SUPPORTING INFORMATION

One step hydrothermal synthesis of photoluminesecent carbon nanodots with excellent antibacterial activity

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1 Synthesis of other CNDs

Other conditions being equal to CNDs-250, CNDs-1h, CNDs-2h, CNDs-3h were obtained at 250 ℃ for 1 h, 2 h, 3 h, respectively. Certainly, CNDs-250 also could be named as CNDs-8h. Afterwards, we just changed the reaction temperature as 200 ℃, 300 ℃ to prepare CNDs-200 and CNDs-300, respectively, but the other conditions were the same with CNDs-250.

2 Bacterial culture and Antibacterial Experiments

Porphyromonas gingivalis (*P. gingivalis*) ATCC 33277 was used in all growth assays and cultures were anaerobically grown at 37 ℃ in an atmosphere containing CO_2 (5%), H_2 (10%), N_2 (85%). Firstly, *P. gingivalis* ATCC-33277 were cultured in solid medium, grown for 48 h, then took a small amount of them into 50 mL liquid medium after identifying they were pure, cultured for 24 h to use (CFU count 10^8 /mL). CNDs-250 and Metronidazole were doubly diluted to different concentrations from 320 μg/mL to 2.5 μg/mL, which including eight concentration gradients. 100 μL of bacterial suspension were added to each well in 96 well plates. After that, 100 μL of CNDs-250 with different concentration gradients were added to above

corresponding wells, respectively, making the final concentrations of CNDs-250 were 1.25, 2.5, 5, 10, 20, 40, 80 and 160 μg/mL. Meanwhile, the same treatment was adopted for Metronidazole. Besides, set the negative control: 100 μL of bacterial suspension and 100 μL of liquid medium were added into each well; the blank control: 100 μL of liquid medium and 100 μL of CNDs-250 were added into each well. Five parallel wells were prepared for each concentration of CNDs-250 and Metronidazole. At last, the resulting mixtures were shaken for *ca.* 5 min at room temperature and then these wells were incubated at 37 ℃ for 24 h. Bacterial growth was recorded at 600 nm against reagent blanks. *Streptococcus mutans* UA159 (*S. mutans*) was treated in the same way with *P. gingivalis*, and its bacterial growth was recorded at 550 nm. Monocolony of *Escherichia coli* ATCC25922 (*E. coli*) on the solid Luria-Bertani (LB) agar plate was transferred to 20 mL of liquid LB culture medium and grown at 37 ℃ for 24 h. Then the bacteria were diluted with broth to 10^8 CFU/mL, its bacterial growth was recorded at 450 nm. Then *E. coli* was treated with CNDs-250 at different concentration to test the antibacterial activity. The inhibition rate of bacterial can be evaluated as the following equation:

$$Inhibition\ (\%) = 1 - \frac{OD_{treated\ control}}{OD_{negative\ control}} \qquad (1)$$

(Where $OD_{\text{treated control}}$ was obtained in the presence of CNDs-250 or Metronidazole, and $OD_{\text{negative control}}$ was obtained in the absence of CNDs-250 or Metronidazole.).

3 Quantum yields (QY) measurements

The QY was determined according to the following formula:

$$\phi_x = \phi_{st} * \frac{I_x}{I_{st}} * \frac{\eta_x^2}{\eta_{st}^2} * \frac{A_{st}}{A_x} \qquad (2)$$

Where ϕ is the QY, I is the measured integrated emission intensity, η is the refractive index of the solvent, and A is the absorbance at 360 nm wavelength. The subscript "st" refers to standard with known QY and "x" for the sample. Quinine sulfate with a known QY in 0.1 M H_2SO_4 solution was employed as the fluorescence standard (ϕ_{st} =

54%, η_{st} = 1.33). In order to minimize re-absorption effects, absorption in the 10 mm fluorescence cuvette was kept below 0.10.

