



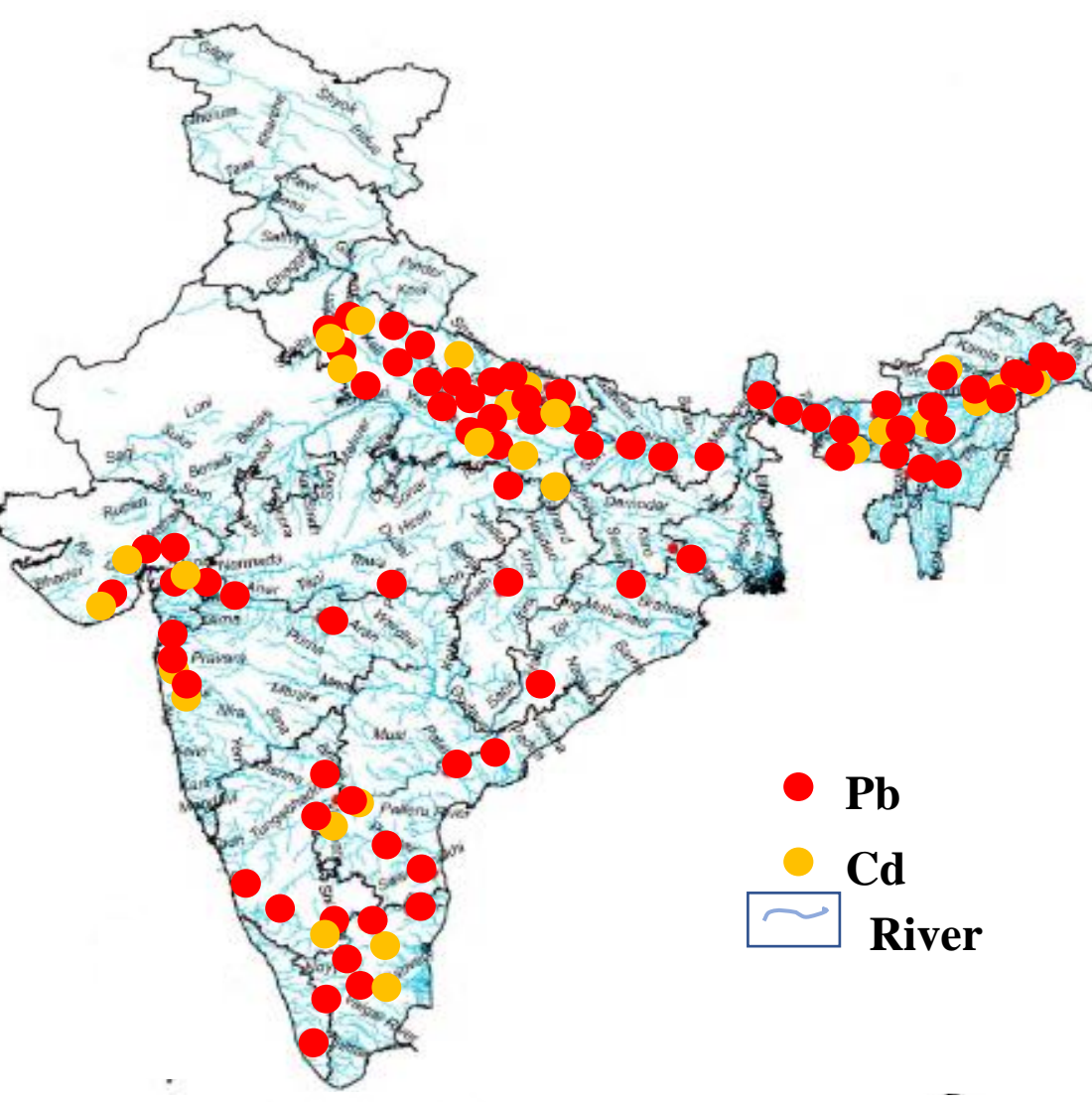
Chemiresistive lead sensing using β -Cyclodextrin functionalized rGO films

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Abstract

Graphene based materials have shown exceptional efficiency in the field of sensing because of its large surface area, high electrical conductivity and