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# Supplementary information

## Hollow-nanospheres-based microfluidic biosensors for biomonitoring of cardiac troponin I

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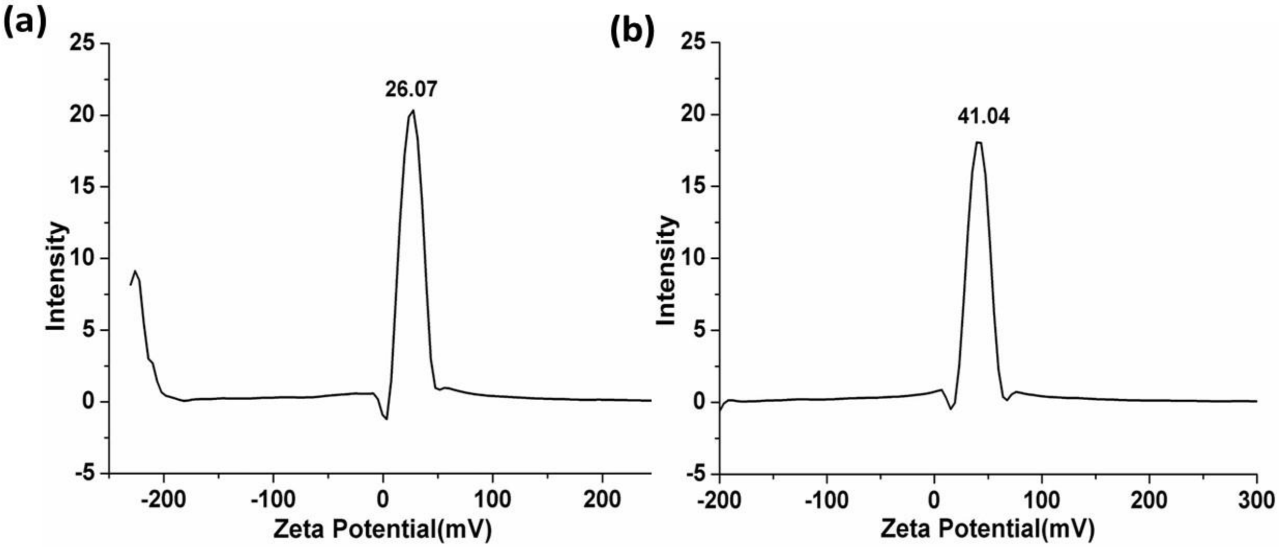
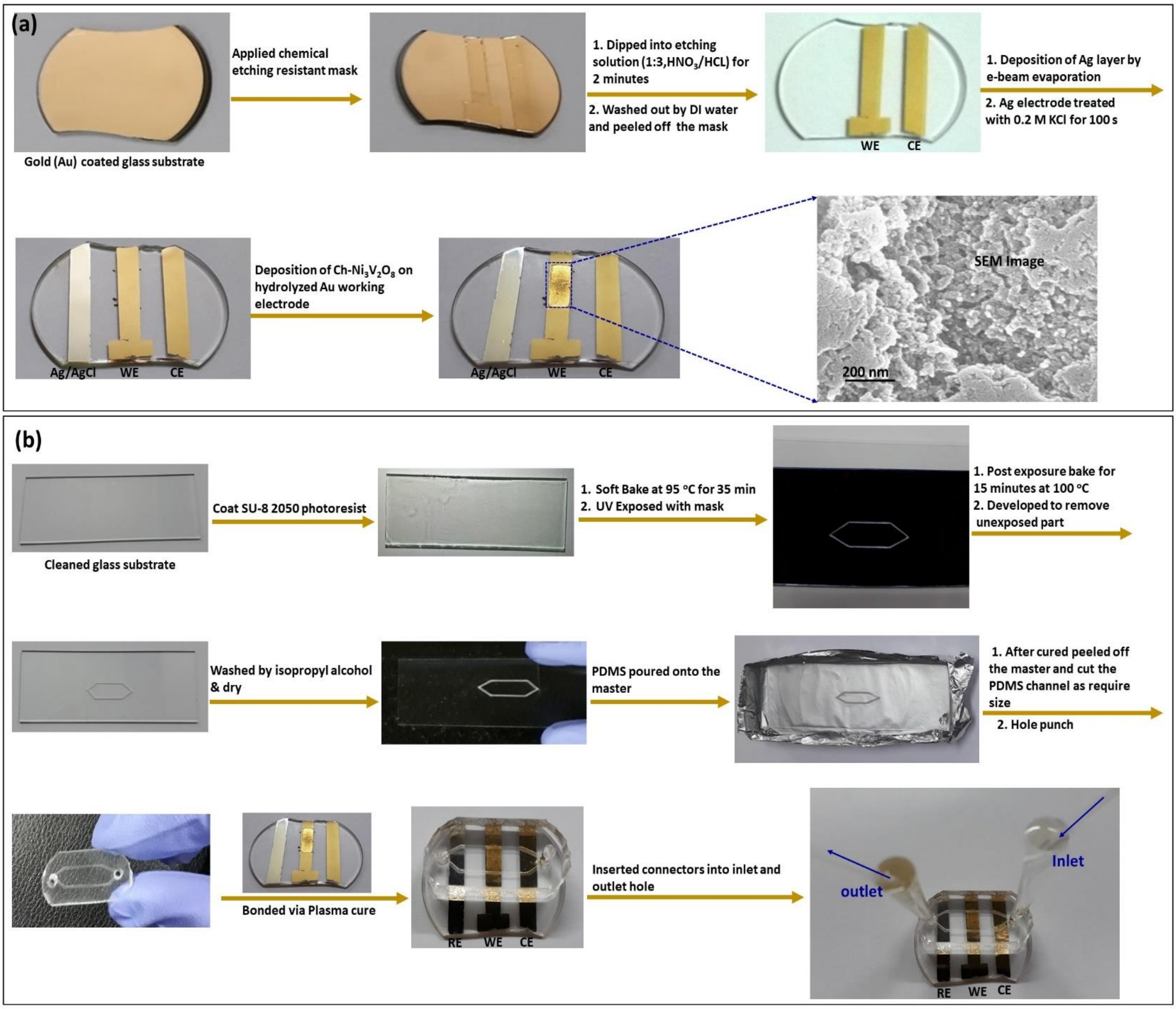
**Fig. S1**. Zeta potential curve for $Ni_3V_2O_8$ (a) and Ch-$Ni_3V_2O_8$ (b).



