Supporting Information

Amplified Peroxidase-Like Activity in Iron Oxide Nanoparticles using Adenosine Monophosphate: Application to Urinary Protein Sensing

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Abstract

In the section of supporting information, we include detail information associated with DLS spectra of the Fe_3O_4 NPs and the AMP-Fe_3O_4 NPs, the fluorescence of the oxidized AU obtained from the different catalytic conditions, the effect of storage time of the AMP-induced enhancement of the Fe_3O_4 NP activity, determination of the net charge of AU by capillary electrophoresis, the use of reversed-phase high performance liquid chromatography for the detection of AMP hydrolysis under different catalytic conditions, and BET analyses of the Fe_3O_4 NPs and the AMP-Fe_3O_4 NPs.

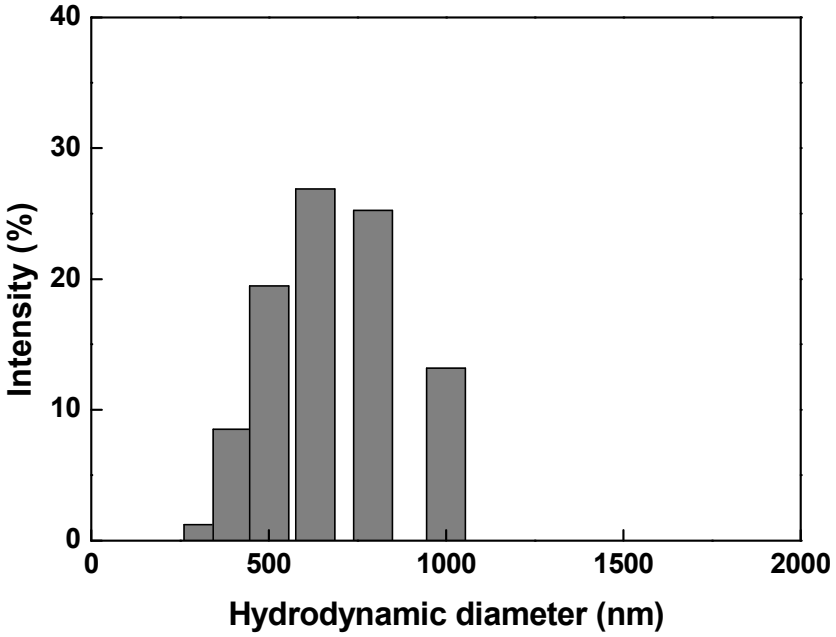


Figure S1. DLS spectrum of the as-prepared Fe_3O_4 NPs.

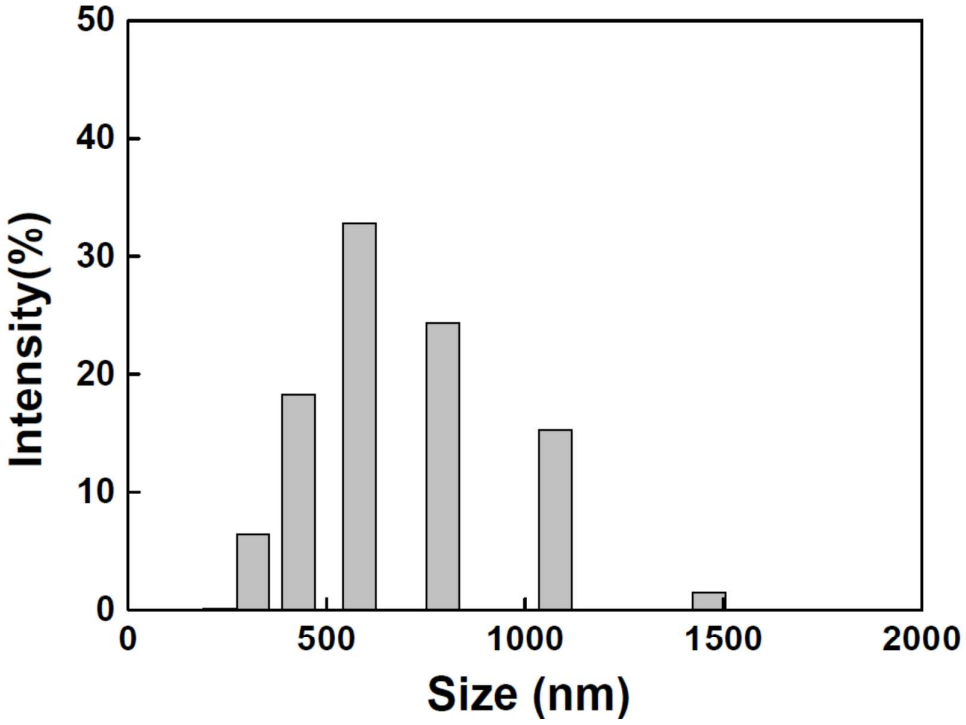
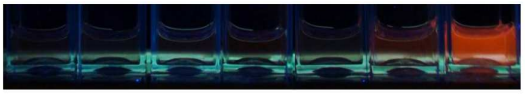


Figure S2. DLS spectrum of the AMP-Fe_3O_4 NPs.

