

## Supplementary Information

### Ultrasensitive and Selective Electrochemical sensing of Hg (II) ions in normal and sea water by solvent exfoliated MoS<sub>2</sub>: Affinity Matters

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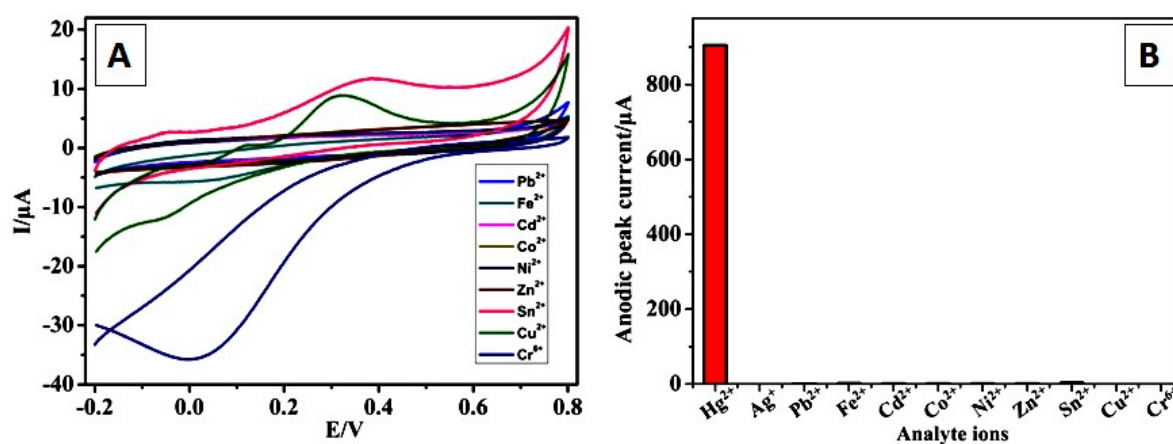


Figure S1. A) CV response at MoS<sub>2</sub>/GCE for the analyte ions other than Hg<sup>2+</sup> and Ag<sup>+</sup>; D) Anodic peak current response of various analyte ions at the peak potential value of Hg<sup>2+</sup>.

**Comparison of MoS<sub>2</sub> with Gr based electrodes for the sensing of Hg<sup>2+</sup>.** The EC sensing studies using rGO modified GCE (rGO/GCE), GO modified GCE (GO/GCE), bare GCE along with MoS<sub>2</sub>/GCE are shown in Figure 4 A (Main manuscript) and is evident from the result that MoS<sub>2</sub>/GCE exhibited the highest current response when compared to rGO/GCE and GO/GCE. The responses of bare GCE and GO/GCE are negligible suggesting that they are not suitable for sensing Hg<sup>2+</sup>. The MoS<sub>2</sub>/GCE exhibited a 30-fold increase in current response compared to that of bare GCE and GO/GCE and four times the current response of rGO/GCE. Though, the structure of GO has many interaction sites, owing to its oxidized nature, the response for Hg<sup>2+</sup> was negligible. The higher electronic conductivity and electron rich nature of rGO, which can reduce Hg<sup>2+</sup> ions to Hg may possibly be the reason for the better response by rGO/GCE compared to that of GO/GCE.

