Supporting information

Construction of colorimetric sensor arrays using steel slag-based composites for highly sensitive detection of tetracycline antibiotics

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Preparation of NMSS-Por:

The SS was transferred to a glass beaker containing DIW to prepare the SS suspension (20 g/L). A magnet was placed on the outside of beaker and the suspension was mechanically stirred at 300 rpm for 2 h. After the stirring was stopped, the nonmagnetic SS was allowed to settle for 1 h, and the MSS attached to the walls of the flask was collected[1]. The collected MSS and nonmagnetic SS (NMSS) were centrifuged (5,000 rpm, 3min) and dried in an oven at 70 °C 12 h. To obtain high-purity NMSS, we repeated this procedure up to twice. Then, porphyrin was prepared according to the

published reports[2]. 1 mg of porphyrin was dissolved in 5 mL of N-N dimethyl formamide solvent (DMF) and then the solution was added dropwise to the obtained NMSS aqueous dispersion. In order to make the solution more uniform, the mixed solution was ultrasonically dispersed for 30 minutes, after that, transferred to the reactor at 100 °C for hydrothermal 2 h, the products NMSS-Por were centrifuged (5,000 rpm, 3min) and dried in an oven at 70 °C 12 h.

**Preparation of alkali-activated steel-slag (A-SS)**

Before using, the coarse steel slag was ground by ball milling at first, and particles were sieved through square hole standard sieve (mesh side length is 178 μm). Subsequently, the steel slag particles were washed with hot deionized water (60 °C) to remove soluble sediment, inorganic salts, and floating organics and then dried in 60 °C 12 h, the obtained clean and dry steel slag is washing steel slag (W-SS). This operation speeds up the production of calcium hydroxide in certain degree. Ultimately, a direct alkaline activation process was used to synthesized alkali activated steel slag (A-SS) composites. Typically, alkaline activator for steel slag which contains 10.0 g of $Na_2SiO_3·9H_2O$ and 50 mL of 4 M NaOH solution were mixed in a three-necked flask for 30 min[3]. Then, 5.0 g of steel slag was slowly added to the alkaline activator while being magnetically stirred. Subsequently, the flask containing the uniform slurry was sealed and transferred to a 60 °C oil bath and stirred for 6-8 h. After that, the resulting product was centrifuged at a high speed of 8000 rpm to remove the supernatant, namely, excess alkaline activator, which could be recycled. Subsequently, the residual sediments were dispersed in deionized water and ultrasonically treated for 20 min. The

well dispersed mixture was then centrifuged at a rate of 500 rpm to separate the unreacted steel slag particles (settled to the bottom) with the A-SS (remained in the suspensions). Finally, the A-SS was collected from the suspension, washed with deionized water for 3-5 times, and then airdried at 60 $^{\circ}$C for 24 h. The final product was the as-expected A-SS.

Preparation of ALANH-Pt

Before use, the raw steel slag is first ground by the ball mill and passed through 80-mesh standard sieve (screen size of 178 μm). Weigh 1.5 g of the sieved steel slag and place it in a solution containing a certain concentration of HCl, and stir it magnetically until the pH of the solution no longer changes. After the acid leaching, the solution was centrifuged at 8000 rpm, and then the supernatant was passed through filter membrane with a pore size of 0.22 μm to finally obtain a clarified yellow-green supernatant. The concentration of HCl was selected to be 1.2 M. Then NaOH solution (1.2 M) is added to the yellow-green supernatant drop by drop until pH=7[4], it can be observed that a gray-green flocculent precipitation occurs, and the color of the solution is converted from yellow-green to orange. With the continuous addition of NaOH solution until the leaching Fe element was completely precipitated, the color of the solution gradually changes to dark green. Finally, the solution at the end of the reaction was transferred to the polytetrafluoroethylene (PTFE) autoclave for hydrothermal reaction at 100 $^{\circ}$C for 2 h[5]. The hydrothermal precipitate was in the form of gelatinization, and after centrifugal washing and drying at 70 $^{\circ}$C, the modified steel slag was produced, and it was recorded as: ALANH. The ALANH produced in the first step was used as a carrier for loading Pt. Weigh 50 mg of ALANH powder, dispersed in 20 mL of water, which was recorded as solution A; weigh a certain mass of K_2PtCl_4, dispersed in 30 mL of anhydrous ethanol, which was recorded as solution B. Solution A and B were fully dispersed under ultrasound respectively, and solution B was added to solution A drop by drop under continuous ultrasonic action, and then the mixed solution was transferred to LED-UV light source and irradiated with magnetic stirring

