

Supplementary Data.

Table1. Operating parameters of ICP-MS

ICP-MS plasma	Parameters
Instrument parameters	
Model	Perkin-Elmer, DRC-e, CEM
RF power	1400W
Plasma gas flow	18 L min ⁻¹
Auxiliary gas flow	1.5 L min ⁻¹
Nebulizer gas flow	0.85 L min ⁻¹
Acquisition parameters	
Scanning mode	Peak Hopping
Dwell time	300ms
Integration mode	Peak area
Isotopes	⁴⁹ Ti

Fig. S1 Effect of reaction time on the signal intensity of ⁴⁹Ti obtained from the sandwich complex for immunoreactions between antibody tagged on the magnetic nanoparticles and PSA.

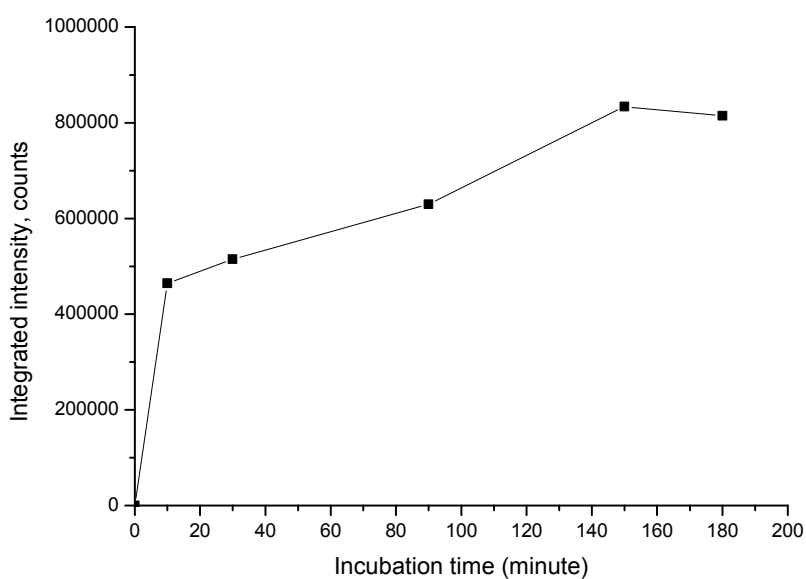


Fig. S2 The effect of reaction time on the signal intensity of ^{49}Ti obtained from the sandwich complex for immunoreactions between antibody tagged on the TiO_2 nanoparticles and PSA

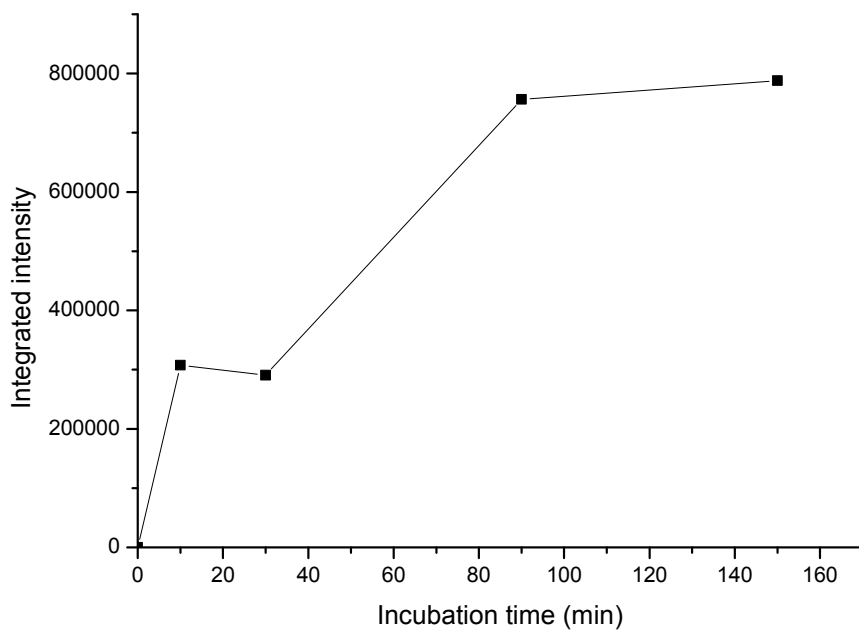


Fig. S3 The effect of elution time on the signal intensity of released Ti (eluent : 2% HNO_3)

