Supporting Information

A paper based microfluidic device for the detection of arsenic using gold nanosensor

All chemicals were received from commercial sources. HPLC grade water was used throughput.

Synthesis of gold nanosensor (Au-TA-TG): Au-TA-TG was prepared by a step-wise chemical conjugation of gold nanoparticles with thioctic acid (TA, Sigma) followed by thioguanine (TG, Sigma) molecules in presence of EDC/NHS. Briefly, 10.0 ml of citrate stabilized gold nanoparticles were prepared using 50.0 µl of 0.1M $HAuCl_4$ and 5.0 mg/ml sodium citrate solutions stirred at 90°C. Color gradually turns to bright red indicating the formation of gold nanoparticles (AuNPs). Next, 3.0 mg of thioctic acid dissolved in 1.0 ml methanol was added to 10.0 ml of citrate stabilized gold nanoparticles at pH 8. The mixture was stirred at room temperature overnight (8 hours). Unbound thioctic acid was removed by centrifuging the mixture at 9,000 rpm (SORVALL RC 6+) for 10 mins. The Au-TA pellet was dissolved in 5.0 ml water in order to perform second conjugation with thioguanine probes. For this purpose, 200.0 µl each of 10 mM aqueous EDC (1-ethyl-3-[3/-(dimethylamino)propyl]carbodiimide, Sigma) and 10 mM aqueous NHS (N-hydroxysuccinimide, Fluka) was added to the 5.0 ml Au-TA mixture and stirred for 1hr at room temperature. 5.0 mg thioguanine dissolved in 1.0 ml of 0.01M of NaOH was added to the above 5.0 ml Au-TA EDC/NHS mixture. The mixture was stirred for 3hours at room temperature. Excess thioguanine was removed by centrifuging the mixture at 9,000 rpm (SORVALL RC 6+) at 10 mins. Finally, the nanosensor was characterized by UV-Vis (Cary 60; Agilent), FTIR (Shimadzu), light scattering (NS500, Nanosight) and Field-emission scanning electron microscopy (SEM, Zeiss Sigma HD) techniques.

Size and charge (zeta potential) measurements of the gold nanosensor (Au-TA-TG): The charge and size of the Au-TA-TG were evaluated to determine the stability of the nanosensor in solution. The average diameter was measured by NS500 (Nanosight Instruments, UK) in aqueous medium at a temperature of 25°C. The surface charge was determined by zeta potential measurement according to the manufacturer's instructions for measurement in high ionic strength media at 25°C. All measurements were performed in triplicate following dilution of the nanoparticle by dispersing in high grade HPLC water (1mg/mL). The values of size and charge are shown in Table S1.

FTIR spectroscopy measurements of the gold nanosensor (Au-TA-TG): Gold nanosensor sample was concentrated by centrifugation and evaporated to dryness. IR spectrum was

recorded in a Shimadzu IR Prestige-21 spectrometer to determine the thioguanine conjugation with the thioctic acid via amide bond formation. The spectrum was blank subtracted and baseline corrected using software.

