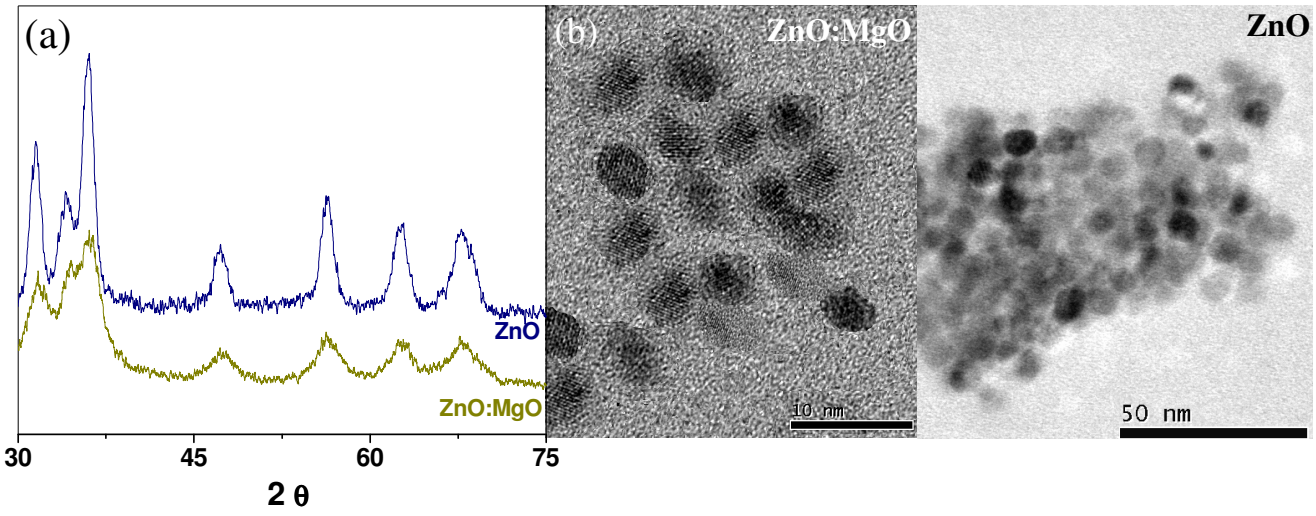

Figure 1. (a) X-ray diffraction patterns and (b) TEM images of 15 day aged ZnO:MgO and ZnO nanocrystals (note the change of scale). The particle size estimated from the X-ray diffraction pattern is 4.6 nm for ZnO:MgO and 10.5 nm for ZnO.

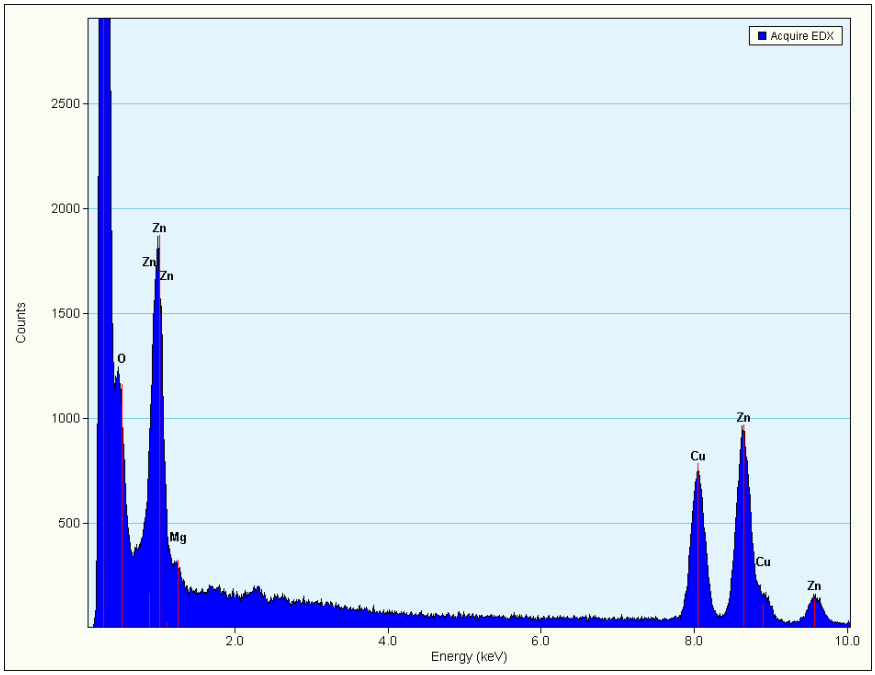

Figure 2. EDAX spectrum of ZnO:MgO nanocrystals. The averaged Mg to Zn molar ratio is 8 %.