for 30 min. The color of the mixture turns black, indicating that the K_2PtCl_4 has been reduced. Finally, the irradiated solution was centrifugally washed for three times and vacuum dried at 70 °C to obtain Pt-modified steel slag (ALANH-Pt).
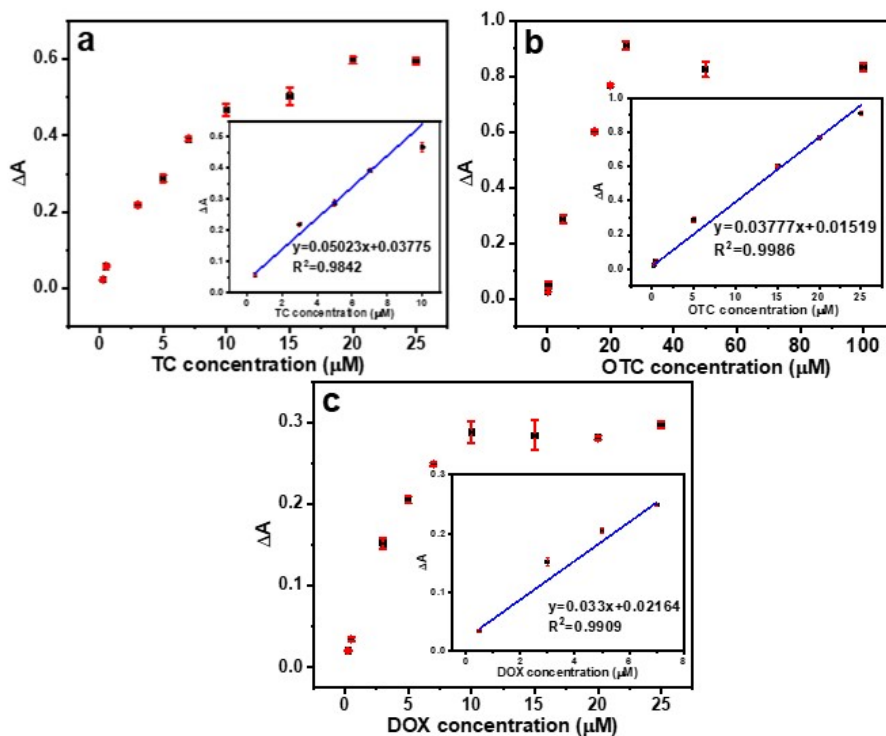
Fig S1 The working curve of TCs by A-SS: (a) the response curve of ox-TMB at ΔA_{652} relative to TC concentration (0~25 µM), the inset corresponds to the linear fitting curve for TC (the error bars standard deviation of three parallel samples detection); (b) the response curve of ox-TMB at ΔA_{652} relative to OTC concentration (0~100 µM), the inset corresponds to the linear fitting curve for OTC; (c)the response curve of ox-TMB at ΔA_{652} relative to DOX concentration (0~25 µM), the inset corresponds to the linear fitting curve for DOX
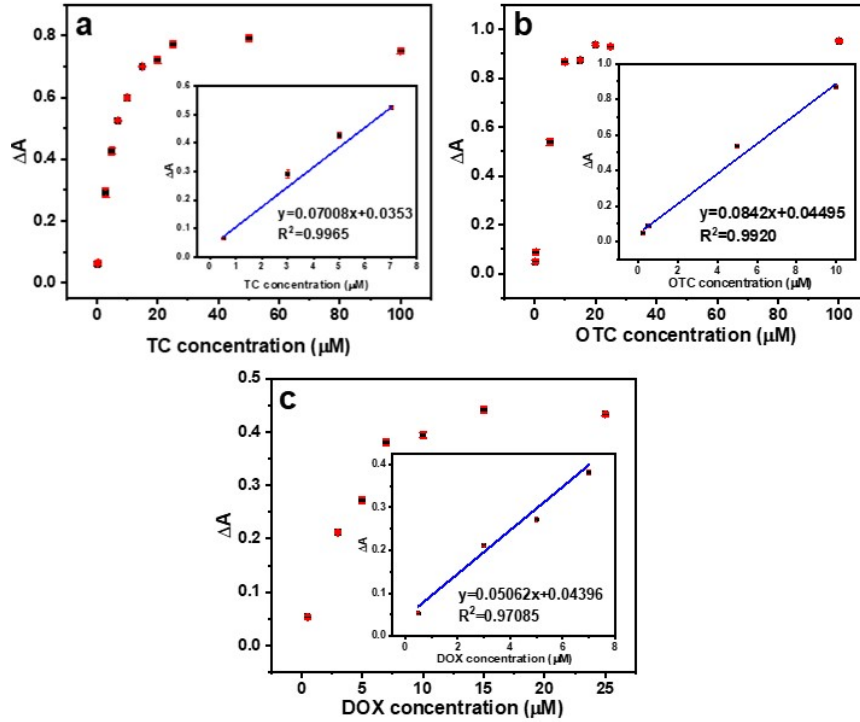
Fig S2 The working curve of TCs by NMSS-Por: (a) the response curve of ox-TMB at ΔA_{652} relative to TC concentration (0~100 µM), the inset corresponds to the linear