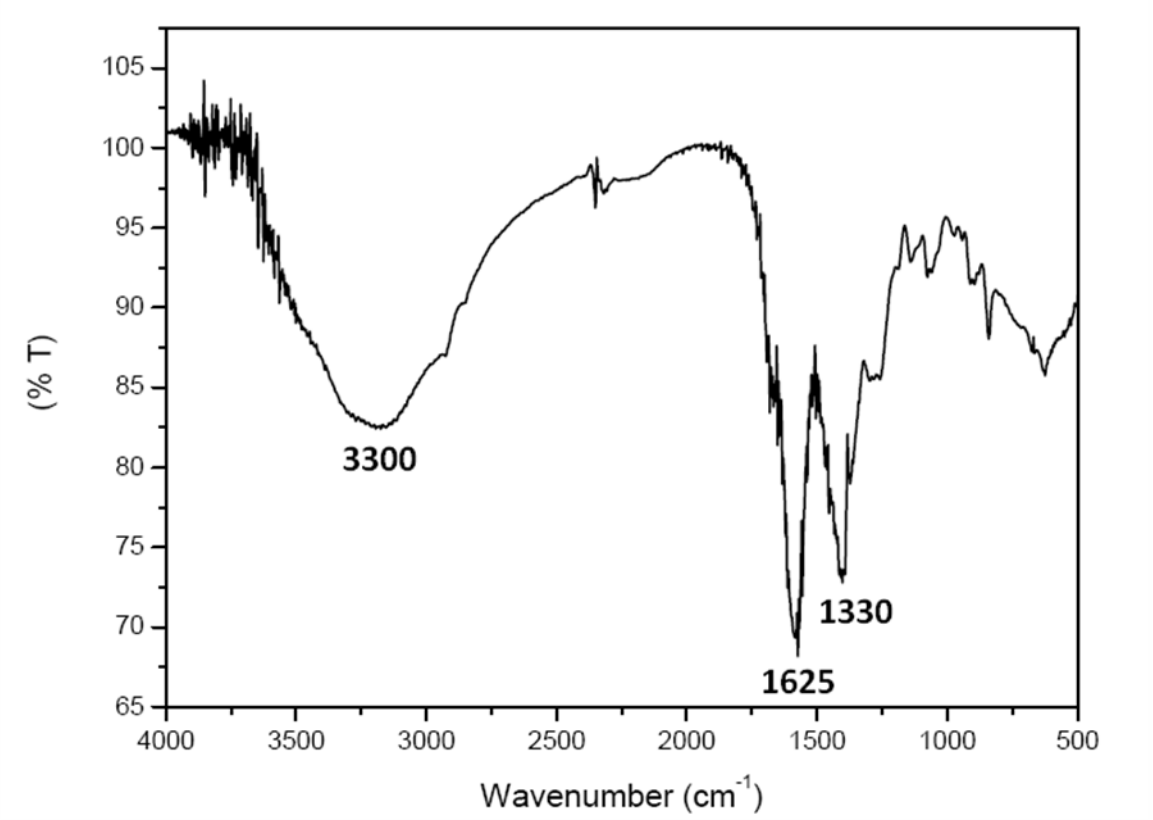

Fig. S1 FTIR spectrum of the complete gold nanosensor Au-TA-TG. Peaks at 3300, 1625, 1330 cm^{-1} corresponds to the stretching vibration of –NH, -C=O, and $–CO_2^-$ respectively.

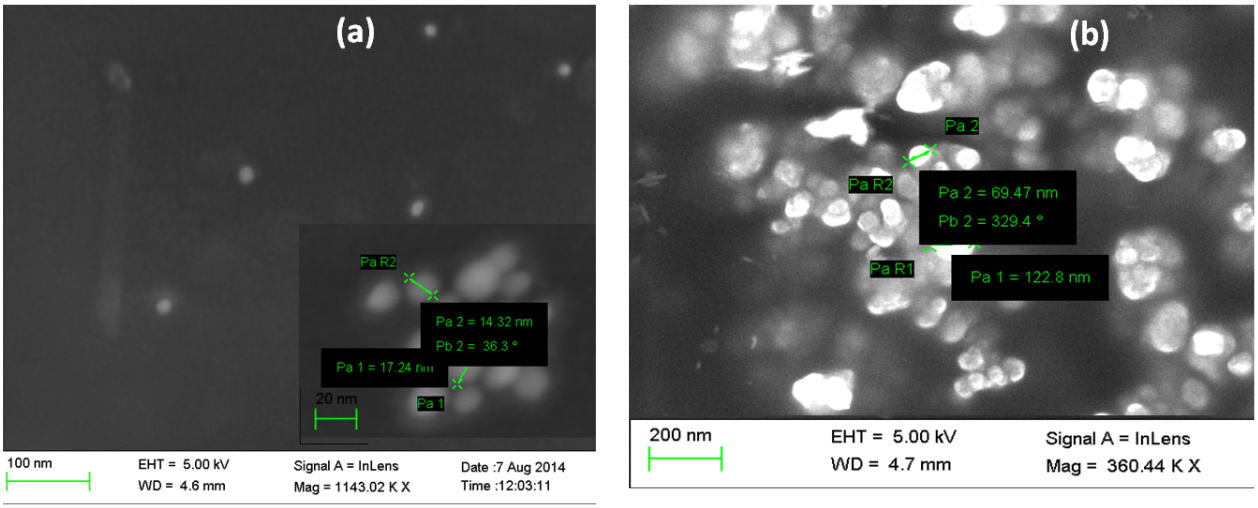

Fig. S2 (a) SEM images of the Au-TA-TG solution and (b) after treatment with arsenic of concentration.

