

Supporting information (SI)

Nucleic acid aptamer-functionalized magnetic MIL-53(Al)-NH₂ for highly selective magnetic dispersion solid-phase extraction of chloramphenicol

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Instruments and Reagents

BRUKER D8 ADVANCE X-ray Diffractometer (BRUKER Corporation, Germany); Fourier Transform Infrared Spectrometer (PLATINUM ELMER Corporation, Germany); F-4600 Fluorescence Spectrophotometer (Hitachi Corporation, Japan); LC-20A High-Performance Liquid Chromatograph (Shimadzu Corporation, Japan); LABCONCO 2.5L Freeze Dryer (Labconco Corporation, USA); BPZ-6033 Vacuum Drying Oven (Shanghai Yiheng Scientific Instrument Co., Ltd.); DGG-9053A Oven (Shanghai Senxin Experimental Instrument Co., Ltd.).

Hexahydrate ferric chloride ($\text{FeCl}_3 \cdot 6\text{H}_2\text{O}$), ethylene glycol (EG), dodecahydrate sodium dihydrogen phosphate ($\text{Na}_2\text{HPO}_4 \cdot 12\text{H}_2\text{O}$), and dihydrate sodium dihydrogen phosphate ($\text{NaH}_2\text{PO}_4 \cdot 2\text{H}_2\text{O}$) were purchased from Damao Chemical Reagent Factory (Tianjin, China). Anhydrous ethanol was purchased from Energy Chemical Technology Co., Ltd. (Anhui, China). N-Propanol (n-PrOH), ammonia water ($\text{NH}_3 \cdot \text{H}_2\text{O}$), and concentrated hydrochloric acid were purchased from Tianjin Zhiyuan Chemical Reagent Co., Ltd. (Tianjin, China). Tetraethoxysilane (TEOS), sodium acetate (NaAc), 1-ethyl-(3-dimethylaminopropyl)carbodiimide hydrochloride (EDC), sodium chloride (NaCl), hexahydrate magnesium chloride ($\text{MgCl}_2 \cdot 6\text{H}_2\text{O}$), and chloramphenicol (CAP), thiamphenicol (TAP), florfenicol (FF), oxytetracycline (OTC), sulfadiazine (SD), bisphenol A (BPA), enrofloxacin (ENR) were purchased from Aladdin Biochemical Technology Co., Ltd. (Shanghai, China). N, N-dimethylformamide (DMF), N-hydroxy succinimide (NHS), tris(hydroxymethyl)aminomethane (Tris), ethylenediaminetetraacetic acid (EDTA), 4-hydroxyethyl piperazine ethane sulfonic acid (HEPES), Thioacetic acid (TGA), hexahydrate aluminum chloride ($\text{AlCl}_3 \cdot 6\text{H}_2\text{O}$), 2-aminoterephthalic acid ($\text{NH}_2\text{-H}_2\text{BDC}$), and N, N-bis(carboxymethyl)-L-lysine were purchased from Macklin Biochemical Technology Co., Ltd. (Shanghai, China). Oligreen fluorescent dye was purchased from Fanbo Biochemicals Co., Ltd. (Beijing, China). Methanol (MeOH) and acetonitrile (ACN) were purchased from Mreda Technology Co., Ltd. (Beijing, China). CAP aptamer (CAP-Apt: 5'-COOH ACT TCA GTG AGT TGT CCC ACG GTC GGC GAG TCG GTG GTA G-3') and its scrambled aptamer (ScrCAP-Apt: 5'-COOH AGG GAT TCA GGG GCT GTA CTC CGC ACC TGA TGG CGT TTG G-3') were purchased from Sangon Biotech Co., Ltd. (Shanghai, China).

Liquid Chromatography Conditions

Column: Athena C18, 4.6 mm*250 mm, 5 μ m.

CAP liquid chromatography separation conditions: mobile phase acetonitrile-water solution (40:60, V/V), flow rate of 0.6 mL/min, UV detection wavelength of 275 nm, column temperature of 30 °C.

OTC liquid chromatography separation conditions: mobile phase acetonitrile-0.1% formic acid aqueous solution (20:80, V/V), flow rate 0.6 mL/min, UV detection wavelength of 355 nm, column temperature 30 °C.

ENR liquid chromatography separation conditions: mobile phase acetonitrile-0.1% formic acid aqueous solution (20:80, V/V), flow rate of 0.6 mL/min, ultraviolet detection wavelength of 275 nm, column temperature 30 °C.

BPA liquid chromatography separation conditions: the mobile phase was acetonitrile-water solution (45:55, V/V), the flow rate was 0.6 mL/min, the UV detection wavelength was 278 nm, and the column temperature was 30 °C.

TAP liquid chromatography separation conditions: acetonitrile-water, mobile phase of acetonitrile-water solution (30:70, V/V), flow rate of 0.6 mL/min, UV detection wavelength of 225 nm, and column temperature of 30 °C.

