Study on the detection of bisphenol A based on a nano-sized metal-organic framework crystal and an aptamer

Mao-Long Chen[a], Jun-Hao Chen[a] , Li Ding[b], Zhou Xu[a], Li Wen[a], Li-Bing Wang*[b] and Yun-Hui Cheng*[a]

College of Chemistry and Biological Engineering, Changsha University of Science & Technology, Changsha, 410114, China

* Corresponding author. Tel.: +86 731 85258322 (Y.-H. Cheng).

E-mail: Chengyh6488@gmail.com (Y.-H. Cheng),

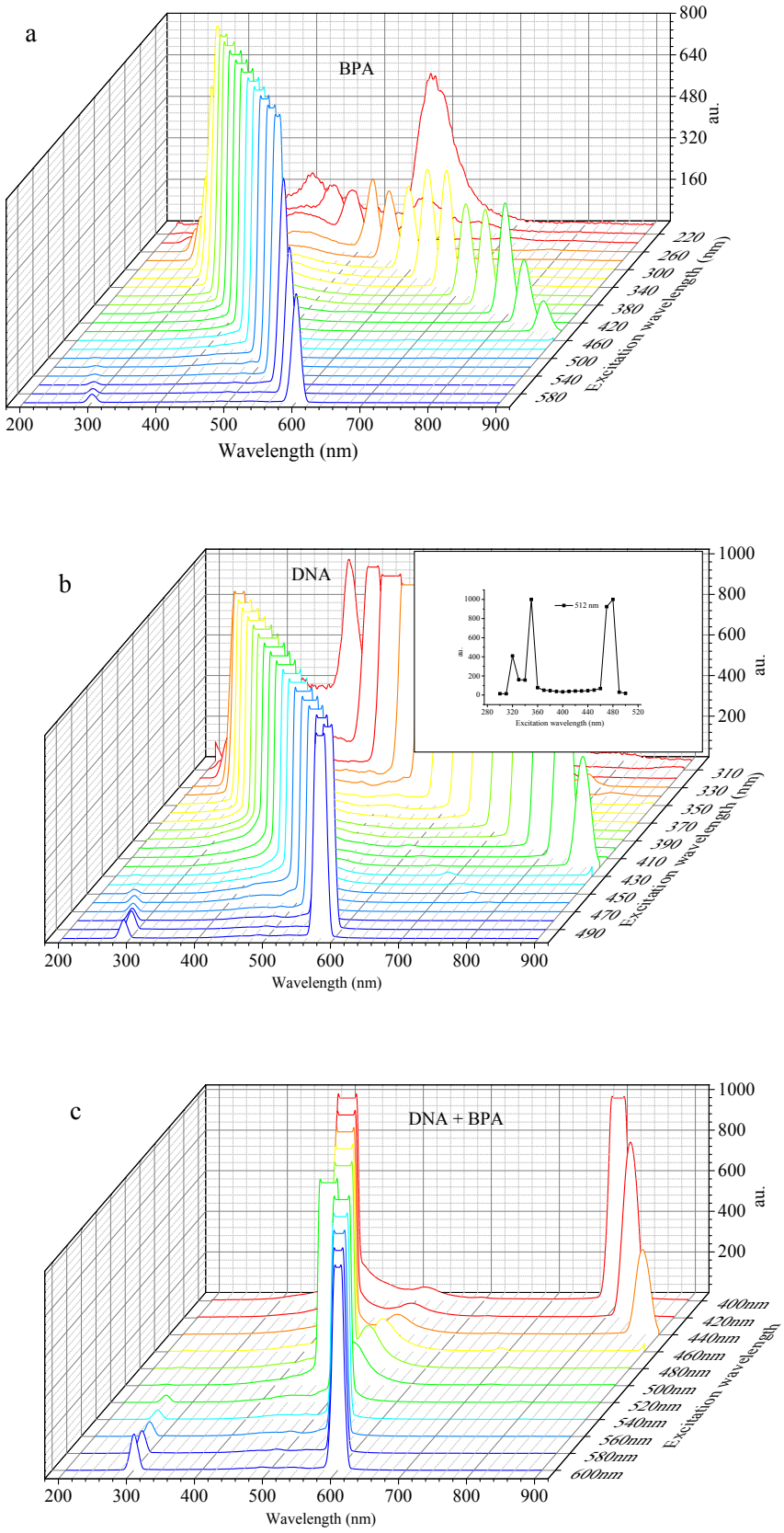

Figure S1. Fluorescence spectra of BPA, DNA and DNA+BPA at different excitation

wavelength. (a) BPA, excitation wavelength from 200-600 nm, and inspected once every 20 nm. (b) DNA, excitation wavelength from 300-500 nm, and inspected once every 10 nm (insert: fluorescence intensity of DNA aptamer at 512 nm versus different excitation wavelength). (c) BPA+DNA, excitation wavelength from 400-600 nm, and inspected once every 20 nm

From these experiments, we found out that the BPA showed weak fluorescence at excitation of 240 nm, and the DNA aptamer showed strong fluorescence at excitation of 480 nm. The mixture of BPA and DNA emitted strong fluorescence at the excitation of 480 nm which comes from the DNA aptamer. So we choose 480 nm as the excitation wavelength.