4 Calculation of radiative rate constant (k_r) and non-radiative rate constant (k_{nr})

The k_r and k_{nr} were calculated according to the following formulas:

$$\tau = \frac{1}{k_r + k_{nr}} \quad (3)$$

$$\phi = \frac{k_r}{k_r + k_{nr}} \quad (4)$$

Where τ is the fluorescence lifetimes, k_r is radiative rate constant and k_{nr} is non-radiative rate constant.

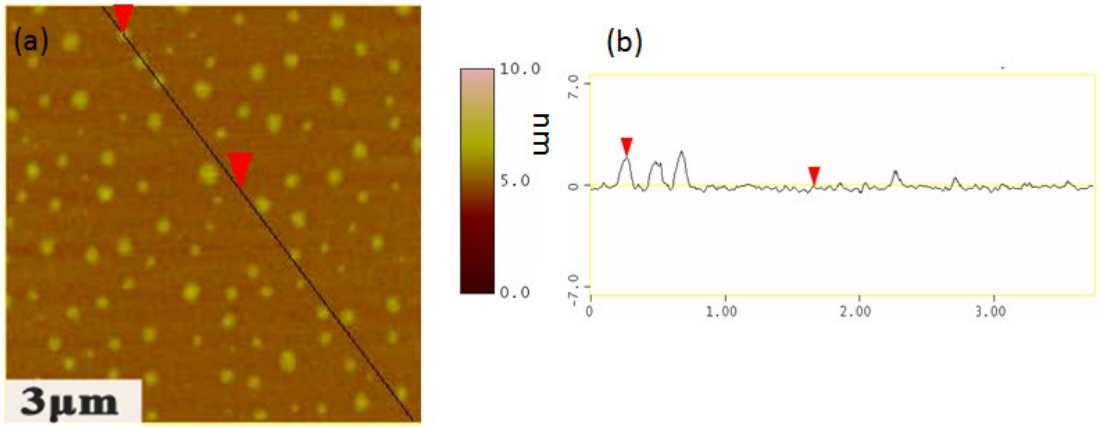

Figure S1 The AFM image of CNDs-250; (d) the height profile along the line in (c).