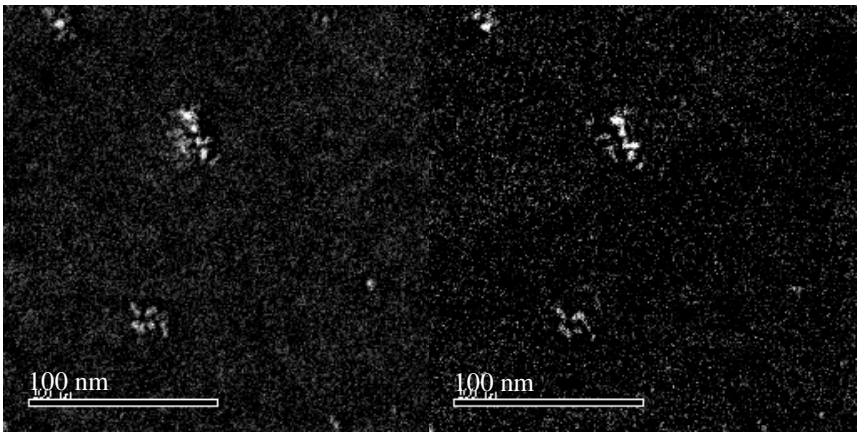

Figure 3. Elemental mapping of Zn and Mg in ZnO:MgO nanocrystals showing that both elements are present on each of the nanoparticles.

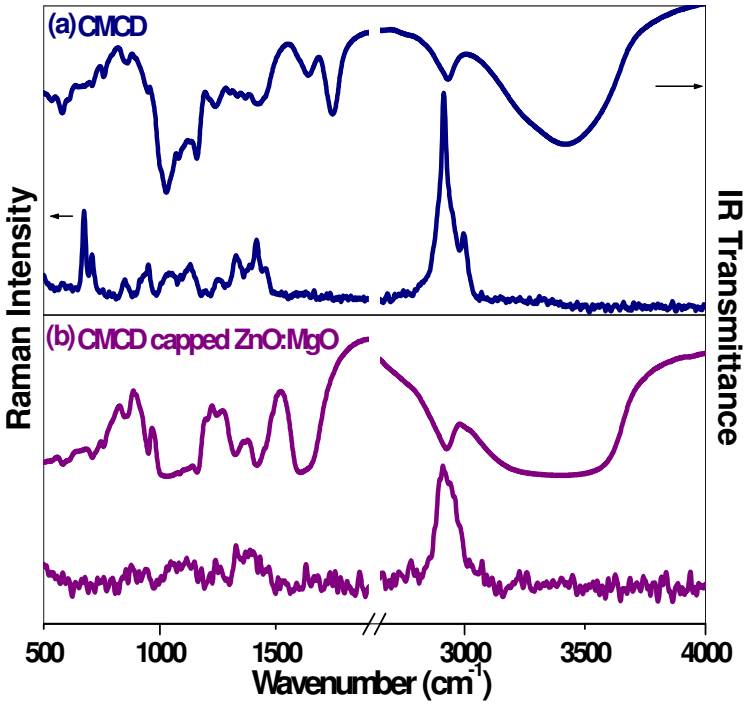

Figure 4. Infrared and Raman spectra of (a). CMCD and (b). CMCD capped ZnO: MgO nanocrystals.

Table 1. Infrared and Raman spectral assignments of CMCD and CMCD capped ZnO: MgO nanocrystals.

IR (cm^{-1})			Raman (cm^{-1})		
β-CMCD	ZnO: MgO-CMCD	Assignment	CMCD	ZnO: MgO-CMCD	Assignment
532 577, 608	532 581, 608	Internal rotation modes about CH_2OH (side) + C-C-O bending		848	C-H bending
708, 758	708, 758	Internal rotation modes about CH_2OH (side)	937, 947	930, 951	C-O-C stretch
948	951	C-C stretching		930, 951	C-O-C stretch
				1047, 1087	C-C skeletal Stretch
1159	1159	C-O stretching		1131	C-O-H stretch
1238,1303, 1334, 1369	1204, 1245, 1325, 1365	C-O-H bending	1388, 1410	1386, 1416	C-C stretch, C-O-H bend
1421, 1456	1418, 1456, 1484	O-C-H, C-C-H	1455	1453	C-H bending
1640, 1744	1606, 1640	C-O stretch of COO^-			
2931	2926	C-H stretch	2911	2914	C-H stretch
3417	3260-3520	O-H stretch		2997	O-H stretch