FF liquid chromatography separation conditions: mobile phase acetonitrile-water solution (40:60, V/V), flow rate of 0.6 mL/min, UV detection wavelength of 230 nm, and column temperature of 30 °C.

SD liquid chromatography separation conditions: the mobile phase was acetonitrile-0.1% formic acid aqueous solution (35:65, V/V), the flow rate was 0.6 mL/min, the UV detection wavelength was 270 nm, and the column temperature was 40 °C.

Determination of aptamer loading

After synthesis of CAP-Apt@MMIL-53(Al)-NH₂, the reaction supernatant (separated after magnetic collection of microspheres) and the three wash supernatants were combined, adjusted to a total volume of 5 mL, and 40 μ L of Oligreen solution was added. After incubation for 10 min, fluorescence intensity was measured under the following conditions: excitation wavelength 480 nm, emission wavelength 548 nm; excitation/emission spectral bandwidths 5 nm each; scanning speed 1200 nm/min; voltage 700 V. Aptamer loading was quantified by calculating the amount of unbound aptamer in the combined solution and subtracting this from the initial aptamer amount. To investigate the saturation binding capacity, 40, 80, 120, 160, 200, and 300 μ L of 66 μ g/mL aptamer solution were tested, respectively.

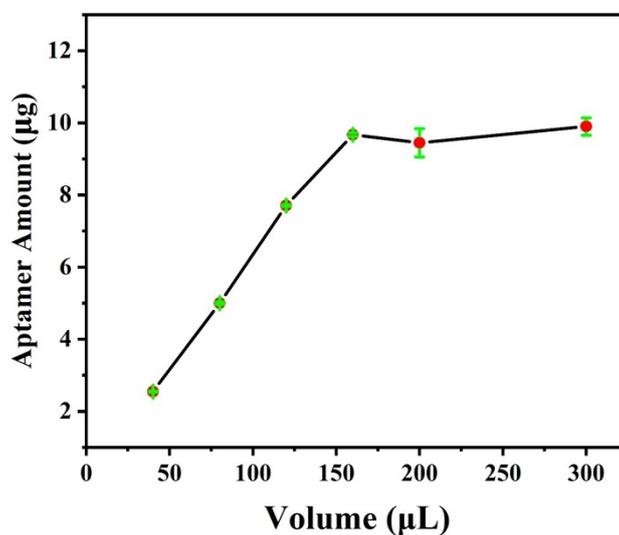


Fig. S1 CAP aptamer bonding capacity curve.

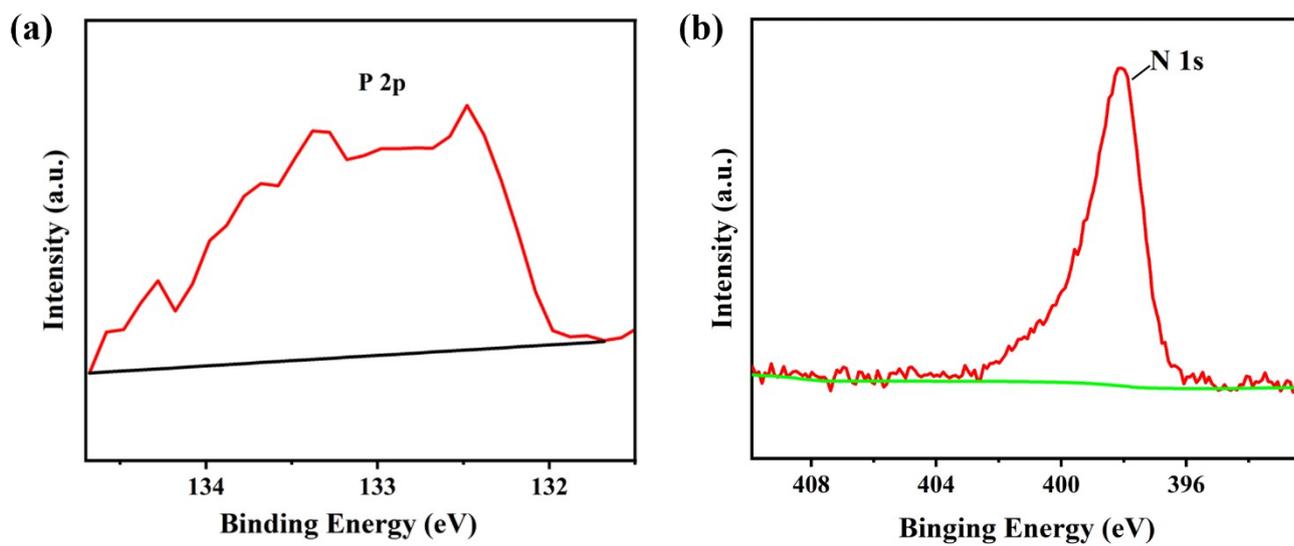


Fig. S2 High-resolution XPS spectra of (a)P 2p and (b)N 1s.

