Electronic Supplementary Material (ESI) for Analyst.

In-Situ SERS Monitoring of Intracellular H_2O_2 in Single Living Cells Based on Label-Free Bifunctional Fe_3O_4@Ag Nanoparticles

Yue Wang*[a], Cheng Cheng[a], Ruofei Ma[a], Zhangrun Xu*[a], and Yukihiro Ozaki*[b]

[a]Department of Chemistry, College of Sciences, Northeastern University, Shenyang 110819, People's Republic of China

[b] School of Biological and Environmental Sciences, Kwansei Gakuin University, Sanda, Hyogo 669-1337, Japan

*Email: yuewang@ mail.neu.edu.cn; Fax:+86-24-83867659; Tel: +86-24-83867659 (Y.W.)

Email: xuzr@mail.neu.edu.cn; Fax:+86-24-83867659; Tel: +86-24-83867659 (Z.X.)

E-mail: ozaki@kwansei.ac.jp; Fax:+81-79-5659077; Tel: +81-79-5658349 (Y.O.).

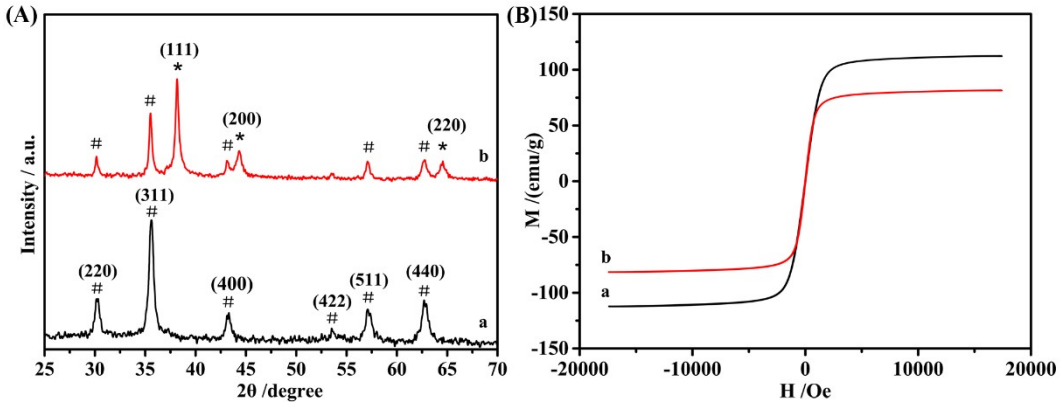

Figure S1 (A) XRD patterns and **(B)** magnetization curves of the synthesized Fe_3O_4 (a) and Fe_3O_4@Ag NPs (b).

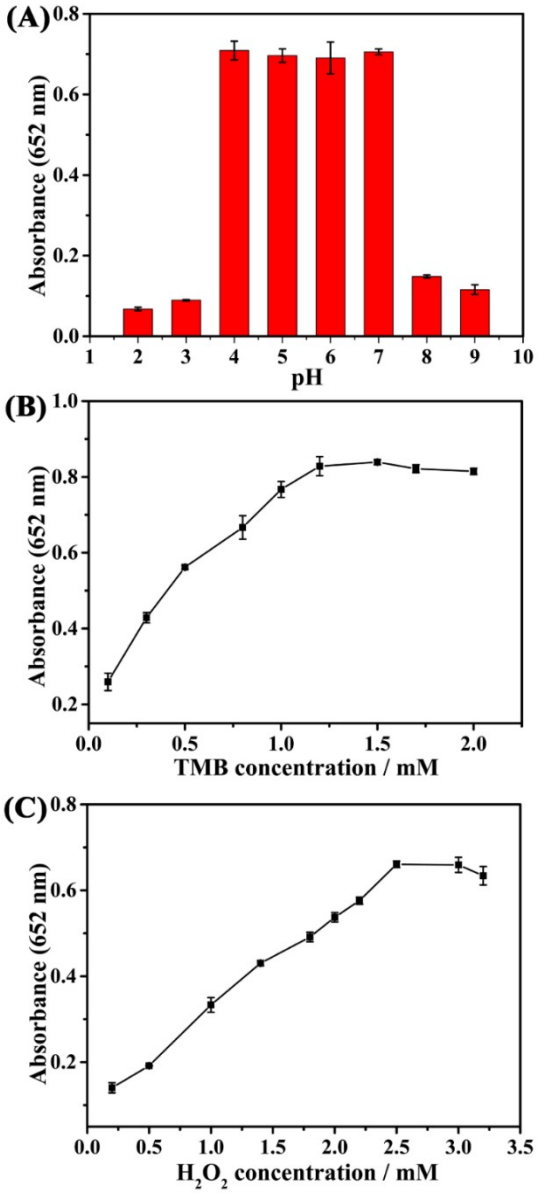

Figure S2. Effects of different conditions on the peroxidase-like activity of Fe_3O_4@Ag NPs: **(A)** pH; **(B)** concentration of TMB; (C) concentration of H_2O_2.

