Supplementary Information (SI) for Analytical Methods.
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**Supplementary Information**

# Electrochemical immunosensor for *B. anthracis* PA toxin using polypyrrole-gold nanoparticles/multiwall carbon nanotubes sensing platform and cadmium sulphide nanocrystal signal tag

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**Result and Discussions**

**Characterization of CdS NCs**

**UV-Visible Spectra Characterization.**

The UV-Vis absorption spectrum of the CdS NCs synthesized by wet chemical method is given in shown in Fig. S1. The CdS have band edge absorption at ~ 500 nm corresponds to the blue shift than to the absorption edge of bulk CdS at ~512 nm.[1]

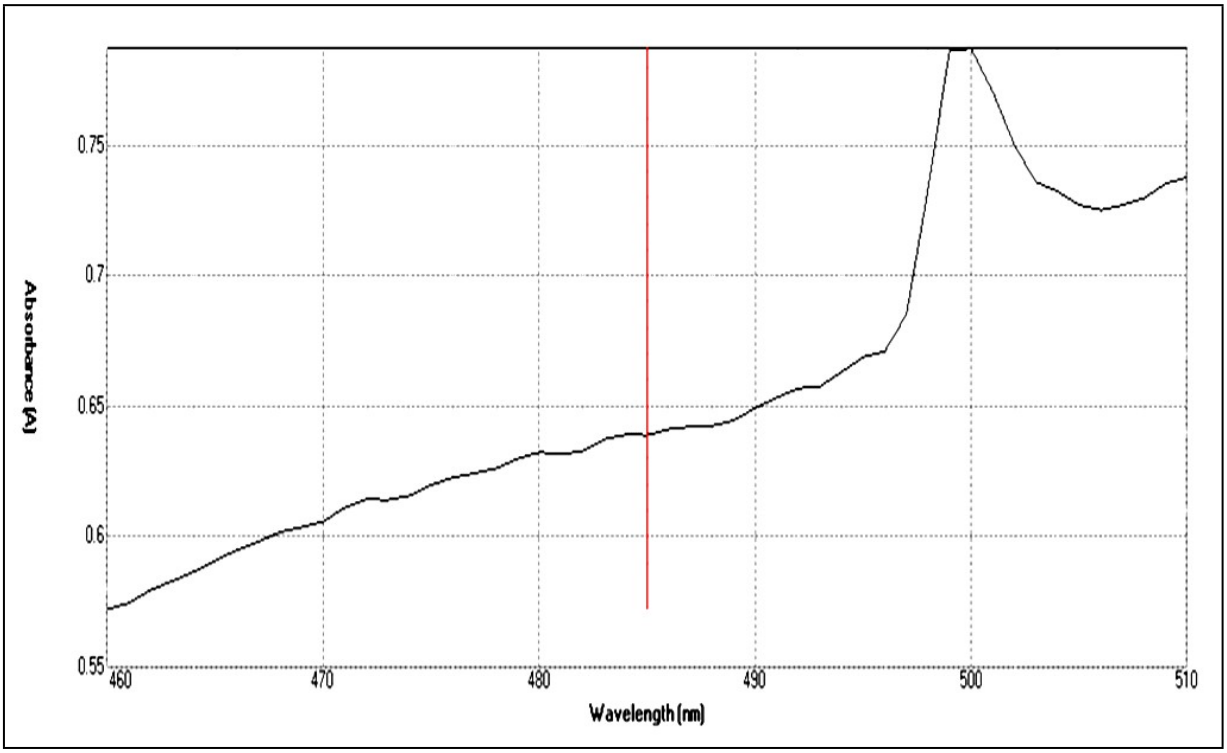


**Fig. S1. UV- Visible spectra of CdS NCs**

**Raman Spectra characterization.**

Raman scattering measurements were also performed and two characteristic CdS peaks were observed, at 296 $cm^{-1}$ and 596 $cm^{-1}$ (overtone) in CdS NCs. The presence of –COOH groups on CdS NCs surface were also confirmed as shown in Fig. S2 and these results were supported by the literature.[2-5]