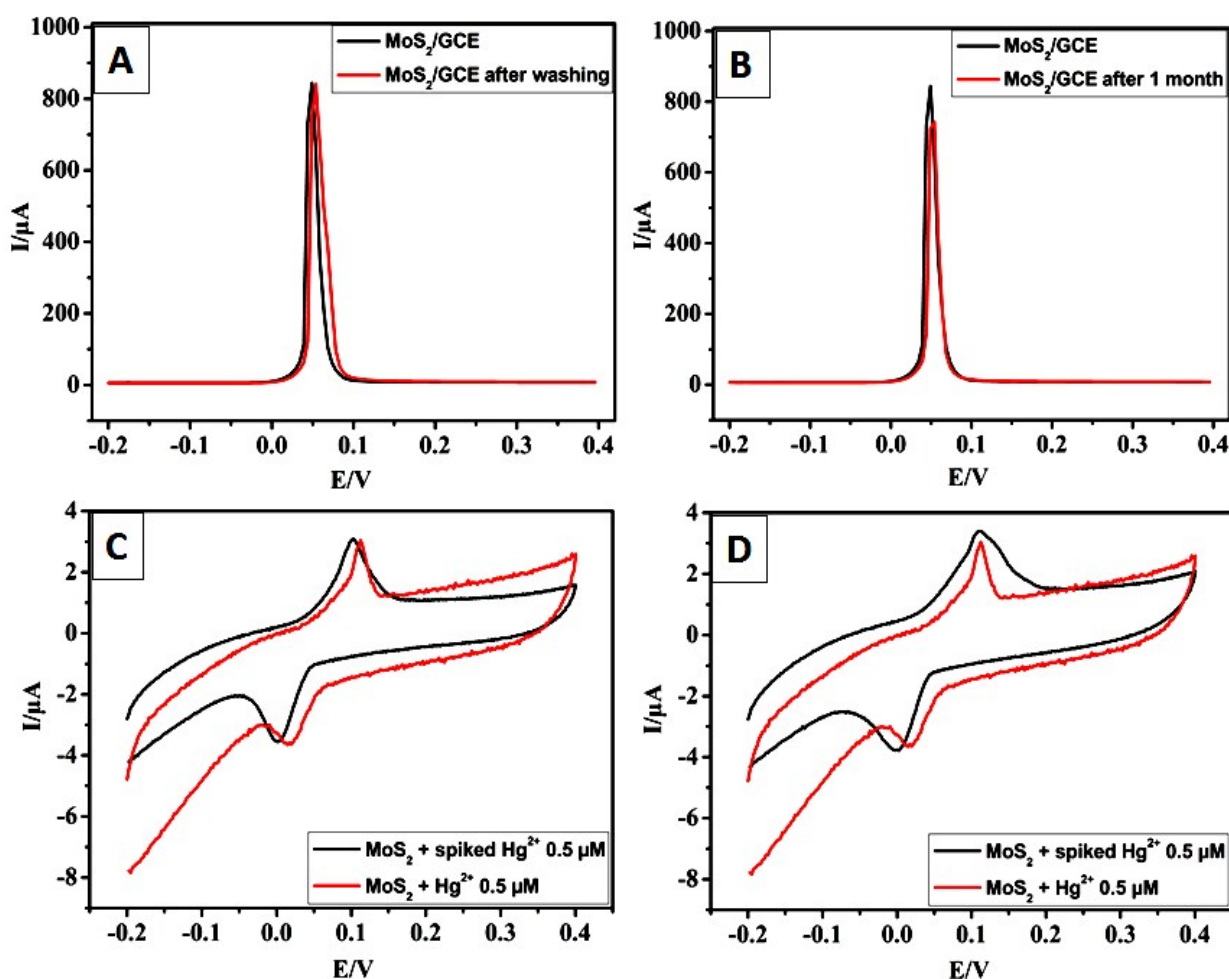


Figure S2. DPV profiles revealing (A): the reusability ; and (B): stability of after 1 month of MoS<sub>2</sub>/GCE; (C) and (D): CV profiles at MoS<sub>2</sub>/GCE comparing the response of Hg<sup>2+</sup> in pure sample and (C) sea water and (D) tap water samples spiked with Hg<sup>2+</sup>, respectively, showing similar current responses.