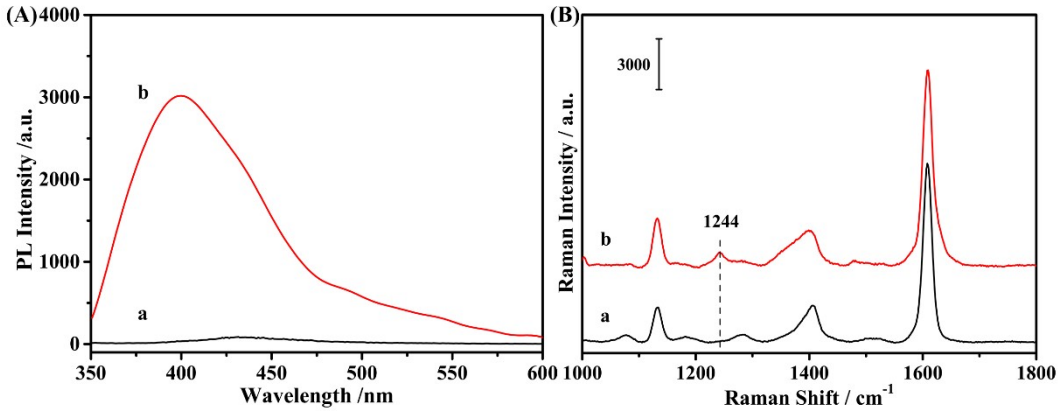

Figure S3. Fluorescence emission spectra (PL = photoluminescence) **(A)** and Raman spectra **(B)** of TA in the presence of (a) H_2O_2, (b) Fe_3O_4@Ag NPs and H_2O_2.

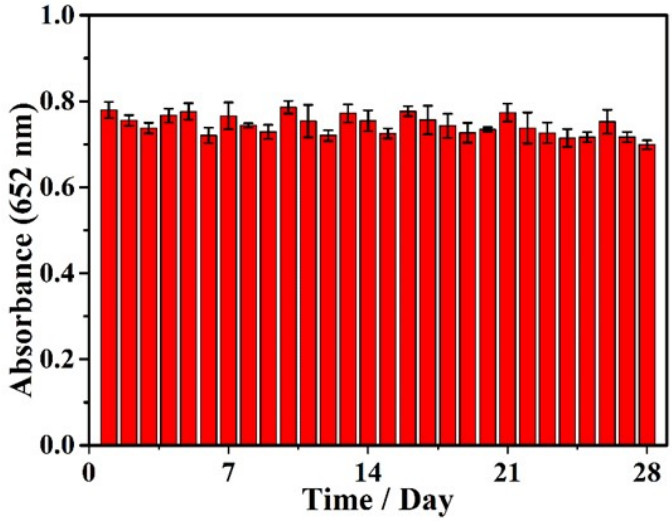

Figure S4. Long-term catalytic stability of Fe_3O_4@Ag NPs stored at room temperature using TMB as the substrate in the presence of H_2O_2.

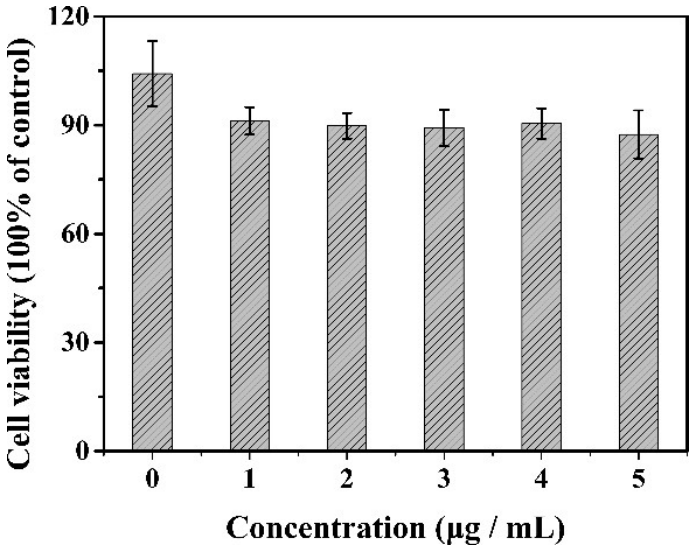

Figure S5. The MTT-based cytotoxicity assay of Fe_3O_4@Ag NPs toward B16 cells.

Table S1. Comparison of Michaelis-Menten constants (K_m) and maximum reaction rates (V_{max}) of the oxidation reaction catalyzed by Fe_3O_4@Ag NPs and reported HRP.

catalyst	substrate	K_m(mM)	V_{max} (10^{-8} M s^{-1})
Fe_3O_4@Ag	TMB	0.61	11.11
Fe_3O_4@Ag	H_2O_2	24.36	6.82
HRP[1]	TMB	0.434	10.0
HRP[1]	H_2O_2	3.70	8.71

Notes and references

1. Gao, L.; Zhuang, J.; Nie, L.; Zhang, J.; Zhang, Y.; Gu, N.; Wang, T.; Feng, J.; Yang, D.; Perrett, S.; Yan, X. *Nature Nanotech.*, 2007, **2**, 577-583.