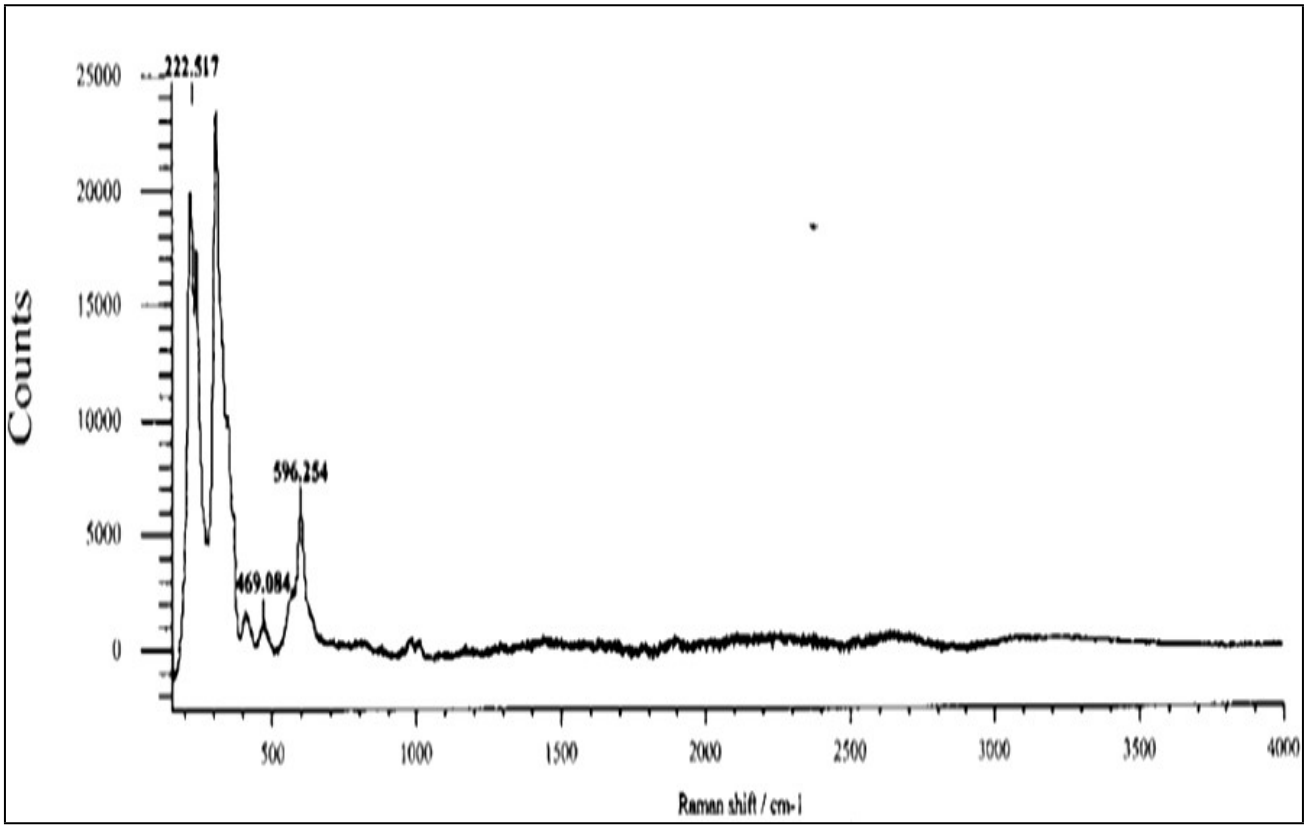


**Fig. S2. Raman Spectra of CdS NCs**

**Thermo-Gravimetric Characterization.**

TGA of CdS microsphere confirmed its thermal stability and the purity (99.925%) (Fig. S3). The TGA of CdS-COOH NCs showed 32.054 % weight loss up to 200 $^{0}$C, which was due to removal of moisture. Further decrement in weight revealed the presence of any chemical absorbed species. In another words, the sample presented a mass loss due to desorption of carboxylic groups present on CdS microsphere surfaces.

