Electronic Supplementary Material

A novel route for fabrication of yellow emissive carbon dots for selective and sensitive detection of vitamin B12

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Instrumentation

Excitation and emission spectra were recorded using a Shimadzu RF-5301 PC spectrofluorometer (Tokyo, Japan). Transmission electron microscopy (TEM) images were acquired with a JEOL 4000 EX microscope. X-ray diffraction (XRD) patterns were analyzed to determine the crystallinity of the Y-CDs using a Philips-FEI X-ray Diffractometer (Netherlands) equipped with a thin-film attachment, operating at 55 kV. UV-Vis absorbance measurements were performed on a Shimadzu 1601 PC spectrophotometer (Tokyo, Japan). X-ray photoelectron spectroscopy (XPS) analysis was conducted with a Focus IS-PEEM X-ray photoelectron spectrometer. The functional groups present on the surface of the Y-CDs were identified using a Thermo Scientific Nicolet iS50 Fourier Transform Infrared (FTIR) Spectrometer (USA). Dynamic light scattering (DLS) measurements were carried out using the ZEN 3600 Nano ZS instrument (Malvern, UK).

Fluorescence quantum yield measurements of Y-CDs (X)

The quantum yield (QY) values were calculated according to the following equation using quinine sulfate (QS) as a reference in 0.1 mol/L H_2SO_4 (QY = 54 %). By measuring the absorbance (less than 0.05) and emission spectra of a certain concentration of Y-CDs and QS at the same excitation wavelength at 360 nm, the absorbance and fluorescence integral area were substituted into the following formula:

$$\phi_X = \phi_{QS} \times \frac{F_X}{F_{QS}} \times \frac{A_{QS}}{A_X} \times \frac{\eta_X}{\eta_{QS}}$$

Φ_X represents the quantum yield of Y-CDs, ϕ_{QS} represents the quantum yield of QS, F_X is the fluorescence intensity of Y-CDs, F_{QS} is the fluorescence intensity of QS, A refers to the absorbance value and η refers to the refractive index of the solvent (distilled water). The synthesized Y-CDs were dissolved in distilled water (η = 1.33) and QS was dissolved in 0.1 M H_2SO_4 (η = 1.33).

Fig.S1 Picture of expired Rabicid® tablets.

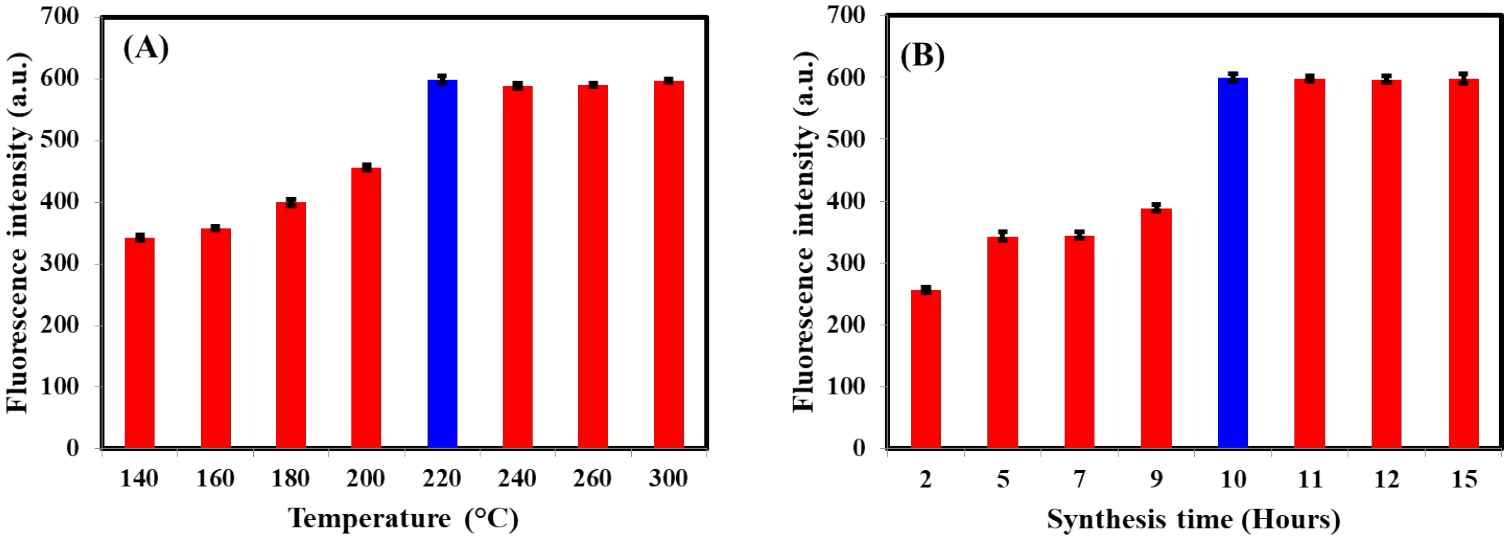

Fig.S2 Influence of synthesis temperature (A) and time (B) on the fluorescence emission of Y-CDs.