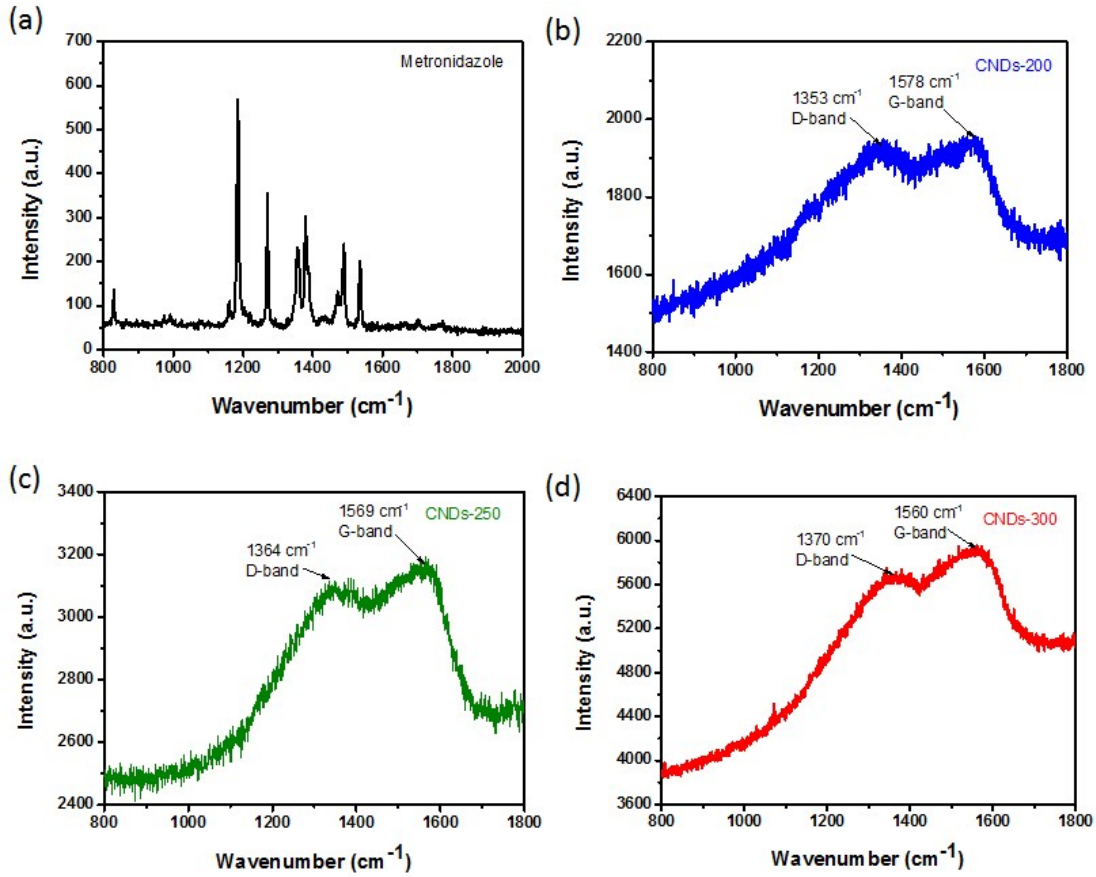

Figure S2 The Raman spectra of the Metronidazole (a), CNDs-200 (b), CNDs-250 (c) and CNDs-300 (d), respectively.

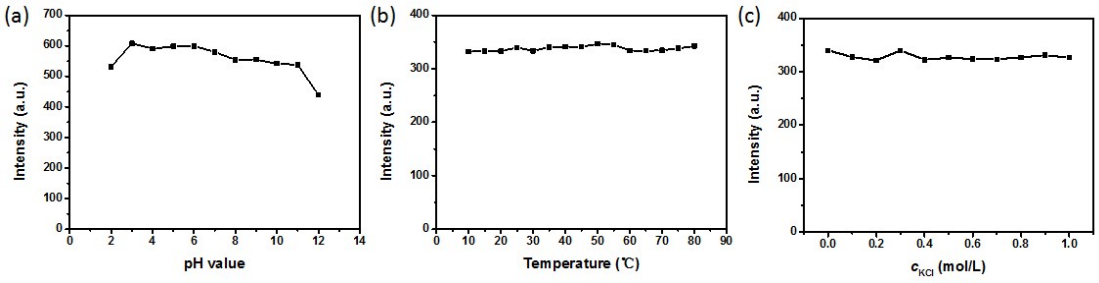

Figure S3 Effects of pH (a), temperature (b) and ionic strength(c) on the fluorescence stability of the CNDs-250.

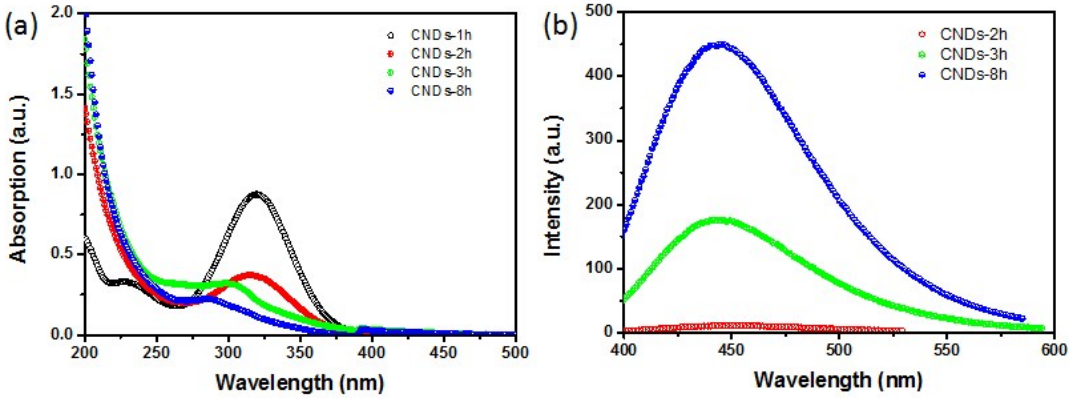

Figure S4 The optical properties of CNDs. (a) UV-Vis absorption spectra of CNDs from different reaction time; (b) The PL emission spectra of CNDs-2h, CNDs-3h, CNDs-8h under 380 nm excitation wavelength, respectively.

