Supplementary Information

for

Magnetic nanoparticle-based aptasensor for selective and sensitive determination of lysozyme with strongly scattering silver nanoparticles

Chun Mei Li,[a] Lei Zhan,[a] Lin Ling Zheng,[a] Yuan Fang Li,[b] and Cheng Zhi Huang*[a,b]

[a] Key Laboratory of Luminescent and Real-Time Analytical Chemistry (Southwest University), Ministry of Education, College of Pharmaceutical Sciences, Southwest University, Chongqing 400715, PR China

[b] Chongqing Key Laboratory of Biomedical Analysis (Southwest University), Chongqing Science & Technology Commission, College of Chemistry and Chemical Engineering, Southwest University, Chongqing 400715, PR China

E-mail: chengzhi@swu.edu.cn; Fax: +86-23-68367257; Tel: +86-23-68254659.

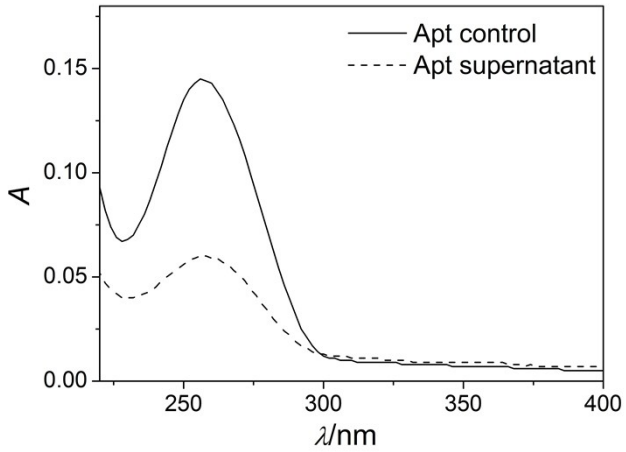

Fig. S1 Comparison of the UV–Vis absorption spectra of aptamer at 260nm before (Apt control) and after (Apt supernatant) conjugation with magnetic nanoparticles.

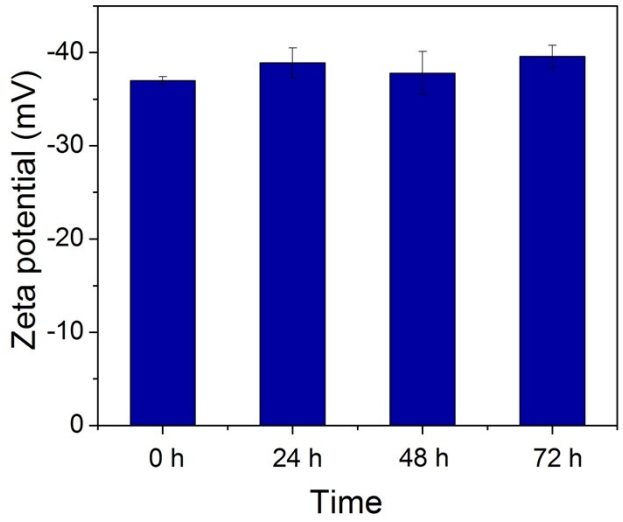

Fig. S2 Zeta potential of MNPs-apt obtained after different time (0, 24 h, 48 h, 72 h).

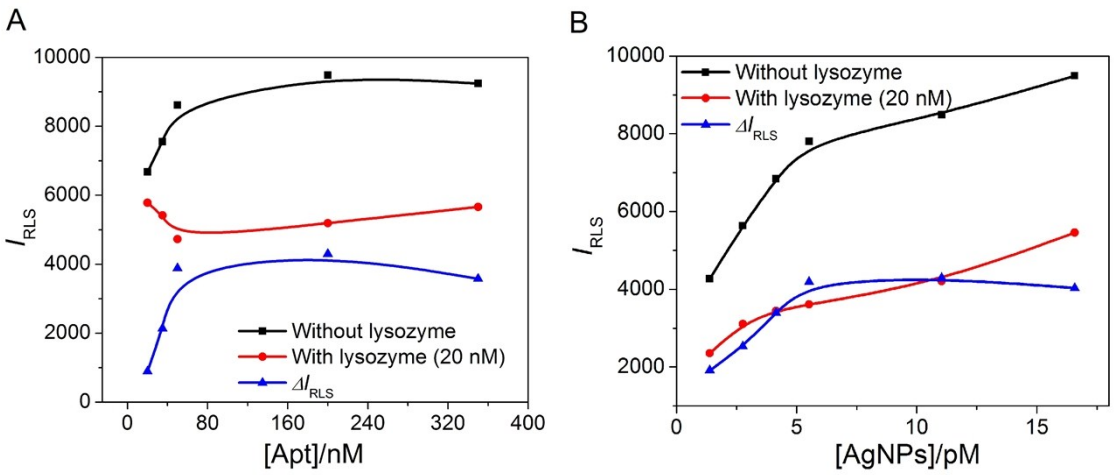

Fig. S3 Optimization of the reaction concentrations for lysoyzme detection. (A) Aptamer concentration was optimized. Concentrations: Lysozyme: 20 nM; AgNPs, 11.04 pM. (B) AgNPs concentration was optimized. Concentrations: Lysozyme: 20 nM; aptamer, 200 nM;

