Supplementary Information for

Colorimetric detection of heparin with high sensitivity based on the aggregation of gold nanoparticles induced by polymer nanoparticles

Fei Qu [a,b*], Yanqun Liu [a,b], Haili Lao [c], Yaping Wang [a,b] and Jinmao You [a,b,d*]

[a] The Key Laboratory of Life-Organic Analysis, Qufu Normal University, Qufu 273165, Shandong, China

[b] Key Laboratory of Pharmaceutical Intermediates and Analysis of Natural Medicine, Qufu Normal University, Qufu 273165, Shandong, China

[c] Department of clinical laboratory, Binzhou central hospital, Binzhou medical college, Binzhou 256600, Shandong, China

[d] Northwest Institute of Plateau Biology, Chinese Academy of Sciences, Xining 810001, China

* Corresponding authors: qufei3323@163.com; jmyou6304@163.com

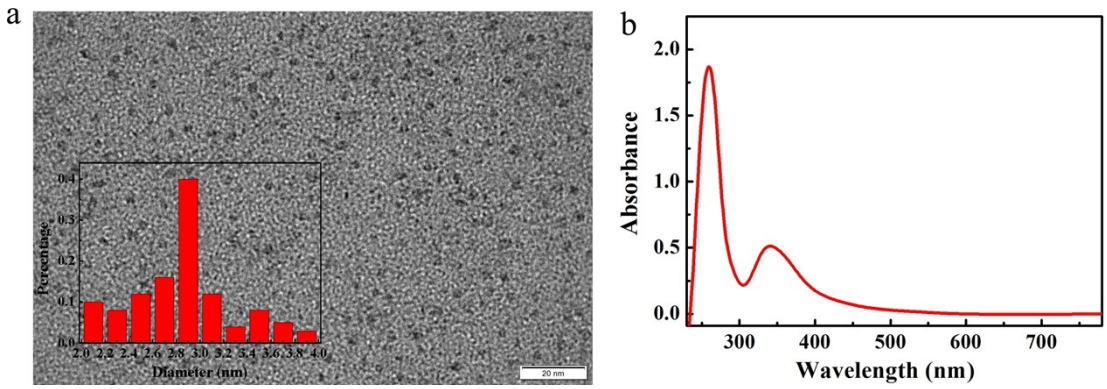

Fig. S1 TEM image (a) and UV-vis absorption spectrum (b) of PNPs. Inset of Fig. S1a is the size distribution graph.

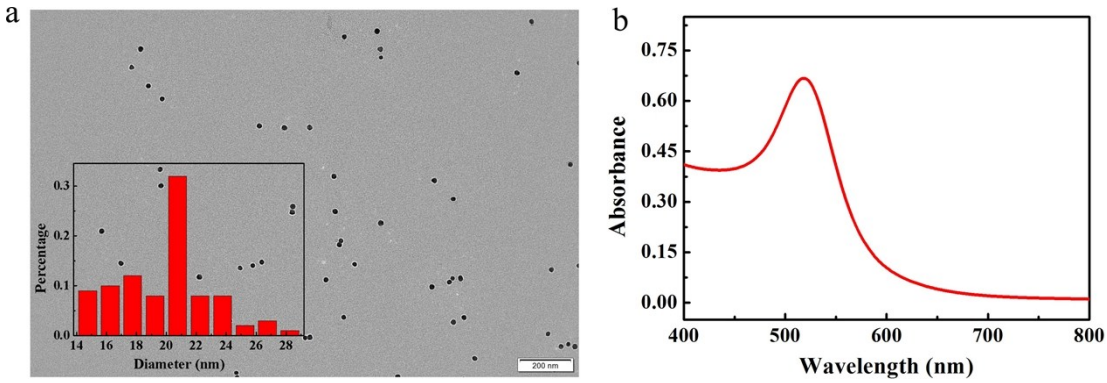

Fig. S2 TEM image (a) and UV-vis absorption spectrum (b) of AuNPs. Inset of Fig. S2a is the size distribution graph.