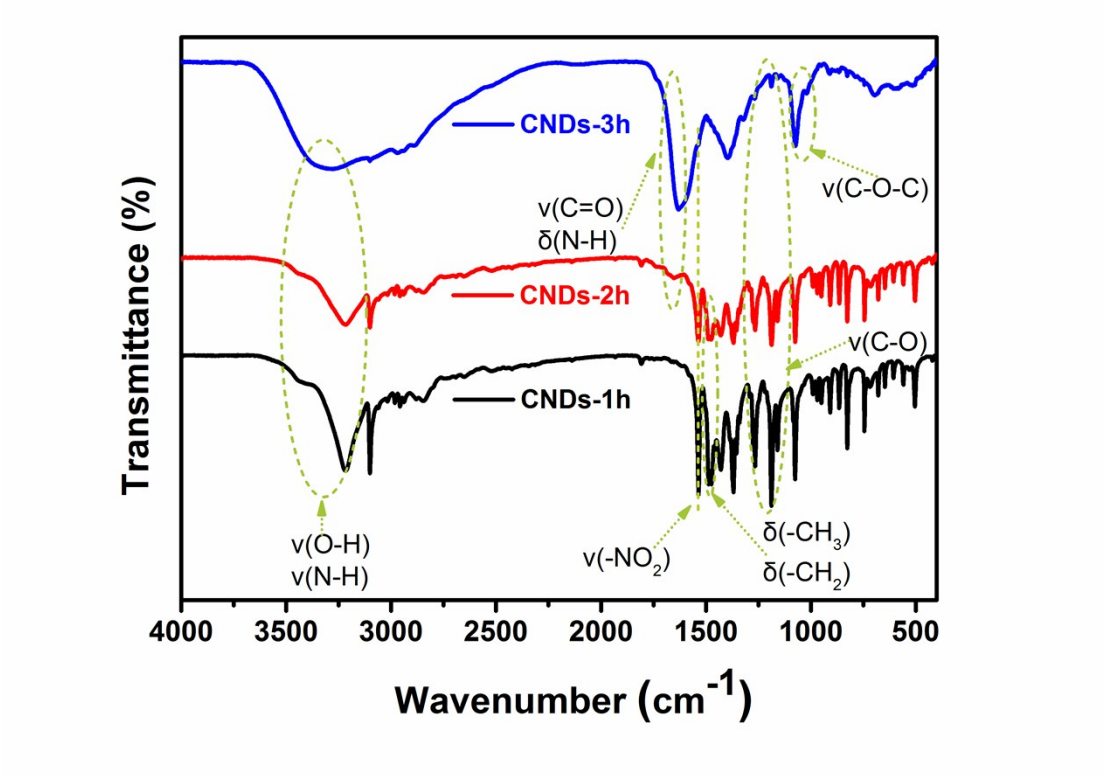

Figure S5 The FTIR spectra of CNDs obtained after different reaction time.