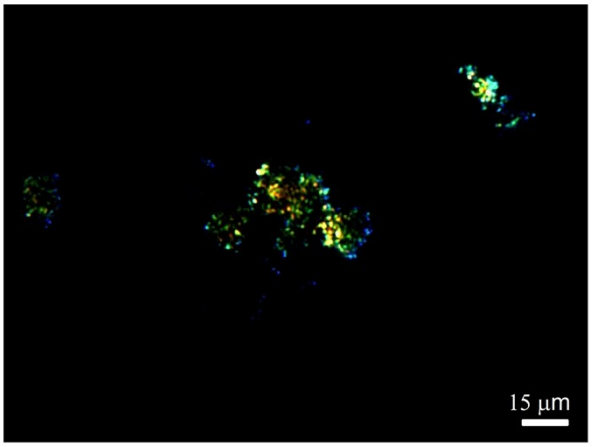

Fig. S4 Semi-quantification of lysozyme concentration in human serum sample by the dark-field light scattering images of AgNPs on the MNPs-apt-lysozyme complex. Concentrations: aptamer, 200 nM; AgNPs, 11.04 pM. Human serum sample was diluted for 50 times.

Table S1. Comparion of different methods for lysozyme detection.

Assay	Principle	Linear range	LOD	Ref
Colorimetry	Peptidecapped gold nanoparticles (AuNPs) aggregation	0.07-1.75 nM	5.6 pM	1
	Light regulation of peroxidase activity by spiropyran functionalized carbon nanotubes	30-500 nM	30 nM	2
	Aptamer-induced positively charged AuNPs aggregation	0.035-1.05 uM	35 nM	3
	Lysozyme induced aggregation of HSA-AuNPs	0.1-1 uM	50 nM	4
Electrochemistry	Aptamer–antibody sandwich assay	5 fM-5 nM	4.3 fM	5
	Iminodiacetic acid–copper ion complex (IDA–Cu) immobilized onto AuNPs-modified glassy carbon electrode as a novel electrochemical platform	0.1pM-0.1 mM	60 fM	6
	Faradic impedance aptasensor based on target-induced aptamer displacement	0.2-4.0 nM	0.07 nM	7
	A three-way junction aptasensor based on target-induced conformational change	0.2-100 nM	0.2nM	8
	Target-induced release of aptamers and back-filling hybridization of the resulting single stranded DNAs	1.0-200 nM	0.75 nM	9
	$[Ru(bpy)_2(dcbpy)NHS]$ labeling/aptamer-based biosensor with AuNPs amplification	0.1 pM-10 nM	0.1 pM	10
Fluorescence	$CuInS_2$ quantum dots and a cationic polyelectrolyte	0.04-0.5 uM	20 nM	11
	Aptamer induced the aggregation of a perylene probe and decreased fluorescence	0-10.5 nM	70 pM	12
	Homogeneous fluorescence anisotropic sensing with FAM-aptamer	12.5-300 nM	4.9 nM	13
	Cytochrome c could quench the fluorescence of FAM-aptamer	0-100 nM	100 pM	14
	Displacing single-stranded DNA binding protein binding to a molecular beacon	0-15 nM	200 pM	15
	Fluorescence resonance energy transfer between an anionic conjugated polymer and a dye-labeled aptamer	0-2.78 uM	5.6 nM	16
	Aptamer can improve the fluorescence intensity of photoactive metallocyclodextrins	0.1-0.5 uM	48 pM	17
	Fluorescent resonant energy transfer biosensor between upconversion nanoparticles and TAMRA-aptamer	30-210 nM	2.5 nM	18
	Exonuclease III-aided amplification assay	8.75-70 nM	5.6 nM	19

	based on graphene oxide platform			
Chemiluminescence	Magnetic molecularly imprinted polymers extraction	0.25-140 nM	0.25 nM	20
	Nicking endonuclease cleavage coupled nanoparticles CL probe signal amplification	1 pM-1 nM	0.2 pM	21
	Magnetic molecularly imprinted nanoparticles	0.25-140 nM	0.25 nM	22
	Electrogenerated chemiluminescence aptasensor	0.64-640 nM	0.12 nM	23
Surface-enhanced Raman scattering (SERS)	Polymerase assisted cross strand-displacement amplification	0.01-10 pM	5.8 fM	24
	Target-triggering multiple cycle amplification strategy based on a gold substrate	1 aM-1 pM	1 aM	25
Light scattering	AuNPs-based aptasensor	0.2~4 nM, 0.3~6 nM, 0.6~8 nM	0.1 nM	26
	Lysozyme induced AuNPs aggregation	15-50 nM	13.1nM	27
	Rayleigh light scattering spectroscopy of individual nanoplasmonic aptasensors	7 pM - 700 nM	7 aM	28
	Magnetic nanoparticle-based aptasensor with strongly scattering silver nanoparticles	0.4-30 nM	0.1 nM	Ours