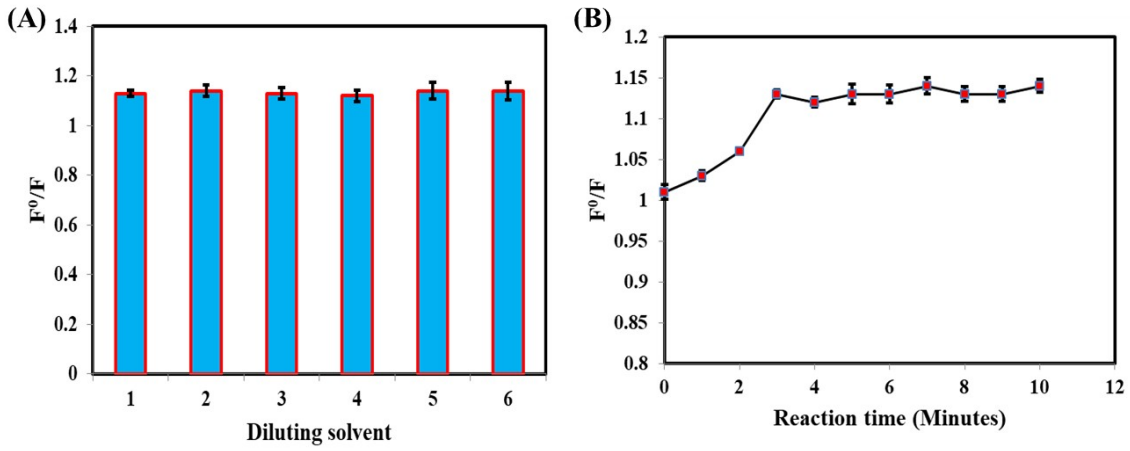

Fig.S3 (A) The effect of different diluting solvents on the fluorescence emission of Y-CDs at 10 µM concentration of vitamin B12, using various 0.1 M diluting solvents: (1) HCl, (2) NaOH, (3) Citrate buffer saline, (4) Acetate buffer saline, (5) Phosphate buffer saline, and (6) Water. (B) Influence of reaction time on the fluorescence emission of Y-CDs in the presence of 10 µM vitamin B12.

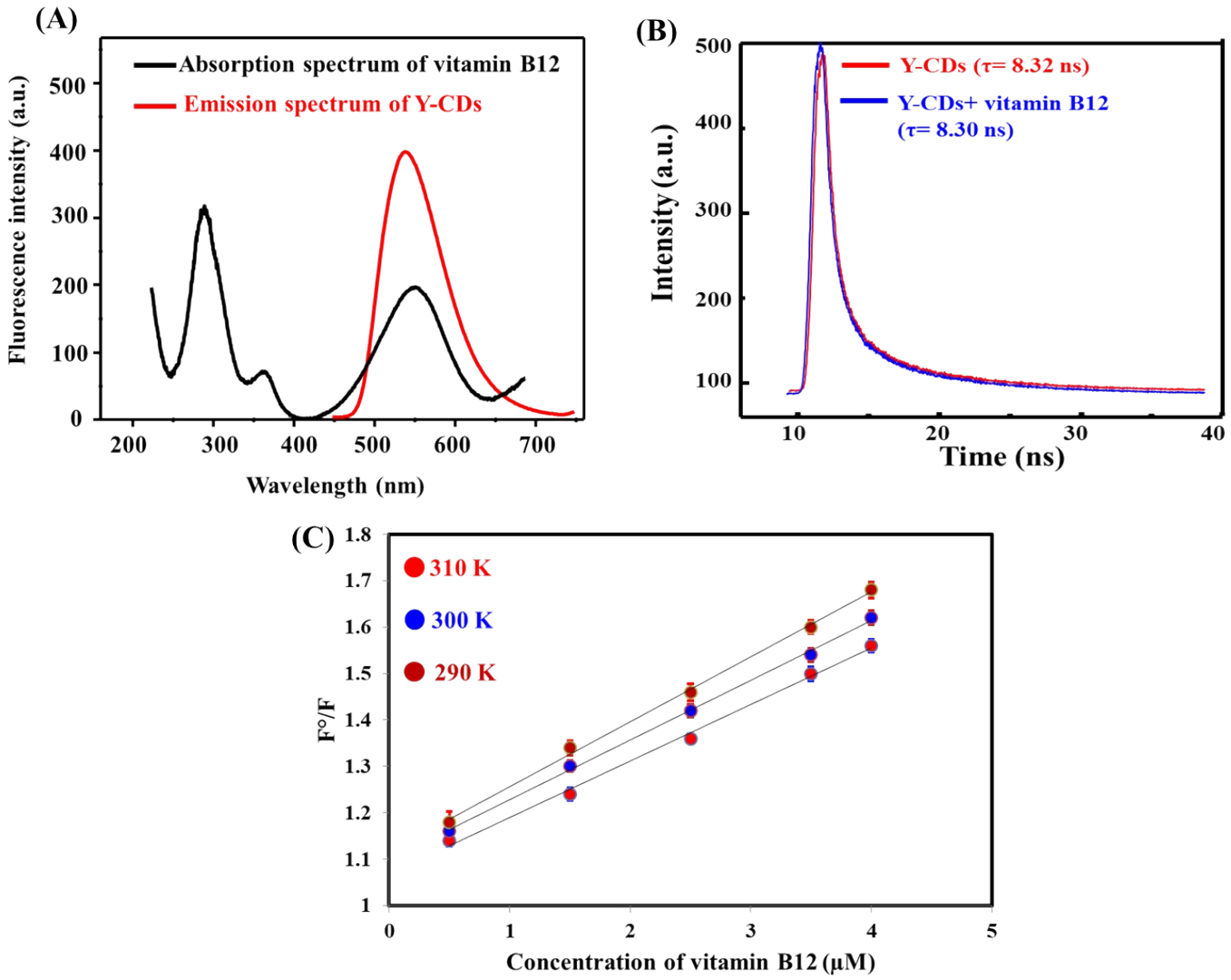

Fig.S4 (A) The absorption of vitamin B12 and emission spectrum of Y-CDs. (B) Fluorescence lifetimes of Y-CDs and Y-CDs+ vitamin B12. (C) Stern-Volmer plots at various temperatures (290°C, 300 °C, and 310°C).