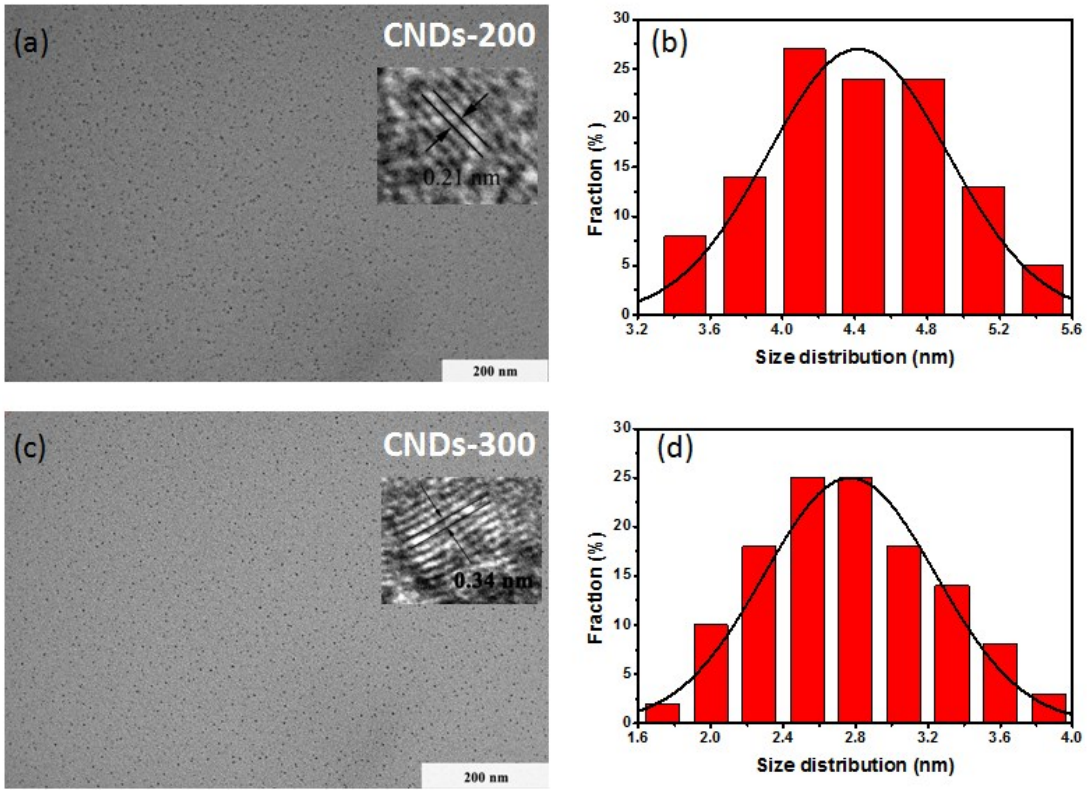

Figure S6 HRTEM (a) and size distribution (b) images of CNDs-200; HRTEM (c) and size distribution (d) images of CNDs-300.

	Abs (nm)	λex (nm)	λem (nm)	QY (%)	Size (nm)	τ_{ave} (ns)
CNDs-200	298	380	445	20.6	4.42	10.14
CNDs-250	285	380	443	28.1	2.86	9.26
CNDs-300	283	380	443	28.4	2.77	8.98

Table S1 The absorption wavelength, optimal excitation and emission wavelength, QY, average size and average τ of CNDs-200, CNDs-250 and CNDs-300, respectively.

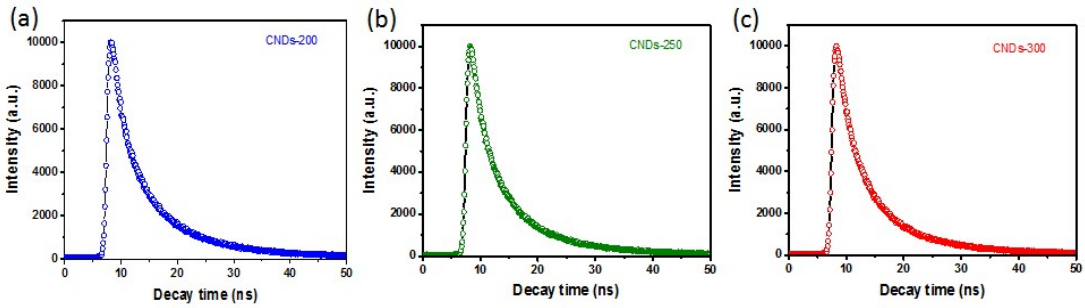

Figure S7 The PL decay curves of CNDs-200 (a), CNDs-250 (b) and CNDs-300 (c).

