## **Supporting Information**

Indicator/Catalyst Displacement Assay: Design of a Latent Catalyst for the Selective Detection and Degradation of Cyanide by Prussian Blue Analog-Modified TiO<sub>2</sub> Nanoparticles

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Figure S1. FTIR of the  $K_4[Fe(CN)_6]$ ,  $K_4[Fe(CN)_6]/TiO_2$ ,  $Fe_4[Fe(CN)_6]_3$  and NP1.



Figure S2. FTIR of the  $K_4[Ru(CN)_6]$ ,  $K_4[Ru(CN)_6]/TiO_2$ ,  $Fe_4[Ru(CN)_6]_3$  and NP2.



Figure S3. FTIR of the  $K_4[Os(CN)_6]$ ,  $K_4[Os(CN)_6]/TiO_2$ ,  $Fe_4[Os(CN)_6]_3$  and NP3.



Figure S4. TEM images of  $TiO_2$  and NP1–3



Figure S5. X-ray powder diffraction patterns of  $TiO_2$  and NP1–3.



Figure S6. UV-vis spectra of (a)  $Fe_4[Fe(CN)_6]_3$ ,  $Fe_4[Ru(CN)_6]_3$ , and  $Fe_4[Os(CN)_6]_3$ , and (b) NP1–NP3 in DI water.

|              | NP1             | NP2             | NP3             |
|--------------|-----------------|-----------------|-----------------|
| MDL<br>(ppm) | 1.10            | 0.60            | 0.83            |
| log K        | $7.52 \pm 0.04$ | $7.46 \pm 0.04$ | $7.44 \pm 0.02$ |

ppn 1.5 1.3 ppn 2.6 ppn 3.9 ppn 5.2 ppn 6.5 ppn 7.8 ppn 1.0 9.1 ppn Abs 10.4 ppn 11.7 ppm 13 ppm 0.5 750 900 450 600 1050 Wavelength/nm R<sup>2</sup>=0.99 Intercept = -1.54781  $A_0/(A - A_0)$  at 681nm -2  $Slope = -4.60277E^{-8}$ -3 logK = 7.52 $-\Delta G = 42.94 \text{KJ/mol}$ -7 0.0 2.0x10<sup>7</sup>4.0x10<sup>7</sup>6.0x10<sup>7</sup>8.0x10<sup>7</sup>1.0x10<sup>8</sup>  $1/[CN]^{2}(M^{2})$ 

**Figure S7.** (a) UV-vis spectroscopic titrations of **NP1** (250 ppm) with  $CN^-$  (0–13 ppm) and (b) The slope and y intercept are -4.60 x 10<sup>-8</sup>M<sup>2</sup> and -1.55, respectively, log K = 7.52 ± 0.04 at 681 nm. (c) Photographs of the colorimetric responses of **NP1** (250 ppm) toward different concentration of  $CN^-$  (0–13 ppm). All the experiments were carried out in deionized water.

**S.Table 1.** Method detection limits (MDLs) and binding constants (log K) of CN<sup>-</sup> by **NP1– 3**.



**Figure S8.** (a) UV-vis spectroscopic titrations of **NP3** (250 ppm) with  $CN^-$  (0–13 ppm) and (b) The slope and y intercept are -1.11 x 10<sup>-7</sup>M<sup>2</sup> and -3.00, respectively, log K = 7.44 ± 0.02 at 570 nm. (c) Photographs of the colorimetric responses of **NP3** (250 ppm) toward different concentration of  $CN^-$  (0–13 ppm). All the experiments were carried out in deionized water.



**Figure S9**. (a) Summary of UV-vis spectroscopic titrations (A/A<sub>0</sub> at 681 nm) of **NP1** (250 ppm) with various analytes including  $CN^-$ , aniline (AN), 1,5-naphthalenedisulfonic acid (NSA), benzoic acid (BA), and 4-nitrophenol (PNP) monitored as a function of increasing of their concentration (1–13 ppm). (b) Photos of the colorimetric responses of **NP1** (250 ppm) with various analytes (13 ppm): from left to right is  $CN^-$ , AN, NSA, BA, PNP and control.



**Figure S10**. (a) Summary of UV-vis spectroscopic titrations (A/A<sub>0</sub> at 570 nm) of **NP3** (250 ppm) with various analytes including  $CN^-$ , aniline (AN), 1,5-naphthalenedisulfonic acid (NSA), benzoic acid (BA), and 4-nitrophenol (PNP) monitored as a function of increasing of their concentration (1–13 ppm). (b) Photos of the colorimetric responses of **NP3** (250 ppm) with various analytes (13 ppm): from left to right is  $CN^-$ , AN, NSA, BA, PNP and control.



**Figure S11**. UV–vis spectroscopic titrations of  $K_4[M_A(CN)_6]$  ( $M_A = (a)$  Fe, (b) Ru, (c) Os = 1 ×10<sup>-4</sup> M) with FeCl<sub>3</sub> (0–1 × 10<sup>-4</sup> M). All the experiments were carried out in deionized water.



**Figure S12.** (a) The degradation efficiencies of  $CN^-$  by **NP1-3** in aqueous medium against reaction time. Reaction conditions: catalyst = 500 ppm,  $CN^-$  = 26 ppm, T = 298 K, and the light source is a 300 W Hg(Xe) light.



**Figure S13.** Concentration changes of  $CN^-$  and  $OCN^-$  during the degradation of  $CN^-$  by **NP1** in aqueous medium against reaction time. Reaction conditions: **NP1** = 500 ppm,  $CN^-$  = 26 ppm, T = 298 K, 3h, and the light source is a 300 W Hg(Xe) light.



**Figure S14.** Repeatability of the oxidation of cyanide ions by **NP1** (500 ppm) with replenishing of Fe(III) in each addition as 44.8 ppm All the degradations were conducted as follows: **NP1** = 500 ppm,  $CN^-$  = 26 ppm, T = 298 K, 3h, and the light source is a 300 W Hg(Xe) light.



**Figure S15.** Repeatability of the oxidation of cyanide ions by **NP3** (500 ppm) with replenishing of Fe(III) in each addition as 44.8 ppm All the degradations were conducted as follows: **NP3** = 500 ppm,  $CN^-$  = 26 ppm, T = 298 K, 3h, and the light source is a 300 W Hg(Xe) light.