**Sensing of  $\text{Hg}^{2+}$  in saline water samples.** The  $\text{Hg}^{2+}$  concentrations found in non-anthropogenic sea waters are extremely low, about  $10^{-11}$  M (2 ng/L). Therefore it is of great importance to have a sensing electrode of very high sensitivity and selectivity which can perform accurate analyses of  $\text{Hg}^{2+}$  in sea water samples [31]. There are numerous methods for the determination of Hg although very few are able to detect  $\text{Hg}^{2+}$  at the ppm to ppb levels in seawater [32]. First, the sensing studies were carried out in 0.6 M NaCl solution and the results are depicted in Figure S3. Other than a shift in the peak potential and increase in the broadness of the redox peak, no change was observed in the current response in the saline medium when compared to that of the aqueous. The slight shift in the peak positions observed may be due to the change in the amount of ions and  $\text{P}^{\text{H}}$  in the electrolyte solution (1M HCl to 0.6 M NaCl). The result is evident of the ability of  $\text{MoS}_2/\text{GCE}$  to detect  $\text{Hg}^{2+}$  in saline water environment.

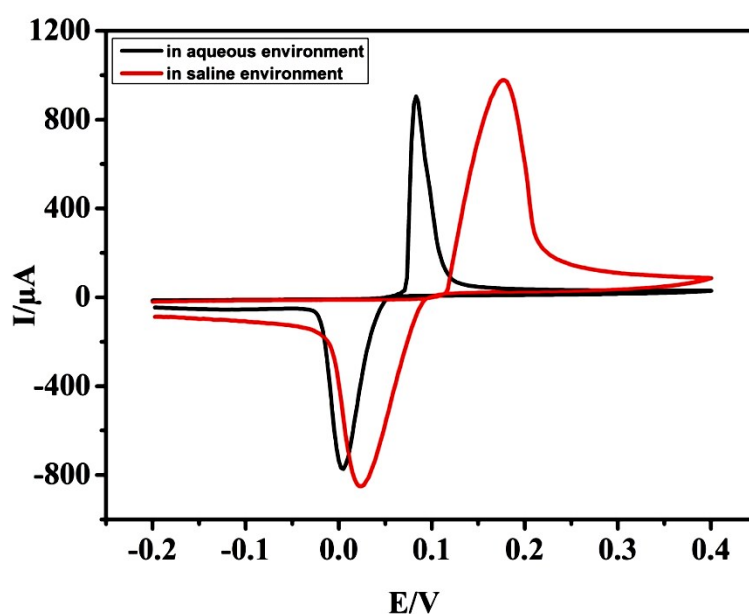


Figure S3. Comparison of CV responses of  $\text{MoS}_2/\text{GCE}$  for  $\text{Hg}^{2+}$  sensing in aqueous and saline medium.

**Optimization of supporting electrolyte.** We have chosen 1 M HCl as the supporting electrolyte based on the literatures: According to ref. (Int. J. Electrochem. Sci., Vol. 7, 2012), the suitable supporting electrolytes for mercury determination are usually NaOH and HCl. However, there are reports of  $\text{Hg}^{2+}$  sensing at highly basic  $\text{P}^{\text{H}}$  values resulting in lower peak current values and broader peak shapes which were attributed to the hydrolysis of  $\text{Hg}^{2+}$  (DOI:

10.1039/C5RA11424A). Moreover, as a part of optimization studies, we conducted the sensing studies of  $\text{Hg}^{2+}$  in various supporting electrolytes, such as 0.1 M Phosphate buffer, 0.1 M NaOH, 1 M HCl, and 0.05 M  $\text{HNO}_3$  (please see Figure S4). It is clear from the Figure S4 that the current response for Hg (II) is better in HCl compared to that of the other electrolytes. Therefore, HCl was selected for the studies.