## Fabrication of microfluidic device

For the fabrication of PDMS microfluidic channels soft lithography technique was used. For this purpose, around 200 µm thick layer of SU-8 negative photoresist was spin coated on cleaned glass substrate after which it was heated on a hot plate at 95 $^0$C for 35 min and exposed to UV rays through mask. For post exposure bake this was heated again for 15 min at 100 $^0$C and developed to remove unexposed part in order to form the master. The developed master was washed with isopropyl alcohol and dried. The standard volume ratio of pre-polymer and silicon elastomer (10:1), was poured on top of the master after which the cured PDMS slab was peeled off from the master. The fabricated two microchannels (height and width, 200 µm each) were connected via single inlet and outlet. The PDMS microchannels were bonded with Ch-$Ni_3V_2O_8$/Au microelectrode via plasma cure and finally connect the single outlet and inlet through the connectors. The stepwise illustration of microfluidic channels fabrication is shown in Fig. S2b.

**Fig. S2.** Microfluidic device fabrication. (a) Fabrication of gold (Au) electrode on gold coated glass substrate via chemical etching and the selective deposition of mesoporous Ch-$Ni_3V_2O_8$ nanocomposite. (b) Fabrication of PDMS microfluidic channel using soft lithography technique and bonded with Ch-$Ni_3V_2O_8$/Au electrode.



## Instrumentation

The crystallinity of $Ni_3V_2O_8$ was investigated by X-ray diffraction (XRD) using a PANalytical, Germany, and Raman and Fourier transform infrared spectroscopy (FTIR, PerkinElmer, Model 2000) measurements were undertaken to examine the qualitative composition of Ni3V2O8 and Ch-$Ni_3V_2O_8$ with cAb. The FTIR and surface plasmon resonance (SPR) studies were used to confirm the immobilization of cAb on a Ch-$Ni_3V_2O_8$/Au electrode surface. Surface area and the pore size were studied volumetrically by Quanta Chrome and the elemental property of surface was calculated by X-ray photoelectron spectroscopy (XPS; PHI 5000 Versa Prob II, FEI Inc.). The nanostructure and morphology of the synthesized $Ni_3V_2O_8$ and functionalized Ch-$Ni_3V_2O_8$ were determined by transmission electron microscope (TEM; FEI Titan G2 60-300) and field emission scanning electron microscope (FESEM; ZEISS Supra 40VP, Germany). The response of the microfluidic device for cTnI detection was determined using an Autolab (Model AUT-86000) electrochemical analyser.