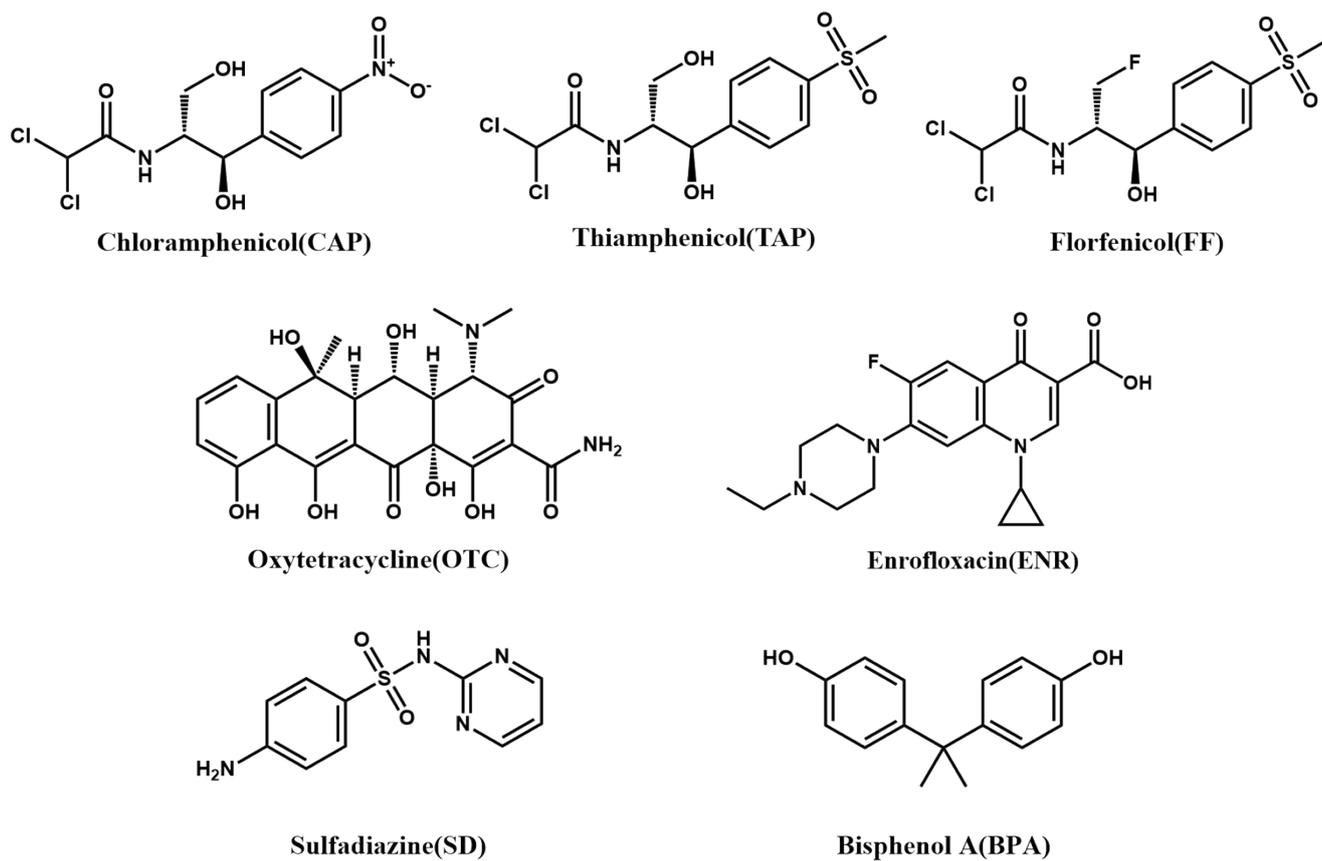


Fig. S3 Molecular structural formulae of CAP, its structural analogs and controls.

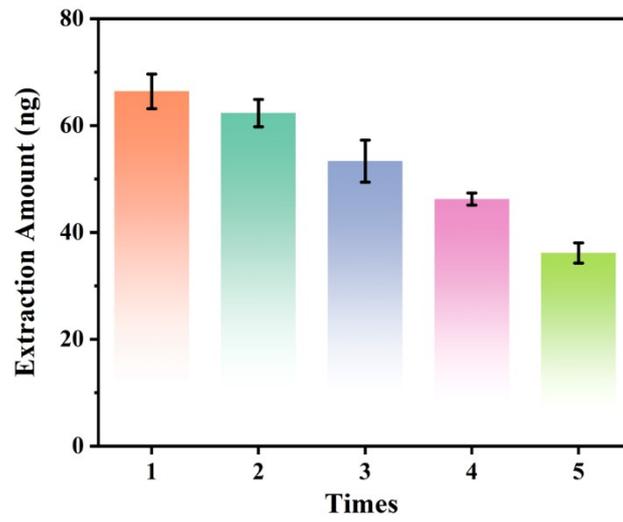


Fig. S4 Extraction amount of CAP by CAP-Apt@MMIL-53(Al)-NH₂ for 5 uses.