fitting curve for TC (the error bars standard deviation of three parallel samples detection); (b) the response curve of ox-TMB at ΔA_{652} relative to OTC concentration (0~100 µM), the inset corresponds to the linear fitting curve for OTC; (c)the response curve of ox-TMB at ΔA_{652} relative to DOX concentration (0~25 µM), the inset corresponds to the linear fitting curve for DOX
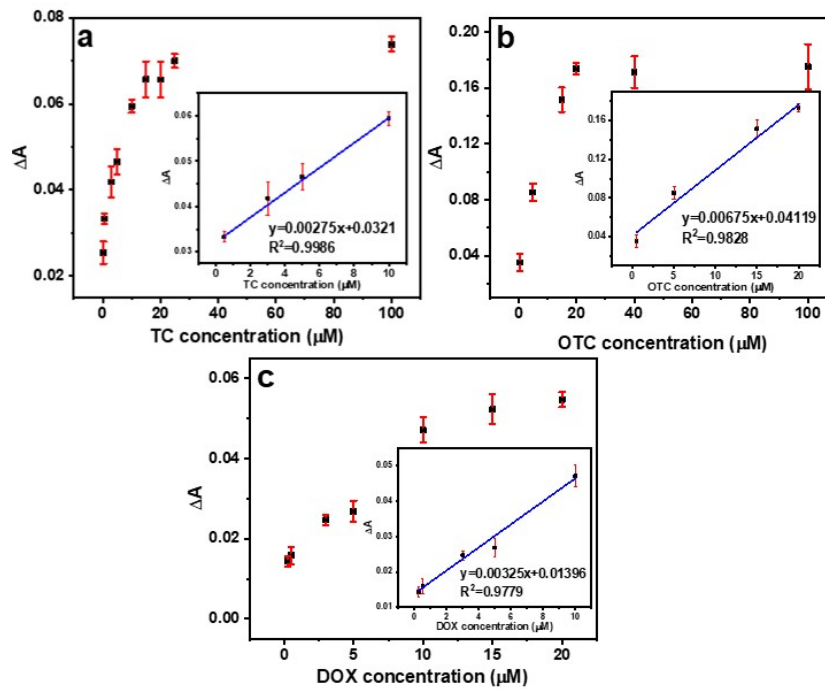
Fig S3 The working curve of TCs by ALANH-Pt: (a) the response curve of ox-TMB at ΔA_{652} relative to TC concentration (0~100 µM), the inset corresponds to the linear fitting curve for TC

(the error bars standard deviation of three parallel samples detection); (b) the response curve of ox-TMB at ΔA_{652} relative to OTC concentration (0~100 µM), the inset corresponds to the linear fitting curve for OTC; (c)the response curve of ox-TMB at ΔA_{652} relative to DOX concentration (0~20 µM), the inset corresponds to the linear fitting curve for DOX

References

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