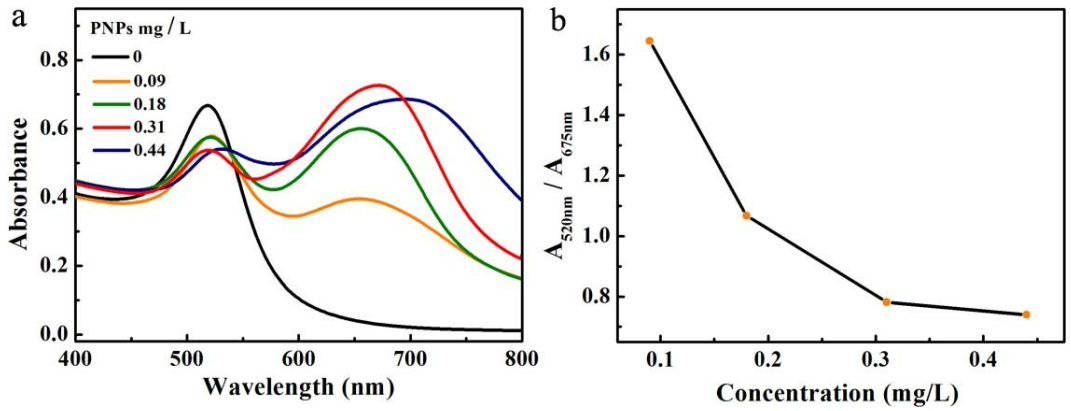

Fig. S3 UV-vis absorption spectra of AuNPs (a) and the absorbance ratios ($A_{520\ nm}/A_{675\ nm}$) upon addition of different concentrations of PNPs.

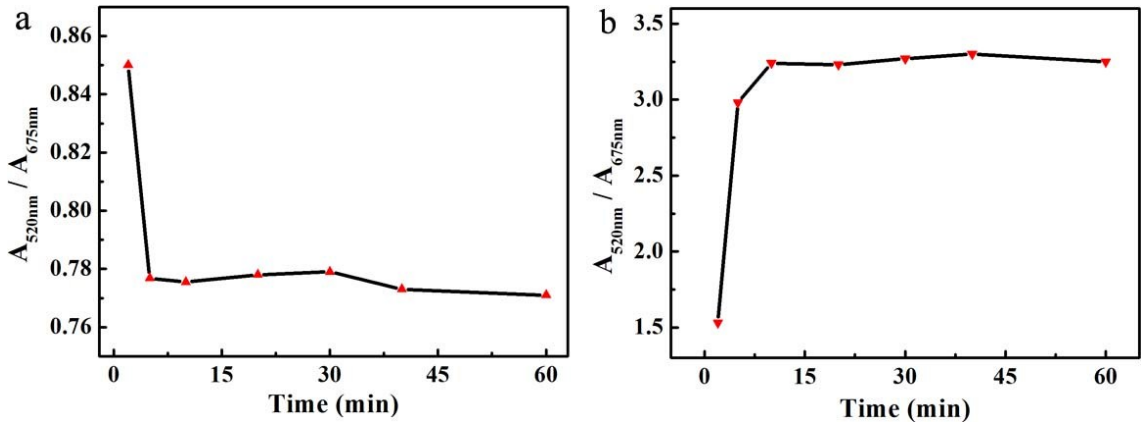

Fig. S4 Influence of reaction time on the aggregation of AuNPs produced by PNPs (a) and the detection of Hep (b). The concentration of Hep is 300 nM.