**Fig. S3.** EDX mapping of $Ni_3V_2O_8$: (a) Oxygen (b) Nickel and (c) Vanadium. (d) EDX spectra and quantitative composition of $Ni_3V_2O_8$.

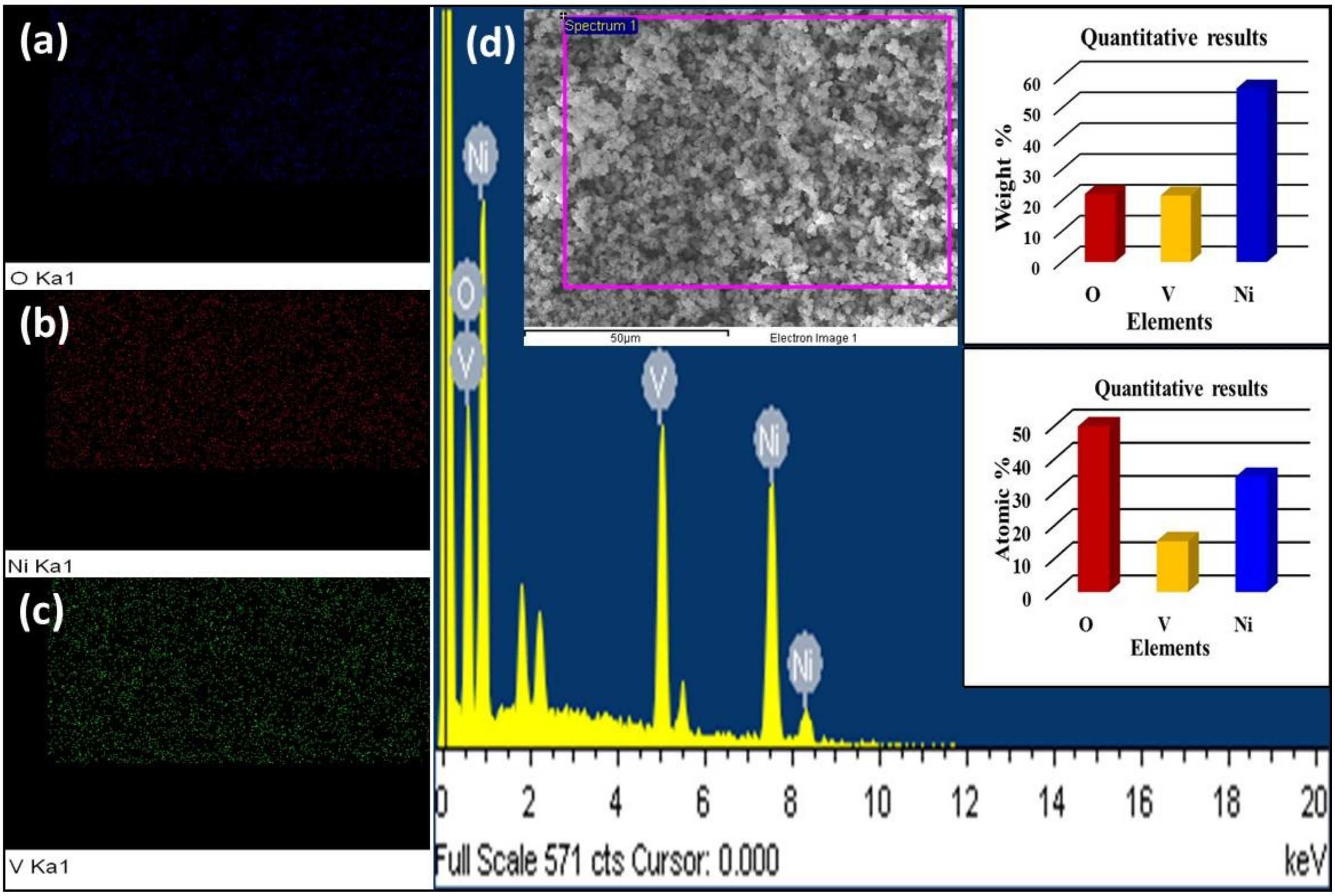


**Fig. S4.** EDX mapping of Ch-$Ni_3V_2O_8$: (a) Carbon (b) Nitrogen (c) Oxygen (d) Vanadium and (e) Nickel. (f) EDX spectra and quantitative composition of Ch-$Ni_3V_2O_8$ composite.