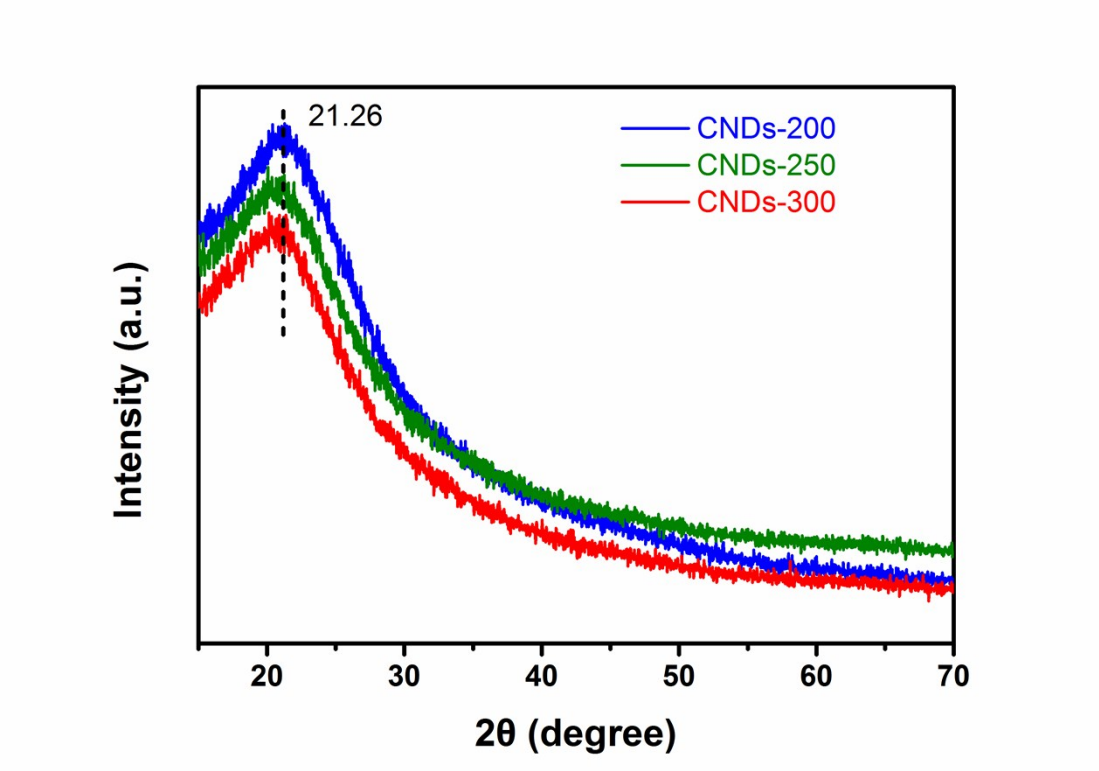

Figure S8 The X-ray diffraction patterns of CNds-200, CNDs-250 and CNDs-300, respectively.