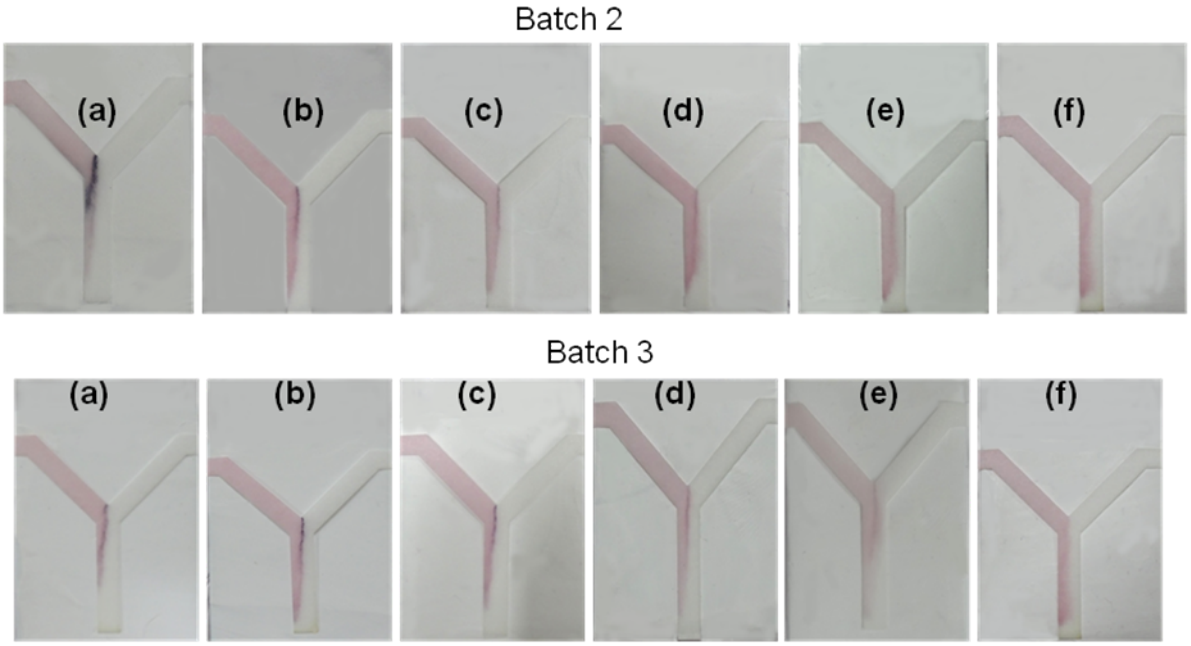

Fig. S3 Visual detection of a series of As^{3+} concentrations, i.e. (a) 10, (b) 1.0, (c) 0.1, (d) 0.01, (e) 0.001 and (f) 0 ppm (control, no arsenic) on paper microchannel. In all the concentrations, a distinct deposition band at the interface of the channel were clearly visible even with the naked eye. This study was performed several batches (No. 1, 2 &3) to check the reproducibility of the performance of the gold nanosensor. Batch 1 Results are shown in Fig.3 while Batch 2 & 3 are shown in Fig. S3.

CONSTRUCT	Citrate-AuNP	Au-TA	Au-TA-TG
SIZE (nm)	44±0.7	56±3.5	76±7.9
CHARGE (mV)	-24.4	-31.3	-30.1

Table S1 Hydrodynamic size and surface charge measurements at different chemical modification steps.