Supporting Information


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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 $\text{K}_4[\text{Os(CN)}_6]$, $\text{K}_4[\text{Os(CN)}_6]/\text{TiO}_2$, $\text{Fe}_4[\text{Os(CN)}_6]_3$ and NP3.
Figure S4. TEM images of TiO$_2$ and NP1–3
Figure S5. X-ray powder diffraction patterns of TiO\textsubscript{2} and NP1–3.
Figure S6. UV-vis spectra of (a) $\text{Fe}_4[\text{Fe(CN)}_6]_3$, $\text{Fe}_4[\text{Ru(CN)}_6]_3$, and $\text{Fe}_4[\text{Os(CN)}_6]_3$, and (b) NP1–NP3 in DI water.
**S.Table 1.** Method detection limits (MDLs) and binding constants (log K) of CN$^-$ by NP1–3.

<table>
<thead>
<tr>
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<th>NP1</th>
<th>NP2</th>
<th>NP3</th>
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<tbody>
<tr>
<td>MDL (ppm)</td>
<td>1.10</td>
<td>0.60</td>
<td>0.83</td>
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<tr>
<td>log K</td>
<td>7.52 ± 0.04</td>
<td>7.46 ± 0.04</td>
<td>7.44 ± 0.02</td>
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</table>

**Figure S7.** (a) UV–vis spectroscopic titrations of NP1 (250 ppm) with CN$^-$ (0–13 ppm) and (b) The slope and y intercept are $-4.60 \times 10^{-8}$M$^2$ 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.
Figure S8. (a) UV–vis spectroscopic titrations of NP3 (250 ppm) with CN⁻ (0–13 ppm) and (b) The slope and y intercept are $-1.11 \times 10^{-7}$M² and $-3.00$, respectively, log $K = 7.44 \pm 0.02$ 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_0 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 ($A/A_0$ 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 K₄[MA(CN)₆] (MA = (a) Fe, (b) Ru, (c) Os = 1 × 10⁻⁴ M) with FeCl₃ (0–1 × 10⁻⁴ 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.