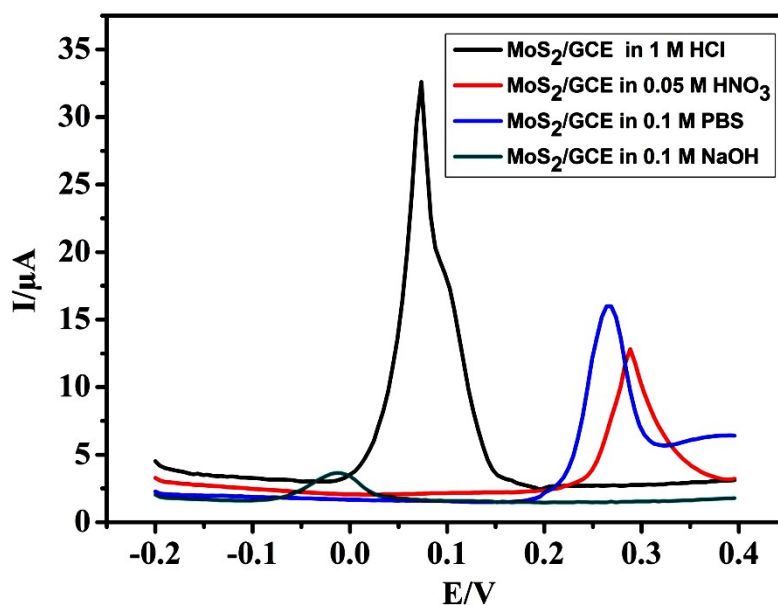


Figure S4. Comparison of DPV responses of  $\text{MoS}_2/\text{GCE}$  for same concentrations of  $\text{Hg}^{2+}$  (10  $\mu\text{L}$ ) in various supporting electrolytes.

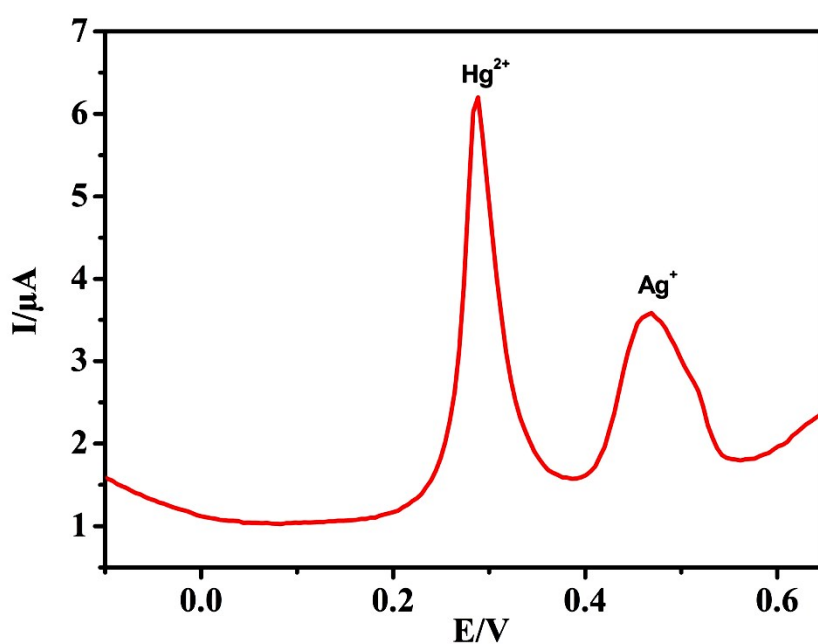


Figure S5. DPV result showing the simultaneous sensing of  $\text{Hg}^{2+}$  and  $\text{Ag}^+$  by  $\text{MoS}_2/\text{GCE}$  in 0.05 M  $\text{HNO}_3$  with concentration of  $\text{Ag}^+$  double that of the  $\text{Hg}^{2+}$ .