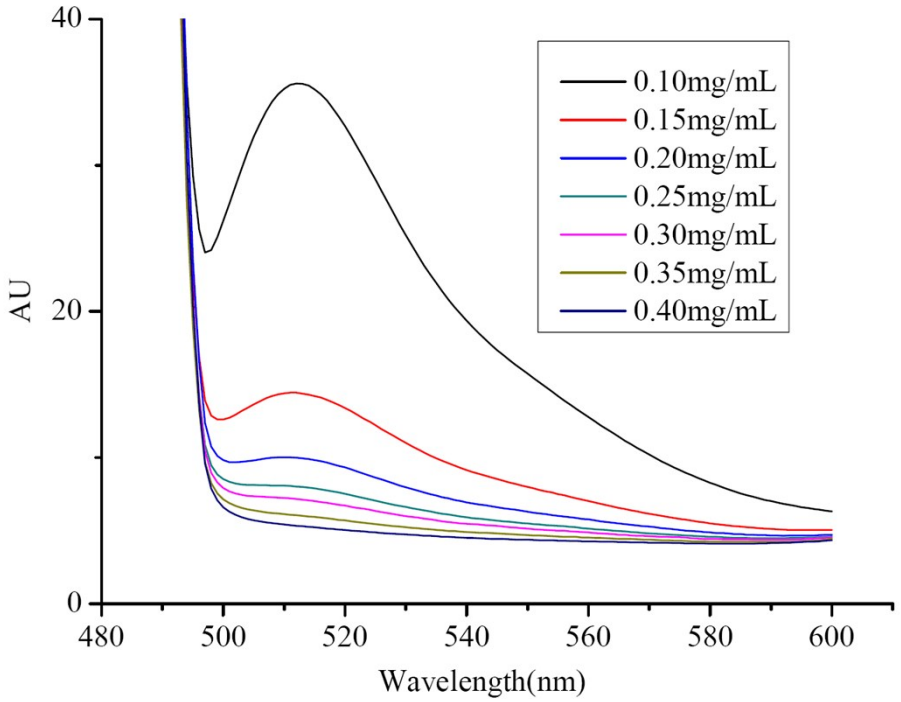

Figure S2. Concentration optimization of the Fe-MIL-88B-NH_2.

Firstly, the FAM-DNA was diluted to 3.0 μM in TE buffer (Tris-HCl and EDTA) buffered solution (pH 8) and stored at 4 ^{o}C in a lucifugal container for later use. Subsequently,

we incubated 10 μL (3.0 μM) FAM-DNA with 10 μL 2×10^{-9} mol/L bisphenol A solution for 3.0 hours at 37 °C. Afterwards, 10 μL different concentrations of MOF solution (1.0 mg/mL, 1.5 mg/mL, 2.0 mg/mL, 2.5 mg/mL, 3.0 mg/mL, 3.5 mg/mL, 4.0 mg/mL) was poured into the solution and stirred for 1.0 hour at 37 °C. At last, 70 μL 0.3 times of TE buffer was poured into the solution. (FAM-DNA and MOF of a final concentration were 0.3μM and 0.10 mg/mL, 0.15 mg/mL, 0.20 mg/mL, 0.25 mg/mL, 0.30 mg/mL, 0.35 mg/mL, 0.40 mg/mL)