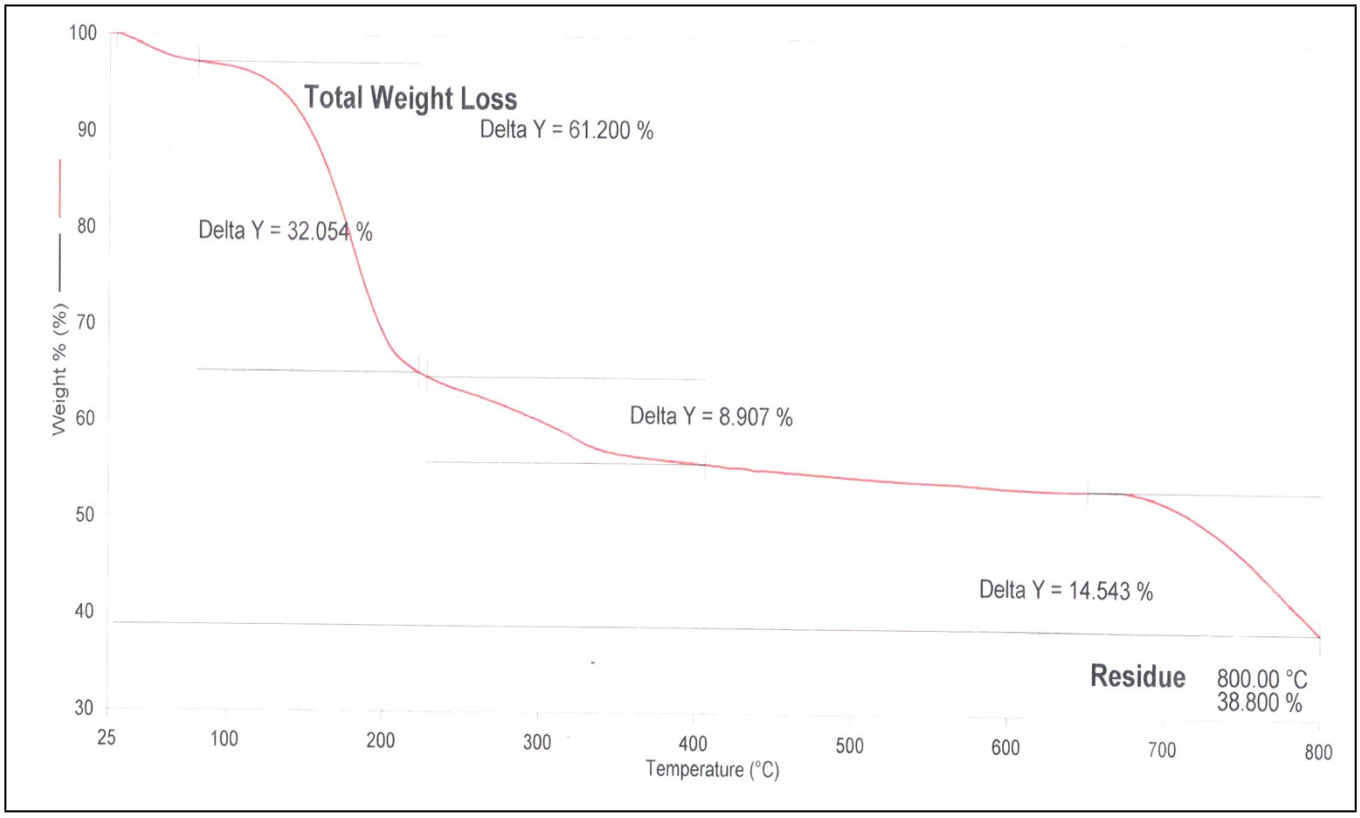


**Fig. S3. TGA Curve of CdS NCs**

**FTIR Spectra Characterization.**

The as-synthesized CdS and CdS-COOH were further characterized by FT-IR spectroscopy (Figure S4). As shown in Fig. S4 (b), the IR absorption band around 1550–1600 $cm^{-1}$ (s COO−), 1400$cm^{-1}$ (m COO−), 3500–3000$cm^{-1}$ (m OH, COOH) indicated the –COOH functional group in CdS-COOH NCs. The peak at 1700$cm^{-1}$ (s C=O) indicated the presence of carbonyl group. It confirmed that the carboxylic groups were present on to the surface of the CdS NCs.