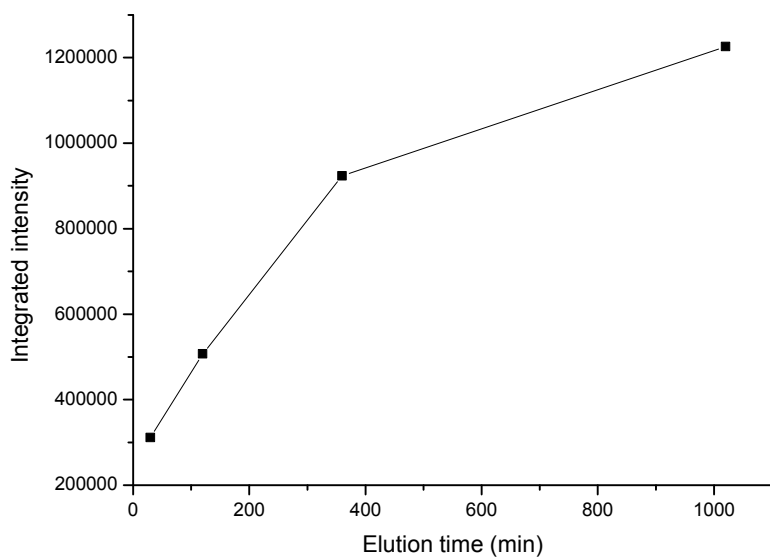


Fig. S4 Effect of BSA for reduction of nonspecific binding using Cy5 NP by LIFM

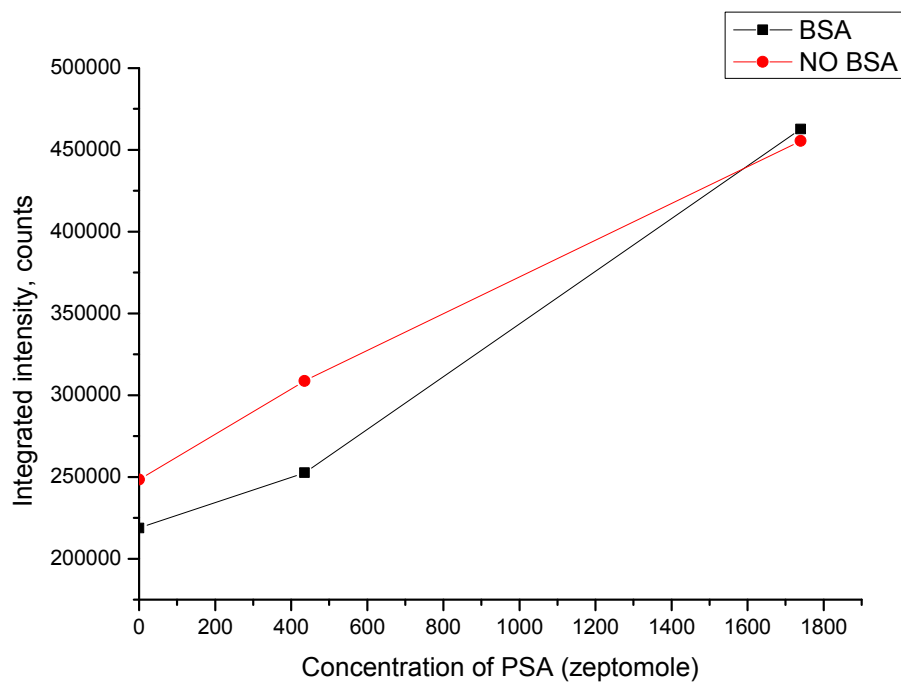
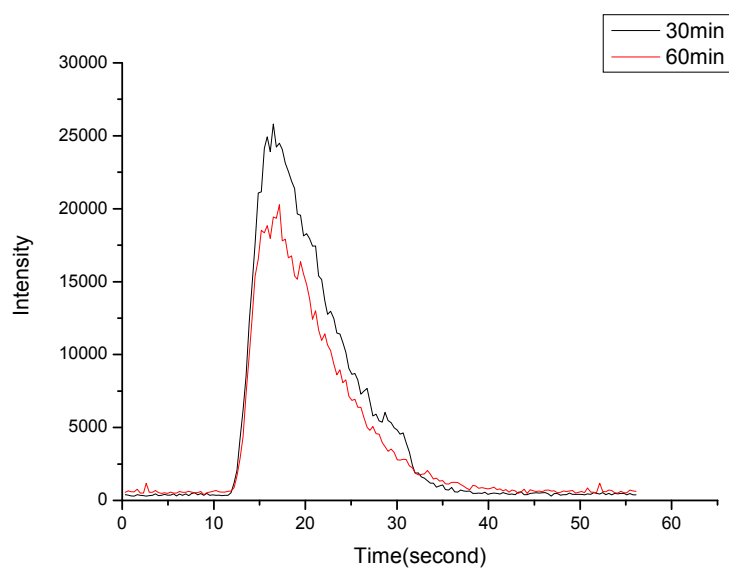


Fig. S5 Background reduction by the removal of nonspecific adsorption using sonicator using Ti NP



Calculation of the Limit of detection.

a. Take the log for each blank intensity (background subtracted intensity) and then, obtain standard deviation. The following table is showing the calculation of five repeated blank intensities:

Blank intensity	log(blank intensity)
335179.2436	5.5206
332108.4038	5.5213
340747.9652	5.5324
339279.2665	5.5306
334635.0294	5.5178
Standard deviation(σ)	0.006522

b. The limit of detection was calculated from $3\sigma/m$, where σ is standard deviation of blank and m (0.30853) is the slope of calibration curve. (The slope of calibration curve is small because Y axis is log function.)

$$\text{LOD} = (3 \times 0.006522) / 0.30853$$

Since LOD was the log of detection limit in concentration of fg/mL, we have to convert it to fg/mL unit as follows;

$$10^{((3 \times 0.006522) / 0.30853)} = 1.16 \text{ fg/mL}$$