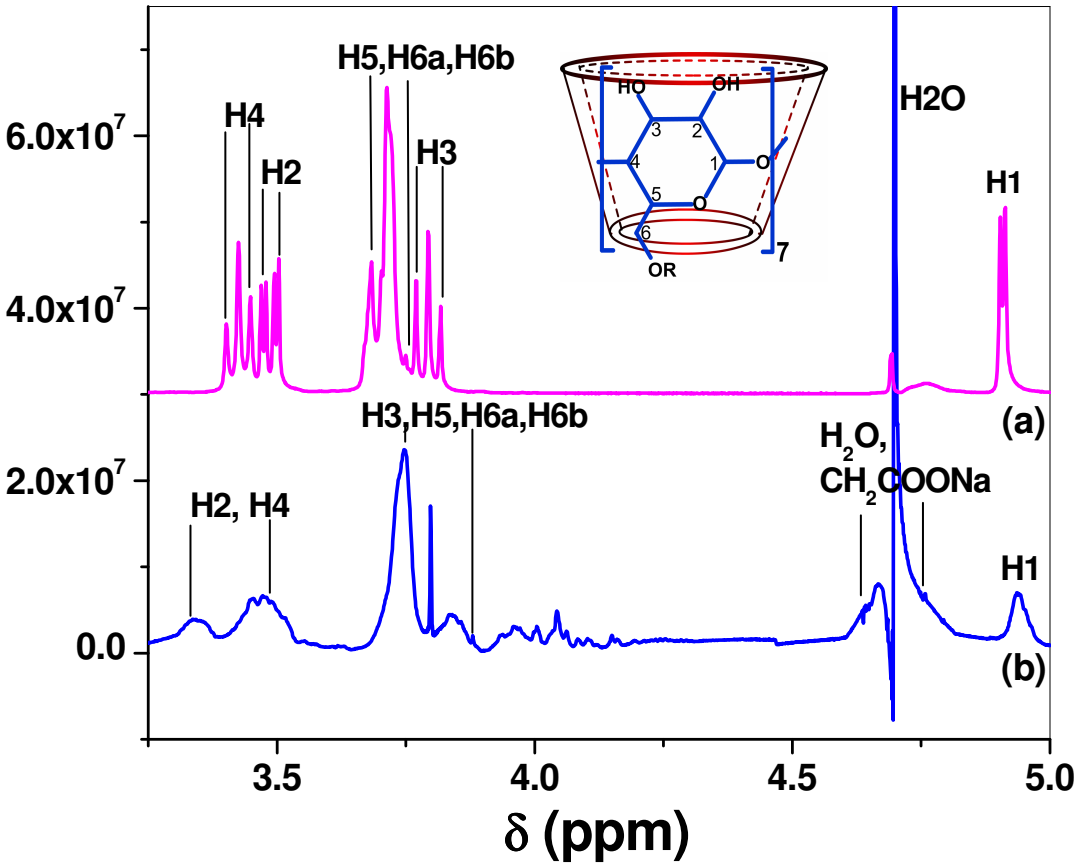

Figure 5. NMR of (a) β-CMCD and (b) β-CMCD capped ZnO:MgO nanocrystals.