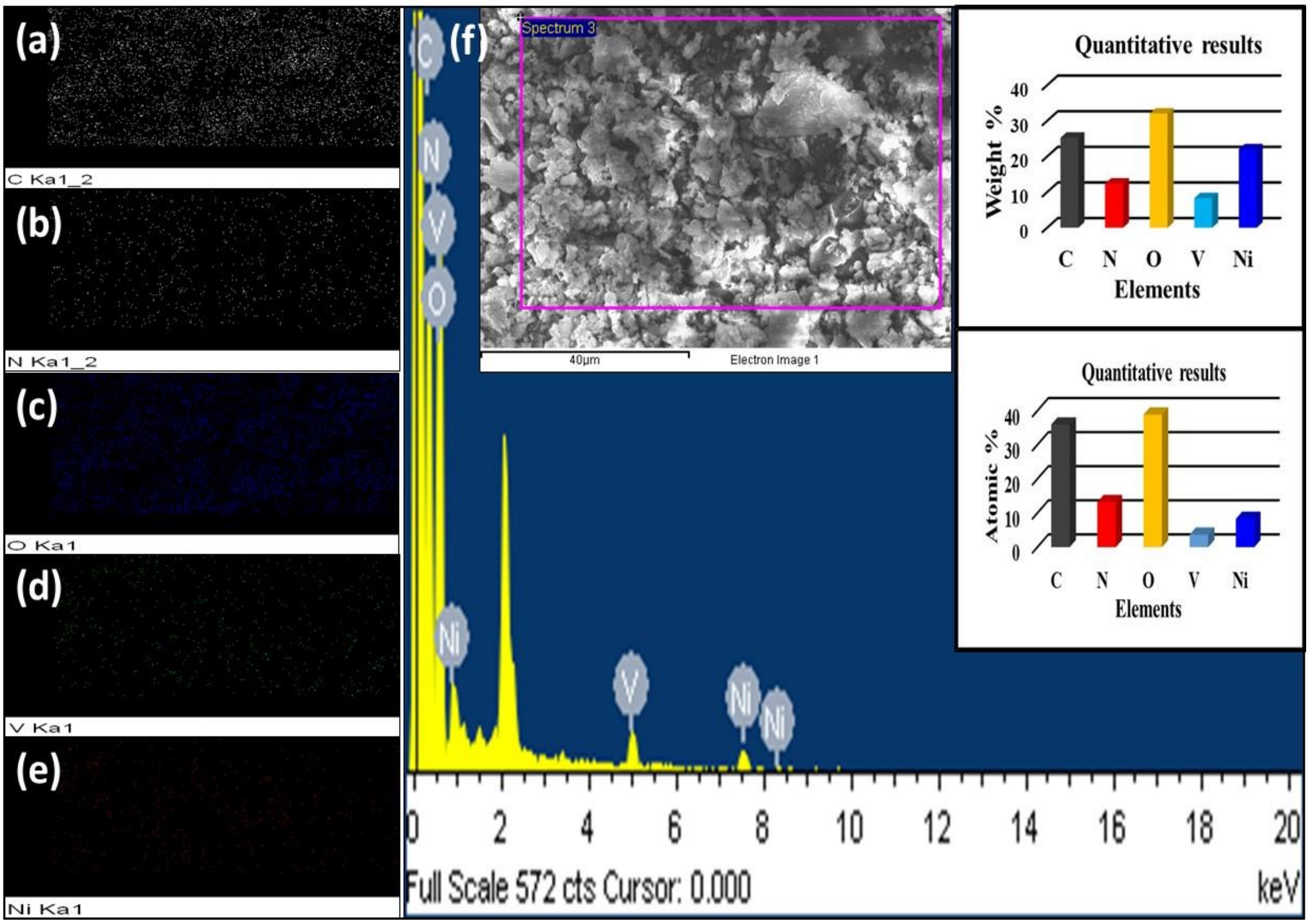


**Fig. S5.** (a) CV response of the microfluidic device at different flow rate and inset shows the current versus flow rate plot for the device. (b) Diffusion coefficient versus flow rate plot for the device at different flow rate and (c) Response time plot in between current and time in second.