Under
UV 254 nm



	A	B	C	D	E	F	G
Fe_3O_4	+	-	+	-	+	+	+
H_2O_2	+	+	-	+	-	+	+
AU	-	+	+	+	+	+	+
AMP	+	-	+	+	-	-	+

Figure S3. Visual analyses demonstrate that the production of the oxidized AU only occurred in the presence of (F) Fe_3O_4 NPs, H_2O_2, AU and (G) Fe_3O_4 NPs, H_2O_2, AU AMP. The Fe_3O_4 NPs were incubated with adenosine analogs for 1 min in 10 mM Tris-HCl (pH 7.0). The concentrations of NPs, AMP, AU, and H_2O_2 are 1 mg/ml, 0,1 mM, 5 µM, and 2.5 mM, respectively.

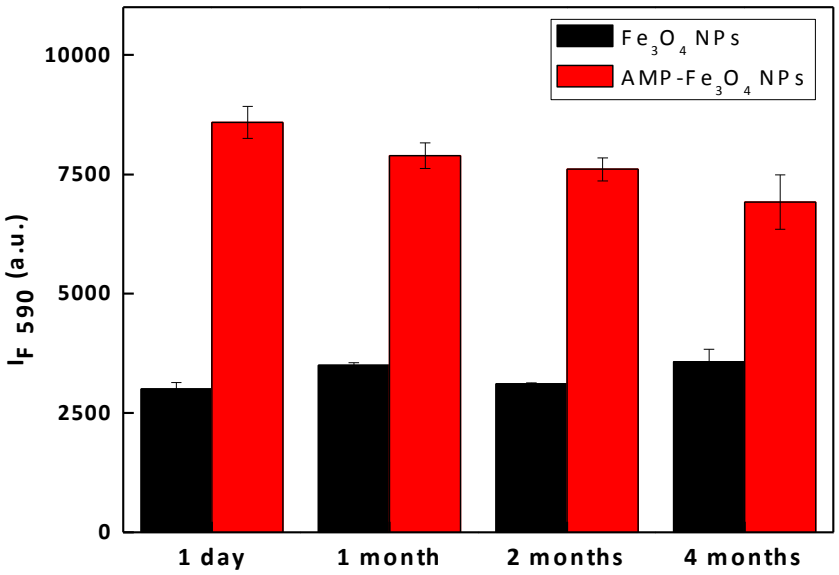


Figure S4. Effect of storage time on the catalytic activity of the Fe_3O_4 NPs in the absence (black bar) and presence (red bar) of 0.1 mM AMP. At each storage time, the catalytic activity of the Fe_3O_4 NPs was measured by incubating 1 mg/mL Fe_3O_4 NPs with 2.5 mM H_2O_2 and 5 μM AU in 10 mM Tris-HCl (pH 7.0) at 37 °C for 25 min. Additionally, the AMP-induced improvement of the catalytic activity of the Fe_3O_4 NPs was examined by mixing 1 mg/mL Fe_3O_4 NPs with 0.1 mM AMP, following by the above mentioned procedure.

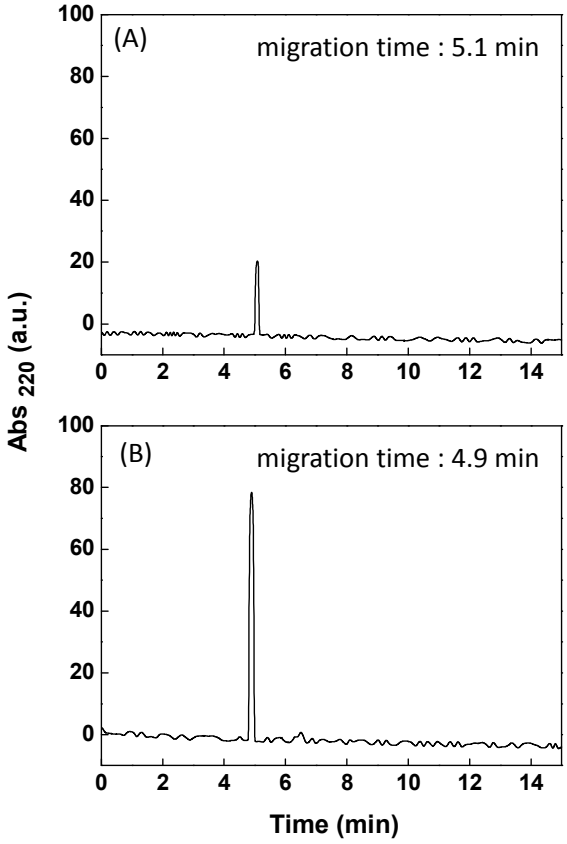


Figure S5. Detection of (A) benzyl alcohol and (B) AU by capillary electrophoresis. Electrophoretic conditions: 60-cm capillary (10-cm to detector); separation buffer, 10 mM Tris-HCl at pH 7.0; applied voltage, 15 kV; hydrodynamic injection at 20-cm height for 10 s; and direct UV detection at 220 nm.

