Mimicking Horseradish Peroxidase and Oxidase by Ruthenium Nanomaterials

Gao-Juan Cao\textsuperscript{a,b}, Xiumei Jiang\textsuperscript{b}, Hui Zhang\textsuperscript{b}, Timothy R. Croley\textsuperscript{b} and Jun-Jie Yin\textsuperscript{b,*}

\textsuperscript{a}Department of Applied Chemistry, College of Life Sciences, Fujian Agriculture and Forestry University, Fuzhou, Fujian 350002, China.
\textsuperscript{b}Division of Analytical Chemistry, Office of Regulatory Science, Center for Food Safety and Applied Nutrition, U.S. Food and Drug Administration, College Park, Maryland 20740, USA.
*Corresponding author: junjie.yin@fda.hhs.gov

Scheme S1 Scheme S1 Two most possible mechanisms responsible for the enzyme mimic activities of Ru NPs.

Table S1 Hydrodynamic size and Zeta potential of Ru NPs dispersed in water.

Fig.S1 Hydrodynamic size and Zeta potential measurements of Ru NPs in water.

Fig.S2 SEM and TEM images of Ru NPs.

Fig.S3 UV-Vis absorption spectra of Ru NPs.

Fig.S4 The velocity of the HRP-like reaction changes in the presence of different concentrations of TMB (a) and H\textsubscript{2}O\textsubscript{2} (b).

Fig.S5 The velocity of the oxidase-like reaction changes in the presence of different concentrations of TMB.

Fig.S6 The velocity of the oxidase-like reaction changes in the presence of different concentrations of NaA.

Fig.S7 a) ESR spectra of Ru NPs in DMPO or H\textsubscript{2}O\textsubscript{2}/DMPO system. b) ESR spectra of Ru NPs in BMPO or H\textsubscript{2}O\textsubscript{2}/BMPO system.
Scheme S1 Two most possible mechanisms responsible for the enzyme mimic activities of Ru NPs.

\[
\begin{align*}
(1) \quad & \quad \text{H}_2\text{O}_2 / \text{O}_2 \xrightarrow{\text{NPs}} 2 \text{OH} \\
& \quad \text{OH} + \text{Substrates} \rightarrow \text{Oxidized Substrates} + \text{H}_2\text{O} \\
(2) \quad & \quad \text{Substrates} - e^- \xrightarrow{\text{NPs}} \text{Oxidized Substrates} \\
& \quad \text{H}_2\text{O}_2 / \text{O}_2 + e \xrightarrow{\text{NPs}} \text{H}_2\text{O}
\end{align*}
\]

Table S1 Hydrodynamic size and Zeta potential of Ru NPs dispersed in water.

<table>
<thead>
<tr>
<th>In H(_2)O</th>
<th>Size (DLS, nm)</th>
<th>PDI</th>
<th>Zeta potential</th>
</tr>
</thead>
<tbody>
<tr>
<td>Ru NPs</td>
<td>123.2±1.9</td>
<td>0.16</td>
<td>−37.7±0.4</td>
</tr>
</tbody>
</table>

Fig. S1 Hydrodynamic size and Zeta potential measurements of Ru NPs in water.

Fig. S2 SEM and TEM images of Ru NPs.
Fig. S3 UV-Vis absorption spectra of Ru NPs.

Fig. S4 The velocity of the HRP-like reaction changes in the presence of different concentrations of TMB (a) and H$_2$O$_2$ (b).

Fig. S5 The velocity of the oxidase-like reaction changes in the presence of different concentrations of TMB.
Fig. S6 The velocity of the oxidase-like reaction changes in the presence of different concentrations of NaA.

Fig.S7 a) ESR spectra of Ru NPs in DMPO or H_2O_2/DMPO system. b) ESR spectra of Ru NPs in BMPO or H_2O_2/BMPO system. There is no ESR signal of DMPO–OH or BMPO–OH adduct, which exhibits a typical quartet with an intensity ratio of 1:2:2:1.