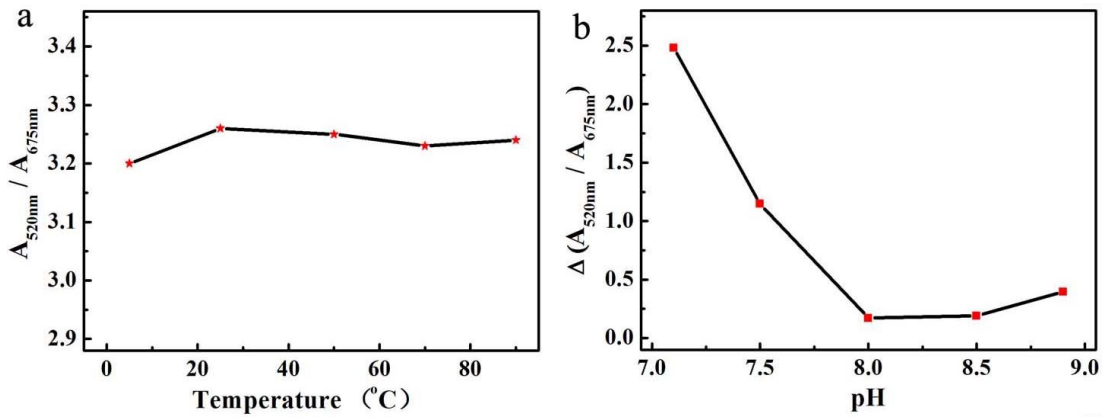

Fig. S5 Influence of temperature (a) and pH value (b) on the detection of Hep. The concentration of Hep is 300 nM.

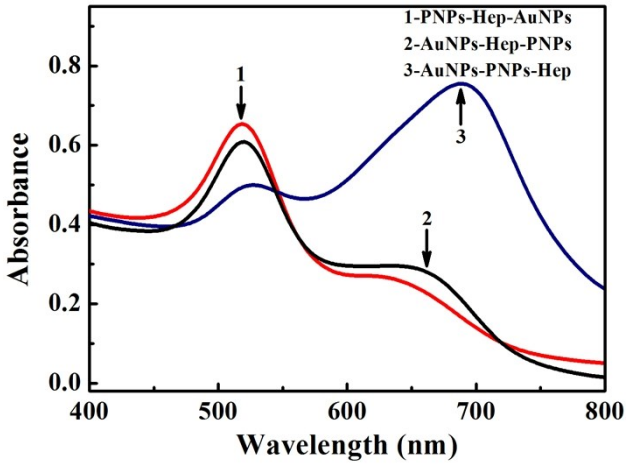

Fig. S6 Influence of addition order on the detection of Hep. Order 1: PNPs are incubated with Hep and then AuNPs are added (line 1); order 2: pre-incubation of AuNPs and Hep is performed and then PNPs are introduced (line 2); order 3: AuNPs react with PNPs at first and then adding Hep (line 3). The concentration of Hep is 300 nM.

Table S1. Detection of Hep in Hep sodium injection samples based on PNPs-AuNPs system.

Sample	Concentration of Hep (nM)			Recovery (%)	RSD (n=3, %)
	labeled amount*	added amount	found amount		
Hep sodium injection 1	100	0	100.1	-	1.3
Hep sodium injection 2	100	10	110.3	102	0.9
Hep sodium injection 3	100	30	129.8	99	1.4
Hep sodium injection 4	100	50	150.3	100.4	1.6

*Note: the labeled amount of Hep in Hep sodium injection without dilution is 52.1 mM; in order to ensure the concentration of Hep in the linear range, the Hep sodium injection is diluted several folds, so the labeled amount of Hep in diluted sample is 100 nM.

Table S2. Detection of Hep in human serum samples based on PNPs-AuNPs system.

Sample	Concentration of Hep (nM)		Recovery (%)	RSD (n=3, %)
	added amount	found amount*		
human serum 1	0	25.2	-	1.3
human serum 2	10	35.4	102	1.2
human serum 3	30	55.5	101	1.6
human serum 4	50	75.6	101	0.9

*Note: the reported concentration of Hep in normal human serum without dilution is about 1.2-1.8 mg/L (equal to 1.86-2.79 μM);[1] in order to ensure the concentration of Hep in the linear range, the human serum is diluted 100 folds.

Reference

1 H. Engelberg, *Circulation.*, 1961, **23,** 573-577.