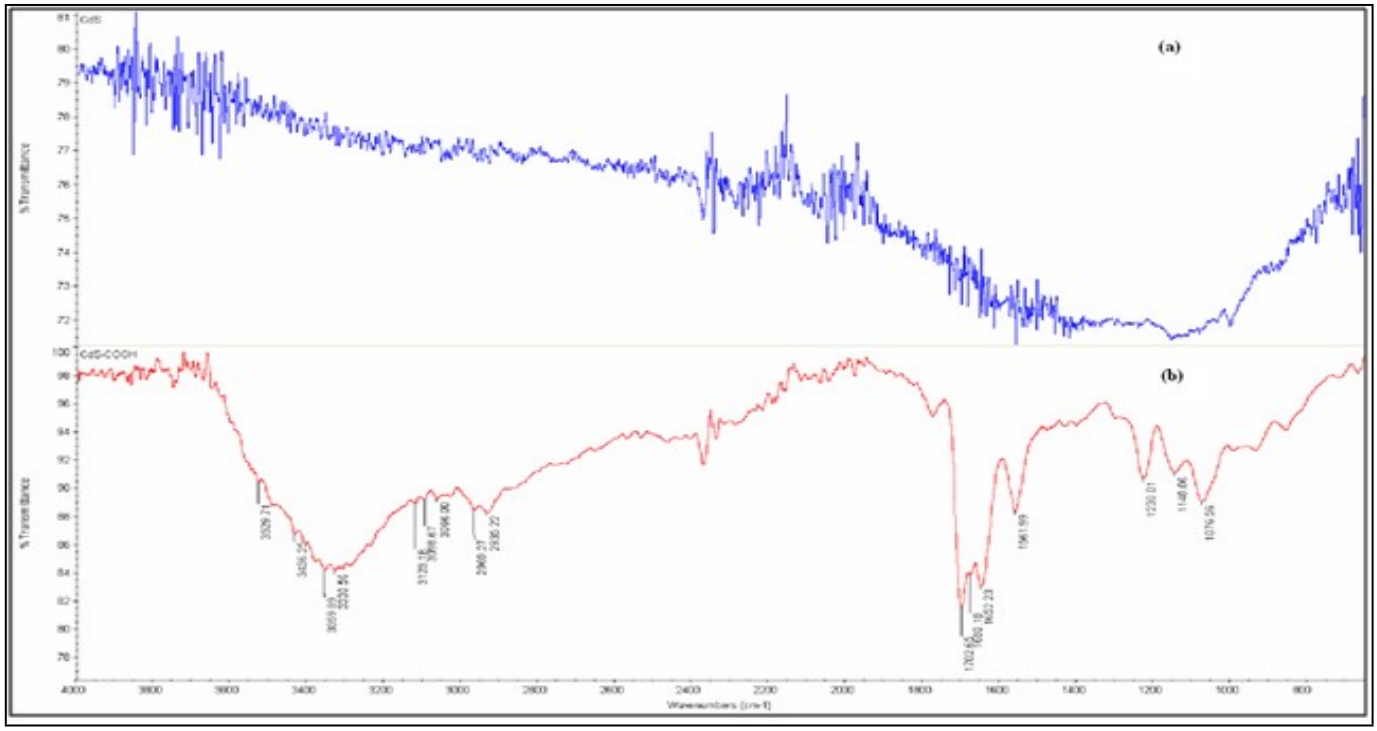


**Fig. S4. FTIR spectra of CdS NCs & CdS-COOH**

**Optimization of the experimental conditions**

Different optimized parameter of proposed immunosensor was assessed with capturing antibodies Ab1 – Antigen- Revealing Antibodies interaction time, temperature and pH. The capturing antibodies Ab1 immobilized on PPy-AuNPs/MWCNTs/GCE and kept to react for 30 to 90 minutes. The dt/dE value first increases from 30 to 60 min and after that remain constant for next 30 min i.e. 60 to 90 min. From here we evaluated the optimized incubation time for the capturing antibodies-antigen interaction of 60 minutes which we had selected for further studies.

Further we assessed the temperature of the antibodies –antigen interaction from 25 $^0$C to 45 $^0$C. The dt/dE value was maximum for 37 $^0$C, so this temperature was chosen for entire experiment.