the ability to interact with various chemical species. Heavy metal contamination of water has always been a serious threat to us as these heavy metals accumulate in our body and cause long term disorders. Lead (Pb (II)), being one of the most dangerous heavy metals, we explore β -cyclodextrin (BCD) functionalized reduced graphene oxide (rGO) as a Chemiresistive sensor material for selectively sensing lead (II) in aqueous medium. Our results show approximately 60% change in resistivity for 50 ppm. The limit of detection of this Chemiresistive technique is 1 ppm. A device was fabricated using this material. This sensor device offers practical solution for field detection of lead in case of industrial wastewater



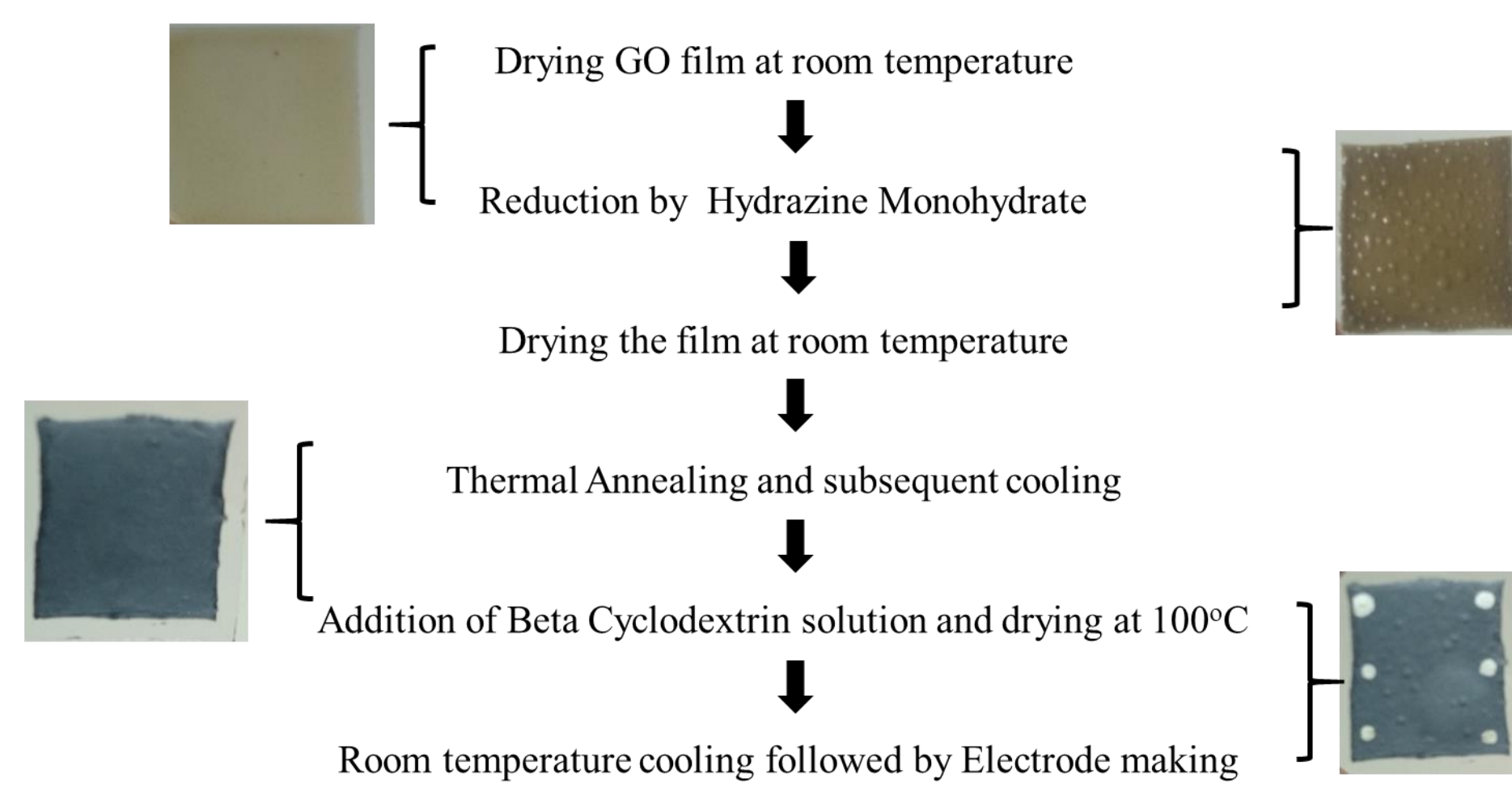
Lead sensing using Electrochemical techniques



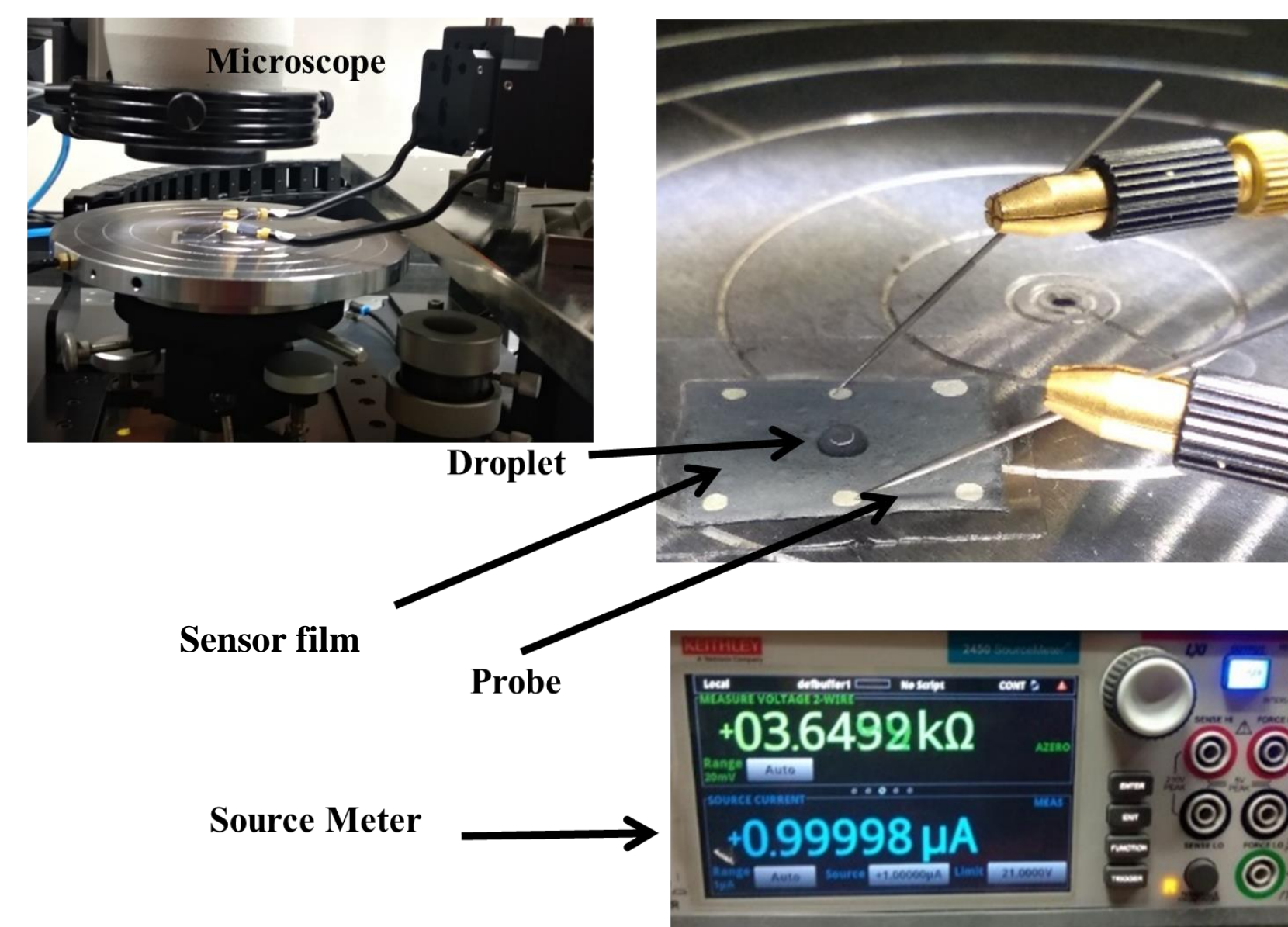
- High Sensitivity and good stability and Reproducible
- Signal to noise ratio of 3 was achieved[1]
- Complex modification of Working electrode required