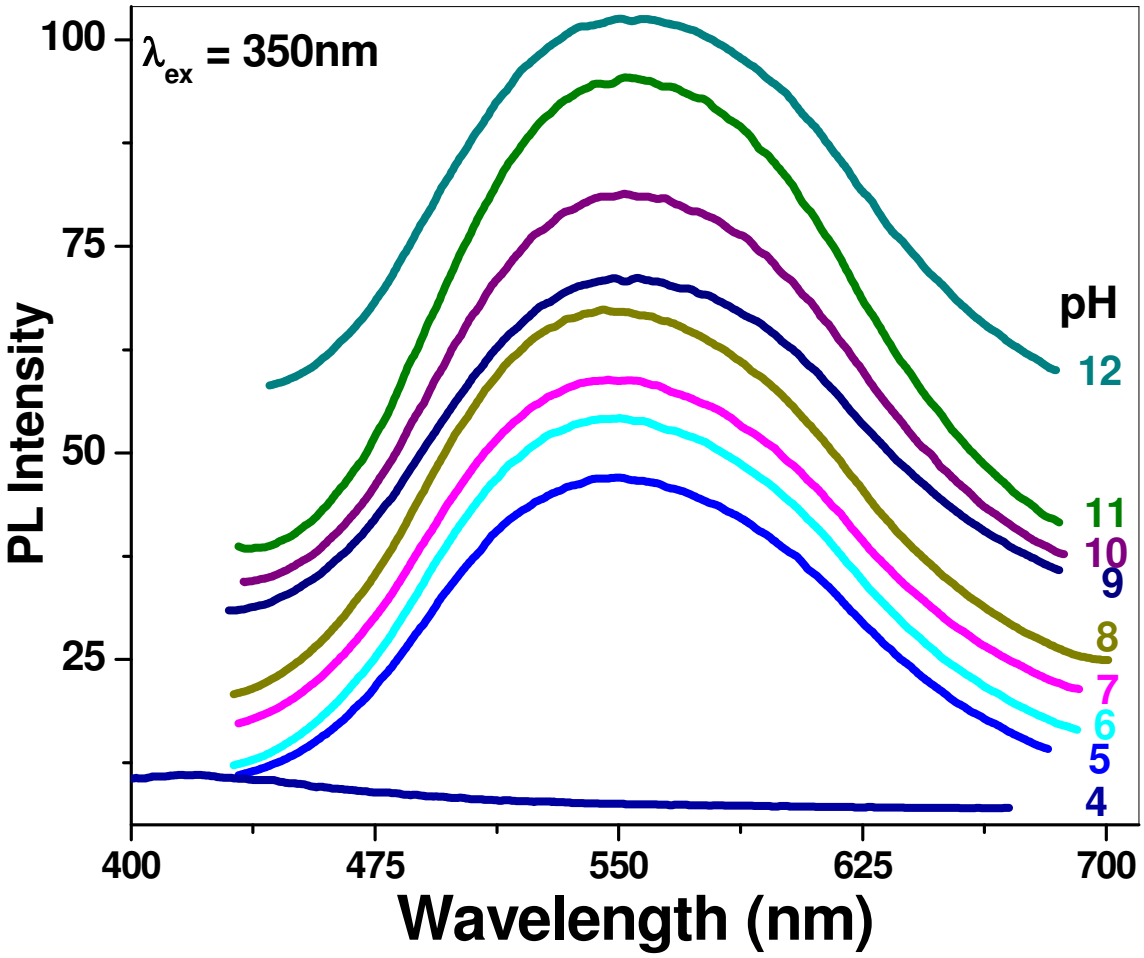

Figure 6. Fluorescence spectra of water-soluble CMCD capped ZnO:MgO nanocrystals recorded at different values of pH. The pH values are indicated on the right of the figure. The excitation wavelength was 350nm.

Quantum Yield Estimation of the water-soluble CMCD capped ZnO:MgO nanocrystals

Quantum yield for the β-CMCD capped ZnO:MgO nanocrystals in water was estimated using Quinine Sulphate in 0.1 (N) H_2SO_4 as standard (quantum yield 0.546). The figure shows the variation of the PL intensity with the absorbance of the quinine sulfate and CMCD capped ZnO:MgO nanocrystal solutions. The quantum yield was estimated from the slope of the linear plots. The quantum yield for the β-CMCD capped ZnO:MgO nanocrystals is 0.07.

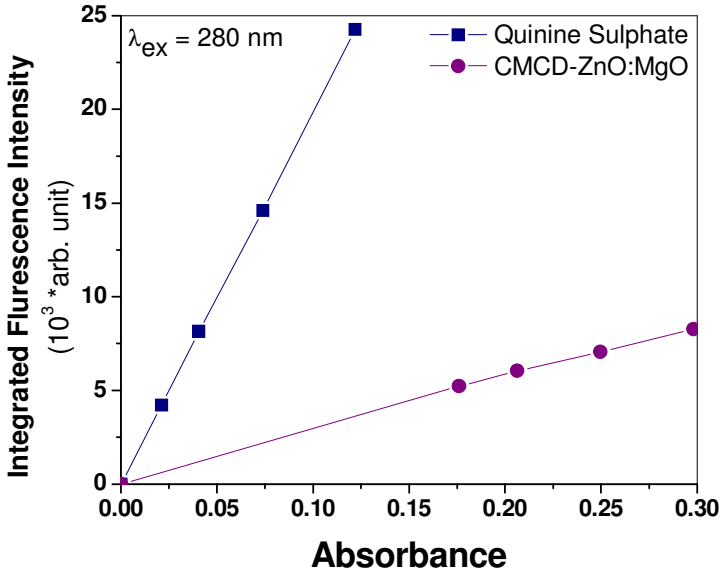

Figure 7. Variation of the fluorescence intensity with the absorbance of the quinine sulfate and CMCD capped ZnO:MgO nanocrystal solutions