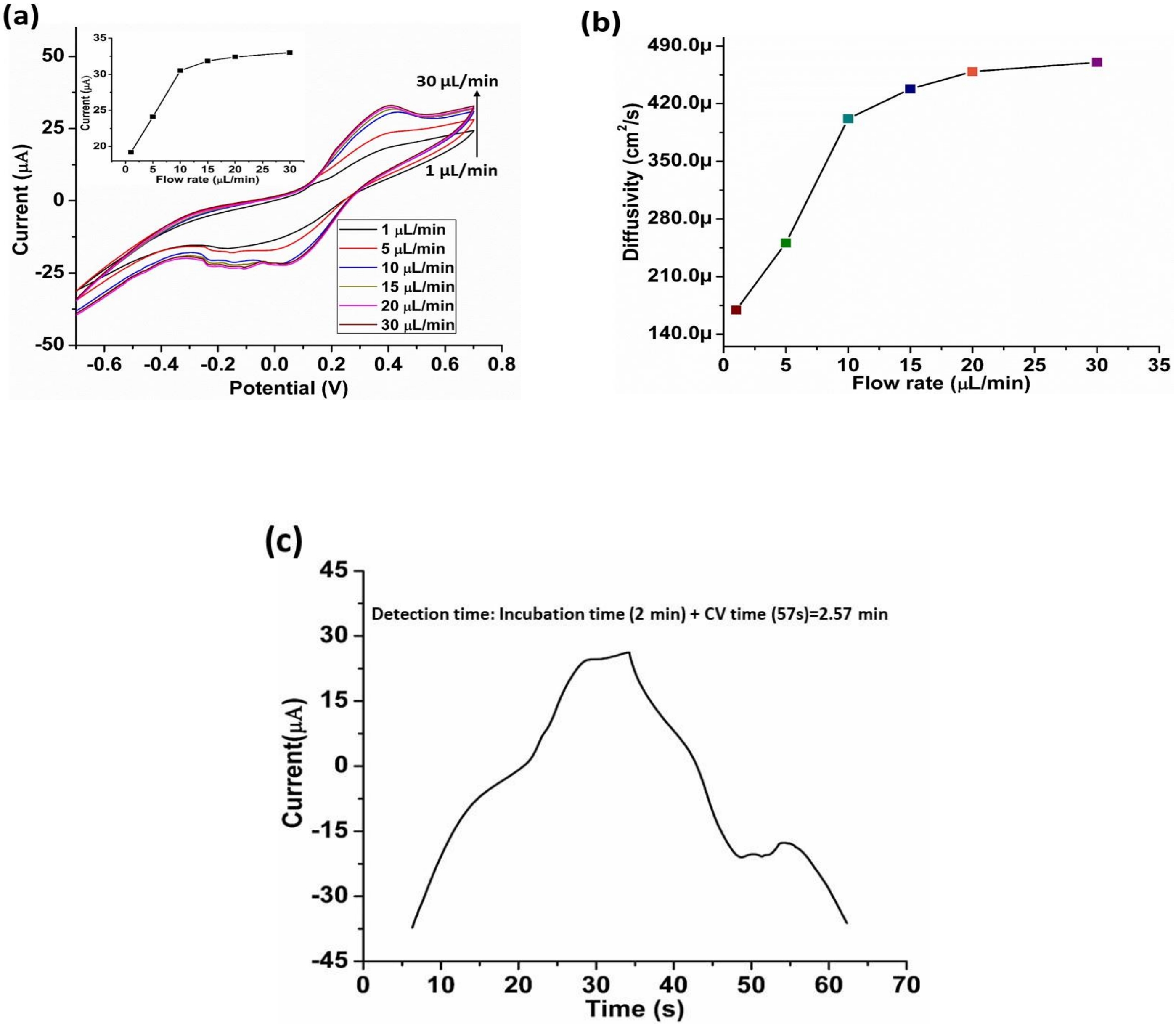


**Table S1.** Determination of percentage standard deviation (%RSD) between peak current (µA) obtained for synthetic (standard) and real serum samples of cTnI using cAb/Ch-$Ni_3V_2O_8$/Au microfluidic device.

| **S.No** | **cTnI Conc. (ng mL$^{-1}$)** | **Peak current (µA) obtained for standard cTnI sample** | **Peak current (µA) obtained for serum cTnI sample** | **% RSD (N=3)** | **Recovery (%)** |
|---|---|---|---|---|---|
| 1 | 0.02 | 32 | 32.54 | ±1.18 | 101.68 |
| 2 | 5 | 28.69 | 29.59 | ±3.13 | 103.13 |
| 3 | 20 | 26.36 | 24.81 | ±0.85 | 94.12 |
| 4 | 50 | 23.48 | 21.71 | ±4.72 | 92.47 |