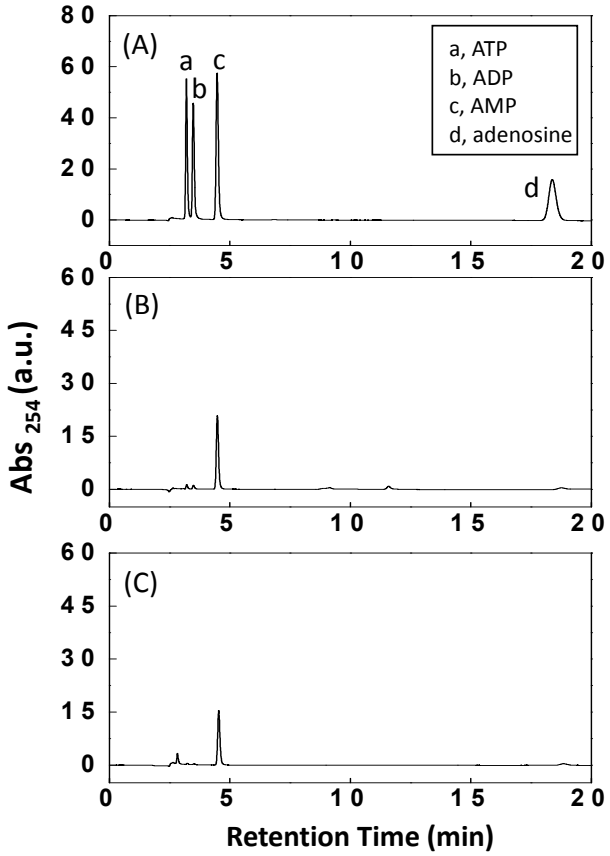


Figure S6. (A) Separation of a mixture of ATP, ADP, AMP, and adenosine by reversed-phase HPLC. (B) Detection of the supernatant 1 by reversed-phase HPLC. A mixture of the Fe_3O4 NP_s and AMP was treated with an external magnetic field. After collecting the Fe_3O_4 NPs, the supernatant 1 was detected by reversed-phase HPLC. (C) Detection of the supernatant 2 by reversed-phase HPLC. A mixture of the Fe_3O4 $NP_{s,}$ AMP, AU, and H_2O_2 was treated with an external magnetic field. After collecting the Fe_3O_4 NPs, the supernatant 2 was detected by reversed-phase HPLC. The flow rate of the mobile phase is 1 mL/min. The composition of the mobile phase includes 90% of 0.1 M phosphate buffer (pH 6.0) and 10% of methanol. The concentration of each adenosine analog is 100 μM.

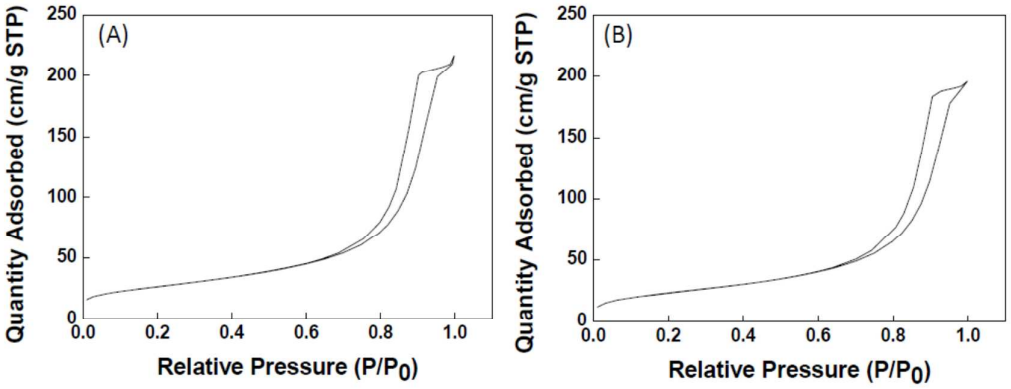


Figure S7. BET analyses of (A) the Fe_3O_4 NPs and (B) the AMP-Fe_3O_4 NPs.