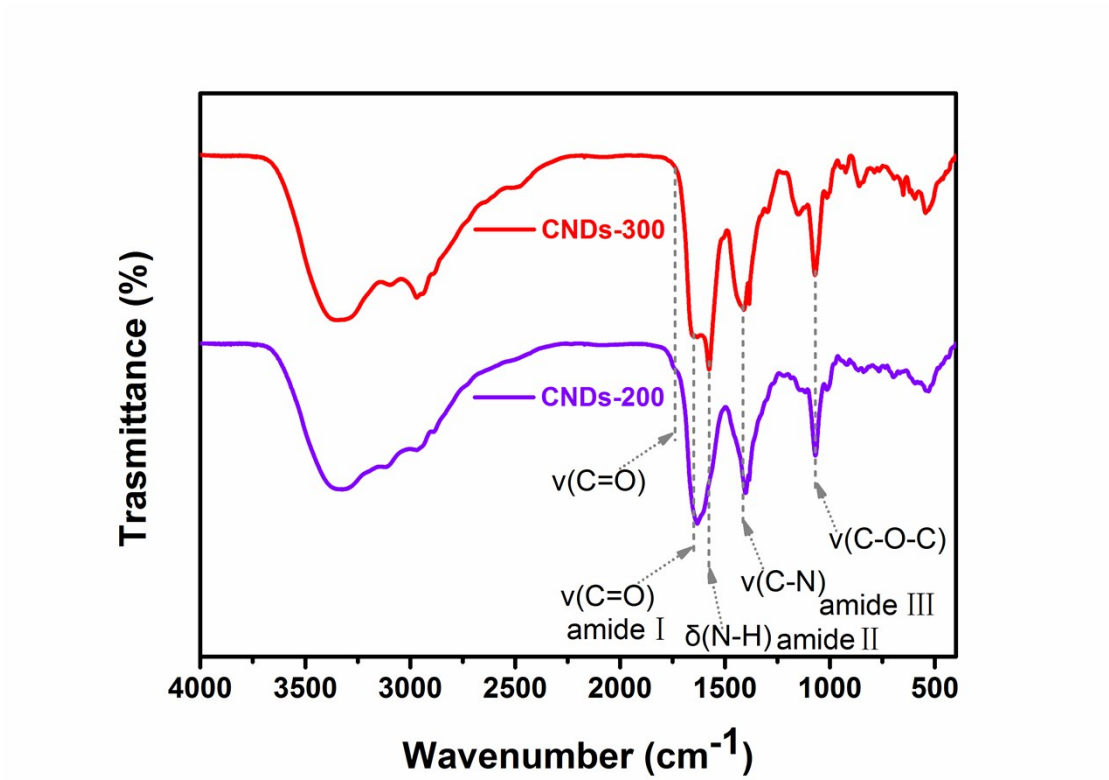

Figure S9 The FTIR spectra of CNDs-200 and CNDs-300, respectively.