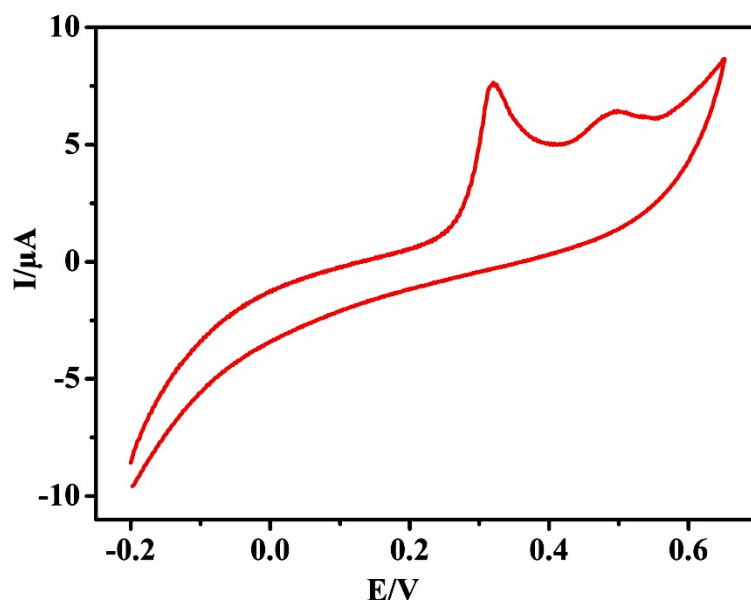


Figure S6. CV response of  $\text{MoS}_2/\text{GCE}$  in 0.05 M  $\text{HNO}_3$  containing  $\text{Hg}^{2+}$ ,  $\text{Ag}^+$ ,  $\text{Pb}^{2+}$ ,  $\text{Fe}^{2+}$ ,  $\text{Fe}^{3+}$ ,  $\text{Cd}^{2+}$ ,  $\text{Sn}^{2+}$ ,  $\text{Ni}^{2+}$ ,  $\text{Cu}^{2+}$ ,  $\text{Cr}^{6+}$ ,  $\text{Zn}^{2+}$  and  $\text{Co}^{2+}$  with concentration of all ions double that of the  $\text{Hg}^{2+}$ .

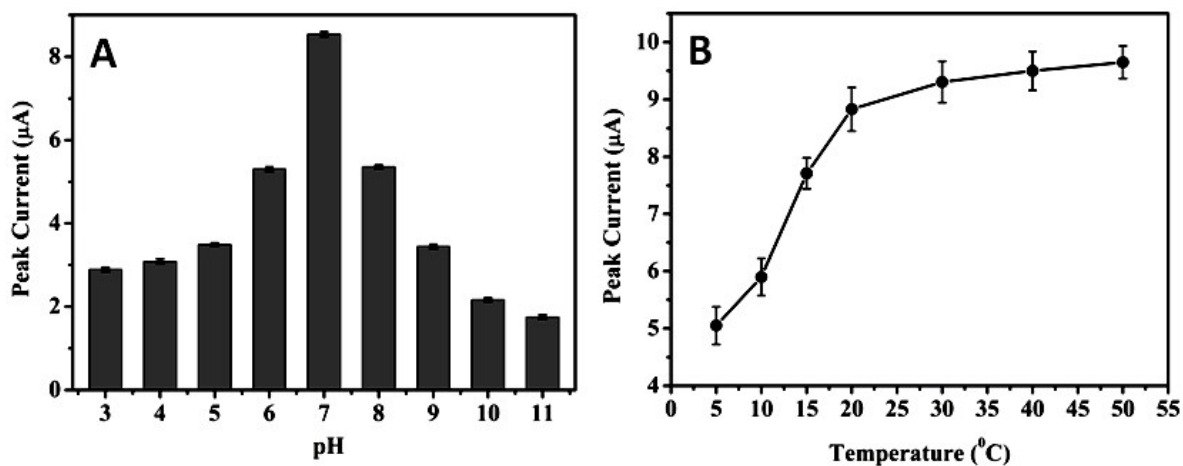


Figure S7. The dependence of  $\text{Hg}^{2+}$  oxidation peak current (by  $\text{MoS}_2/\text{GCE}$ ) on (A) buffer pH.  
and (B) Temperature of the electrolyte solution