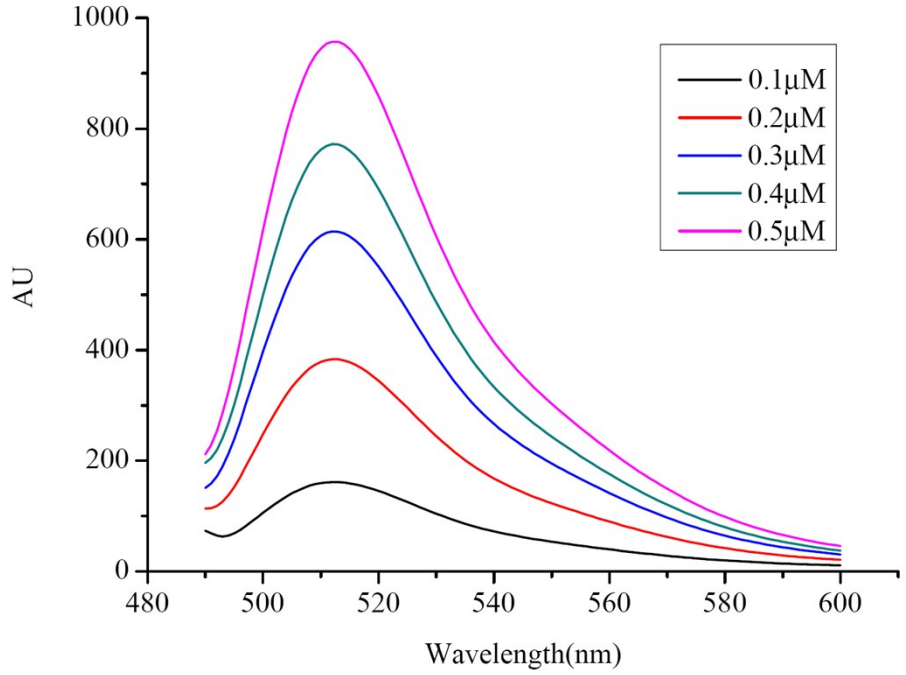

Figure S3. Concentration optimization of the DNA.

Firstly, the FAM-DNA was diluted to different concentrations in TE buffer (Tris-HCl and EDTA) buffered solution (pH 8) and stored at 4 °C in a lucifugal container for later use. Subsequently, we incubated 10 μL different concentrations of FAM-DNA (1μM, 2μM, 3μM, 4μM, 5μM) with 10 μL 2×10^{-9} mol/L bisphenol A solution for 3.0 hours at 37 ℃. Afterwards, 10 μL MOF solution (2.5 mg/mL) was poured into the solution and stirred for 1.0 hour at 37 °C. At last, 70μL 0.3 times of TE buffer was poured into the solution.

(FAM-DNA and MOF of a final concentration were 0.1μM, 0.2μM, 0.3μM, 0.4μM, 0.5μM and 0.25 mg/mL).

For better proving the aptamer probe can be adsorbed by the Fe-MIL-88B-NH_2 and bisphenol A can prevent the adsorption of the fluorescent DNA probe to Fe-MIL-88B-NH_2. Four centrifuged solutions of MOFs, DNA, MOFs+DNA and MOFs+DNA+BPA fluorescence were measured. The supernatant of the solutions of MOFs and MOFs+DNA show no fluorescence and the supernatant of the solutions of DNA and MOFs + DNA + BPA which can prove that the DNA aptamer can be adsorbed by the MOFs and bisphenol A can prevent the adsorption of the DNA aptamer to MOFs. But the fluorescence intensity of the supernatant of MOFs+DNA+BPA is smaller than that of DNA which indicate the BPA cannot prevent the adsorption of the DNA aptamer to MOFs.

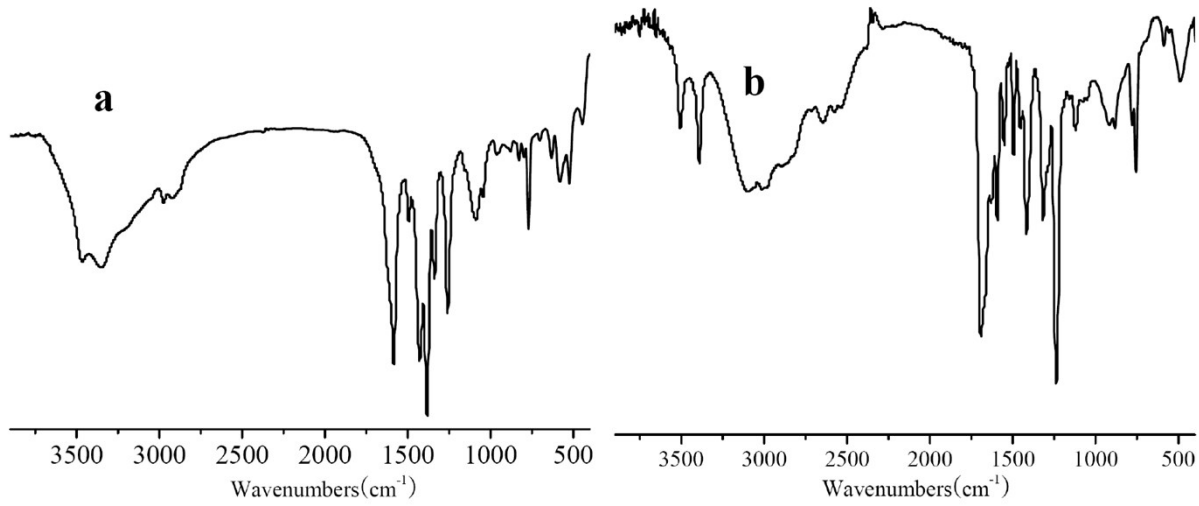

Figure S4. FT-IR spectra of the prepared Fe-MIL-88B-NH_2 nanocrystals and used ligand. (a) IR spectrum of the Fe-MIL-88B-NH_2, (b) IR spectrum of the ligand of 2-aminoterephthalic acid.