SUPPORTING INFORMATION

Biocompatible cellulose-nanofiber-based multifunctional material for Fe^{3+} detection and drug delivery

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Effect of Fe^{2+} and high concentration of interfering ions on detection of CNF-DA for Fe^{3+}

The detection of Fe^{2+} ions by CNF-DA and the influence of high concentration of interfering ions on the detection of Fe^{3+} ions were shown in Fig. S1. Since Fe^{2+} is easy to be oxidized to Fe^{3+} in the detection process, the reducing agent ascorbic acid (AC) (0.2 g) was added in the solution preparation process to prevent the oxidation of Fe^{2+}. The results showed that CNF-DA had no color response to Fe^{2+} solution with a concentration of 10^{-4} mol/L (Fig. S1(a) ①) and 10^{-5} mol/L (Fig. S1(a) ②) in the present of AC. However, CNF-DA showed the color changed similar to low concentration Fe^{3+} when the solution of Fe^{2+} (10^{-5} mol/L) without AC (Fig. S1(a) ③), indicating that the solid CNF-DA sensor could detect Fe^{3+} but not Fe^{2+}.

In order to confirm the oxidation process of Fe^{2+} solution, 10.0 mL Fe^{2+} solution (10^{-3} mol/L) and 10.0 mL Fe^{2+} solution (10^{-3} mol/L) with 0.1 g AC were prepared. Then 1.0 mL NaOH (10^{-2} mol /L) solution was added in the above solution at 1 min and 10 min (Fig. S1(b)), respectively. It can be seen from the Fig. S1 (b), the green precipitate was produced between the reaction of Fe^{2+} with AC and NaOH within 10 minutes, while the red precipitate was produced when that without AC, which indicated that part of Fe^{2+} ions had been oxidized to Fe^{3+}, and the AC could prevent the oxidation of Fe^{2+}.

The effect of high concentration of interfering ions on detection of CNF-DA for Fe^{3+} was investigated. The mixed solution with high concentration of interfering ions (10^{-4} mol/L) and low concentration of Fe^{3+} (10^{-6} mol/L), AC was not added into the solution due to that AC could reduce Ag^{+} and Fe^{3+} in mixed solution. The solid CNF-DA sensor also exhibited color changes for the detection of Fe^{3+} in the presence of high concentration of interfering ions although the concentration of the interfering ions (Fe^{2+}, Cu^{2+}, Mn^{2+}, Hg^{2+} and Ag^{+}) is 100 times of that of Fe^{3+} ions (Fig. S1(a) ④ and ⑤). The results further confirmed the superior recognition ability of CNF-DA to Fe^{3+}.

For the CNF-DA spectrophotometric sensor, the UV absorption peak intensity at 196 nm was almost not affected by Fe2+ (Fig. S1(c)). This was consistent with the detection results of the solid CNF-DA sensor. When the concentration of interfering ions was 100 times as much as that of Fe^{3+}, the CNF-DA spectrophotometric sensor still had a highly selective property of Fe^{3+} except Pb^{2+}. However, the detect of CNF-DA for high concentration Pb^{2+} appeared a new peak at 210 nm. Therefore, the interference of Pb^{2+} could be eliminated through the change of the UV spectral shape.

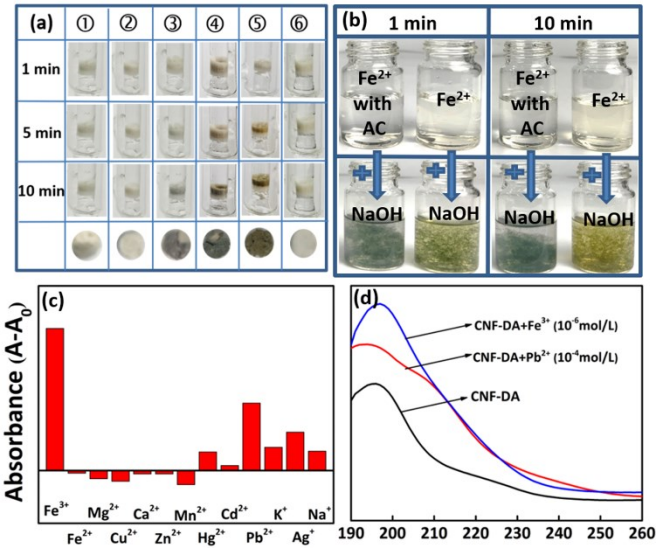

Fig. S1 (a) CND-DA detect for Fe^{2+} (10^{-4} mol/L) with AC ①, Fe^{2+} (10^{-5} mol/L) with AC ②, Fe^{2+} (10^{-5} mol/L) ③, mixed ions 1 (Pb^{2+} (10^{-4} mol/L) and Fe^{3+} (10^{-6} mol/L) ④), mixed ions 2 (Fe^{2+}, Cu^{2+}, Mn^{2+}, Hg^{2+} and Ag^{+} (10^{-4} mol/L) and Fe^{3+} (10^{-6} mol/L) ⑤, H_2O ⑥, (b) Fe^{2+} (10^{-3} mol/L) under different conditions, (c) UV spectrum of CNF-DA for Fe^{3+} (10^{-6} mol/L) and other ions (10^{-4} mol/L), (d) UV spectrum of CNF-DA with Pb^{2+} (10^{-4} mol/L) and Fe^{3+} (10^{-6} mol/L)

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The experiment process of DOX loading on CNF-DA

CNF-DA sample (5.00 mg) was dispersed in a 10.0 mL centrifuge tube containing 1.0 mL distilled water, and then amount of DOX (1 mg/mL) was added in the solution. The centrifuge tube was covered with foil to prevent DOX decomposition and placed in a thermostatic gas oscillator to oscillate for 24 h at 25 °C. After that, the sample was centrifuged and washed with distilled water until no DOX separate out. The sample was freeze-dried to obtain the drug loaded CNF-DA-DOX aerogel. The DOX loading capacity was calculated by formula (S1).

$$A = \frac{1 \cdot x - \sum_{0}^{i} Ci \cdot yi}{m} / 1000 \quad \text{(S1)}$$

where *A* (mg/g) is the loading capacity of DOX on CNF-DA, 1 (mg/mL) is the concentration of DOX in the solution, x (mL) is the volume of DOX, i is the number of washing times, *Ci* (mg/mL) is the concentration of DOX in washing solution, *yi* (mL) is the volum of washing solution, and *m* (mg) is the quality of CNF-DA. The drug loading capacity of CNF-DA was shown in Fig. 8, and the maximum drug loading capacity of CNF-DA was 879.09 mg/g.