The pH of the interaction was also evaluated and the optimized pH was found to be 7.2, which we had taken for entire experiment.

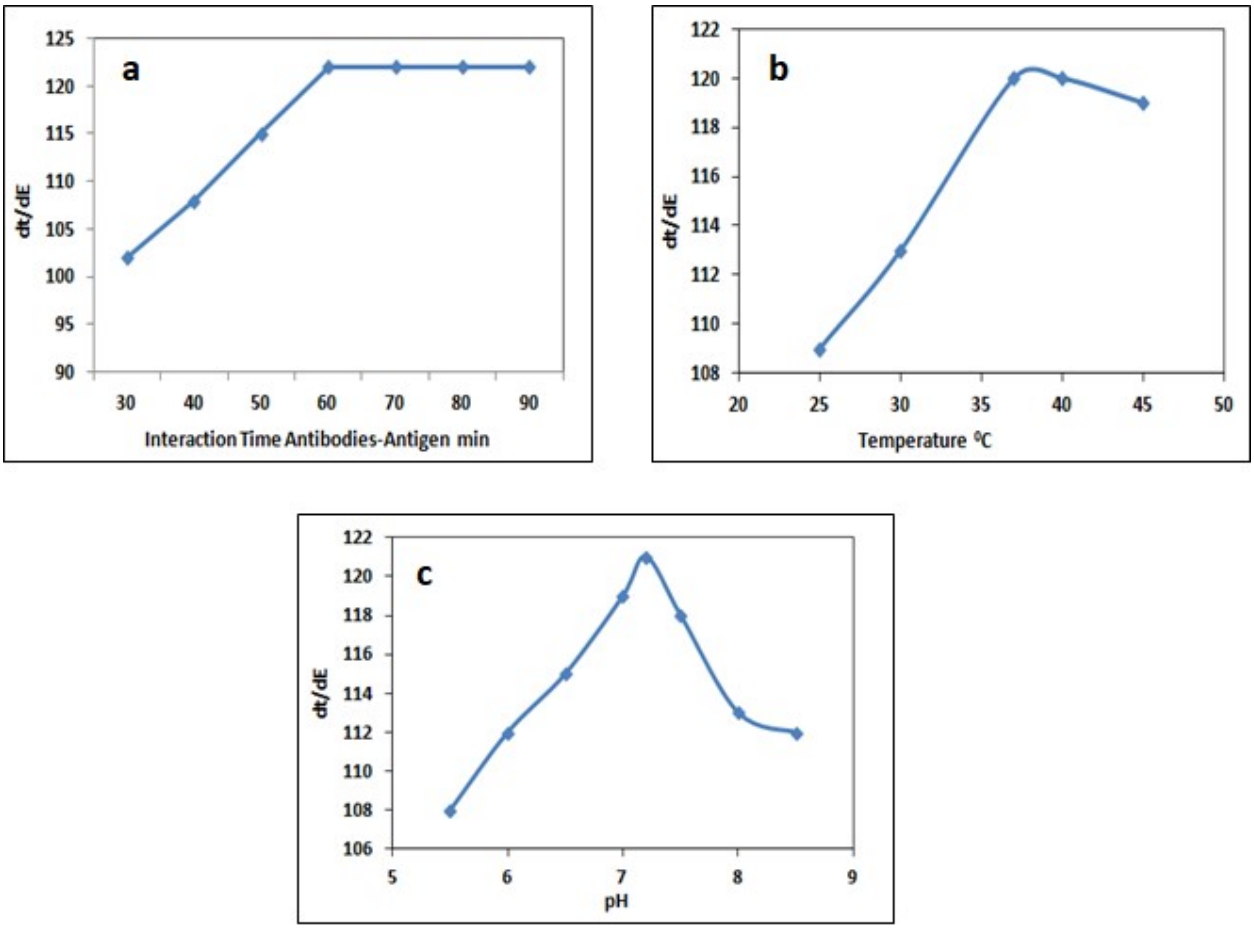


**Fig. S5. Optimization of Antibodies –Antigens (a) Interaction Time (b) Temperature (c) pH Change**

**References**

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