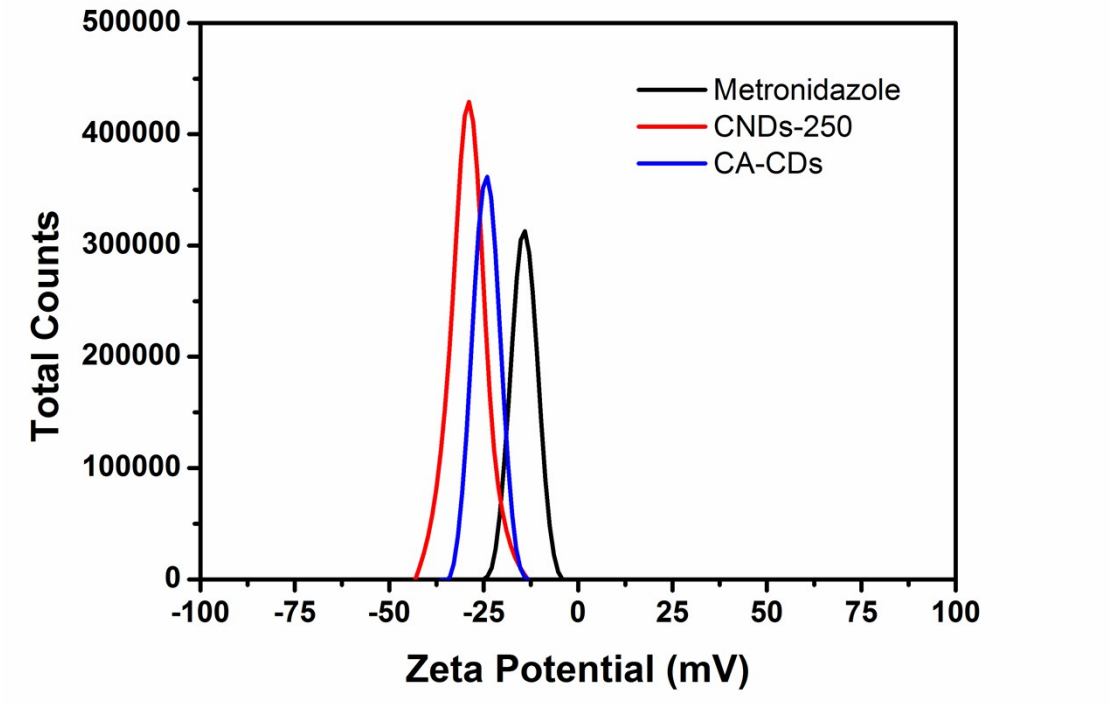

Figure S10 Zeta potential of Metrondazole, CNDs-250, CA-CDs in deionized water, respectively.

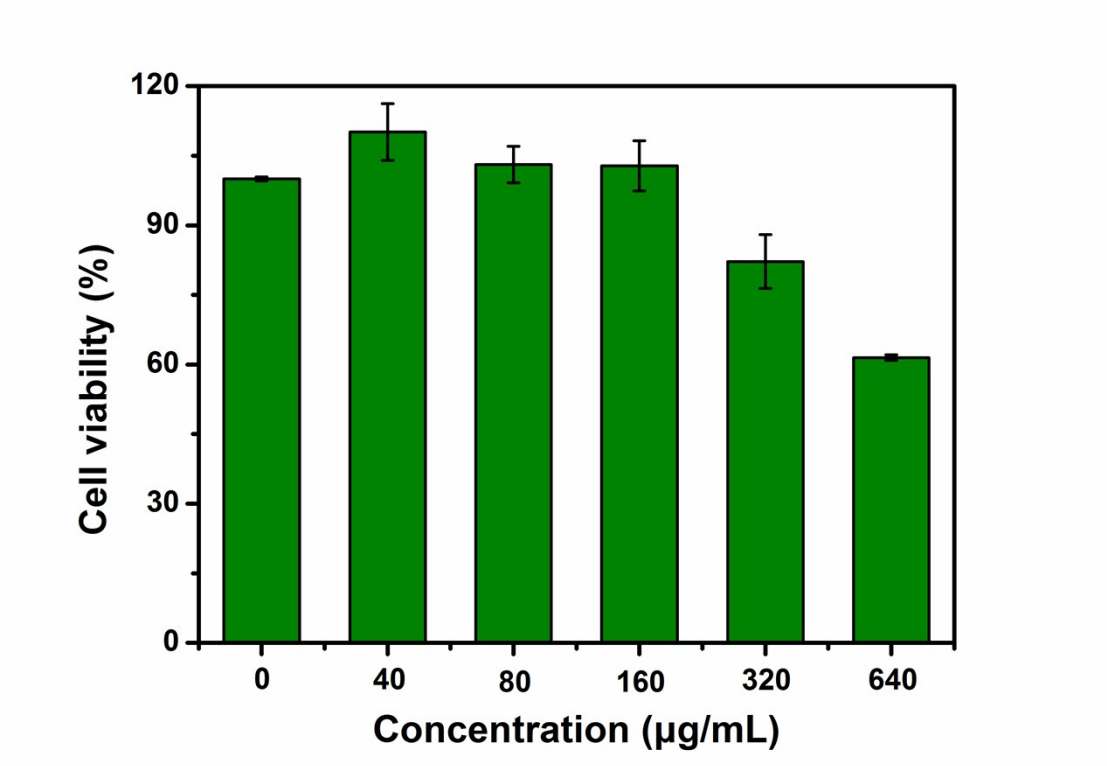

Figure S11 Cell viability of MC3T3-E1 after incubation with various concentrations of Metronidazole for 24 h.