References

1. H. Huang, Q. Zhang, J. Luo and Y. Zhao, *Anal Methods*, 2012, **4**, 3874-3878.
2. Y. Song, C. Xu, W. Wei, J. Ren and X. Qu, *Chem. Commun.*, 2011, **47**, 9083-9085.
3. J. Su, W. Zhou, Y. Xiang, R. Yuan and Y. Chai, *Chem. Commun.*, 2013, **49**, 7659-7661.
4. Y.-M. Chen, C.-J. Yu, T.-L. Cheng and W.-L. Tseng, *Langmuir*, 2008, **24**, 3654-3660.
5. C. Ocana, A. Hayat, R. Mishra, A. Vasilescu, M. del Valle and J. L. Marty, *Analyst*, 2015, **140**, 4148-4153.
6. A. Arabzadeh and A. Salimi, *Biosens. Bioelectron.* 2015, **74**, 270-276.
7. Y. Peng, D. Zhang, Y. Li, H. Qi, Q. Gao and C. Zhang, *Biosens. Bioelectron.* 2009, **25**, 94-99.
8. Y. Xia, S. Gan, Q. Xu, X. Qiu, P. Gao and S. Huang, *Biosens. Bioelectron.* 2013, **39**, 250-254.
9. Y. Xiang, X. Qian, B. Jiang, Y. Chai and R. Yuan, *Chem. Commun.*, 2011, **47**, 4733-4735.
10. J. Bai, H. Wei, B. Li, L. Song, L. Fang, Z. Lv, W. Zhou and E. Wang, *Chem-Asian J*, 2008, **3**, 1935-1941.
11. S. Y. Liu, W. D. Na, S. Pang, F. P. Shi and X. G. Su, *Analyst*, 2014, **139**, 3048-3054.
12. B. Wang and C. Yu, *Angew. Chem. Int. Ed.* , 2010, **49**, 1485-1488.
13. M. Zou, Y. Chen, X. Xu, H. Huang, F. Liu and N. Li, *Biosens. Bioelectron.* 2012, **32**, 148-154.
14. D. Liao, J. Chen, W. Li, Q. Zhang, F. Wang, Y. Li and C. Yu, *Chem. Commun.*, 2013, **49**, 9458-9460.
15. D. Tang, D. Liao, Q. Zhu, F. Wang, H. Jiao, Y. Zhang and C. Yu, *Chem. Commun.*, 2011, **47**, 5485-5487.
16. J. Wang and B. Liu, *Chem. Commun.*, 2009, 2284–2286.
17. F. Zhang, Y. Y. Zhao, H. Chen, X. H. Wang, Q. Chen and P. G. He, *Chem. Commun.*, 2015, **51**, 6613-6616.
18. H. Zhu, Y. Ding, A. Wang, X. Sun, X.-C. Wu and J.-J. Zhu, *J Mater Chem B*, 2015, **3**, 458-464.
19. C. Chen, J. Zhao, J. Jiang and R. Yu, *Talanta*, 2012, **101**, 357-361.
20. T. Jing, H. Xia, Q. Guan, W. Lu, Q. Dai, J. Niu, J.-M. Lim, Q. Hao, Y.-I. Lee, Y. Zhou and S. Mei, *Anal. Chim. Acta*, 2011, **692**, 73-79.
21. X. Hun, H. Chen and W. Wang, *Biosens. Bioelectron.* 2010, **26**, 248-254.
22. T. Jing, H. R. Du, Q. Dai, H. A. Xia, J. W. Niu, Q. L. Hao, S. R. Mei and Y. K. Zhou, *Biosens. Bioelectron.* , 2010, **26**, 301-306.
23. Y. Li, H. Qi, Q. Gao and C. Zhang, *Biosens. Bioelectron.* 2011, **26**, 2733-2736.
24. Y. Li, C. Lei, Y. Zeng, X. Ji and S. Zhang, *Chem. Commun.*, 2012, **48**, 10892-10894.
25. P. He, Y. Zhang, L. J. Liu, W. P. Qiao and S. S. Zhang, *Chem-Eur J*, 2013, **19**, 7452-7460.
26. X. Wang, Y. Xu, Y. Chen, L. Li, F. Liu and N. Li, *Anal Bioanal Chem* 2011, **400**, 2085-2091.
27. X. Wang, Y. Xu, X. Xu, K. Hu, M. Xiang, L. Li, F. Liu and N. Li, *Talanta*, 2010, **82**, 693-697.
28. P. L. Truong, S. P. Choi and S. J. Sim, *small*, 2013, **9**, 3485-3492.