- Simple and highly sensitive
- Real time Detection
- Signal to noise ratio of 25-30 is achievable[2]
- Faster than Stripping Voltametry

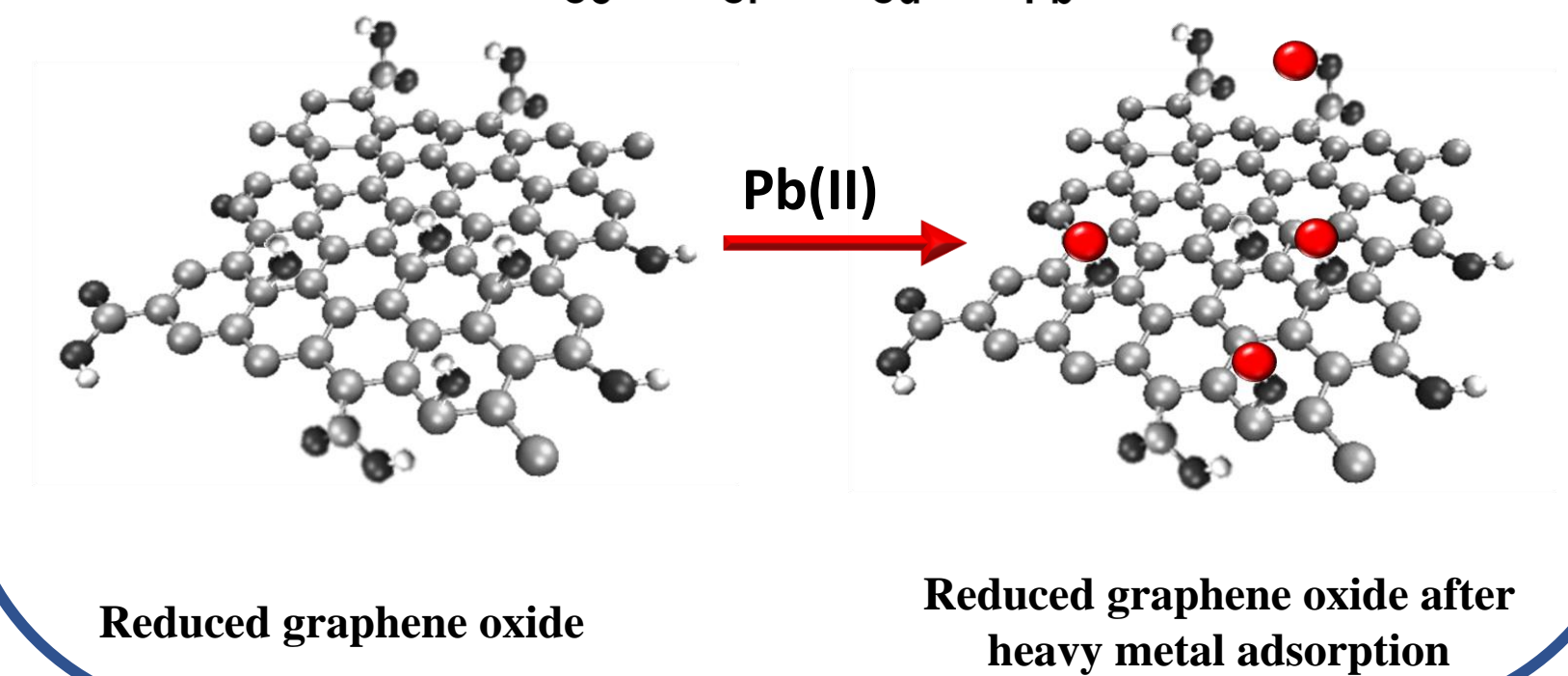
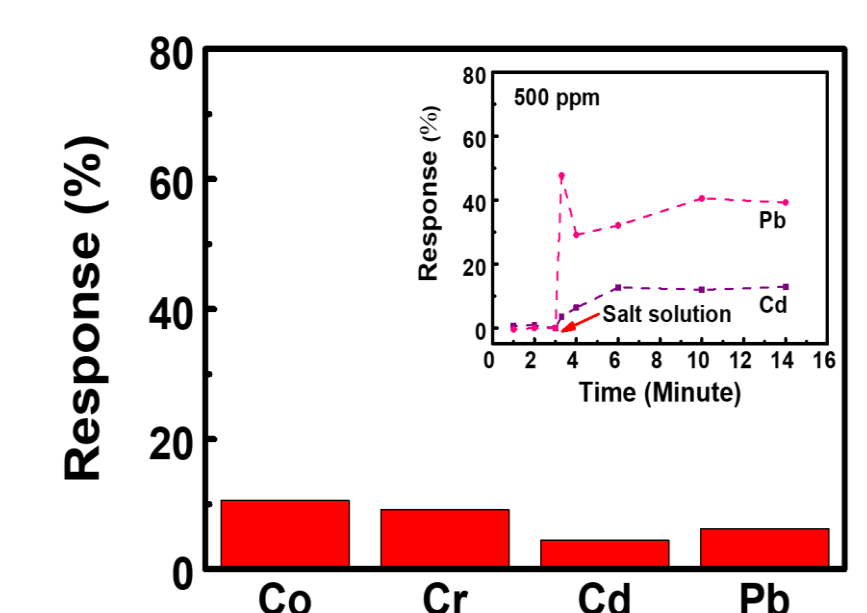
Device Making for the sensing of Heavy Metals



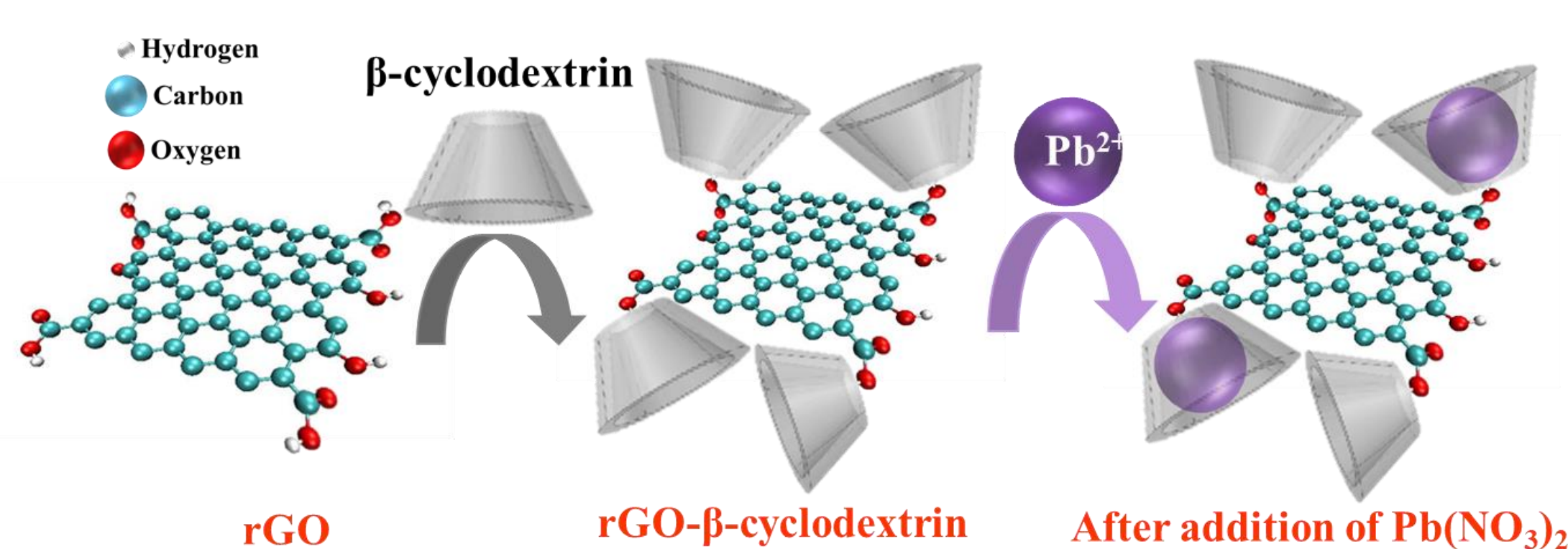
Measurement Set Up



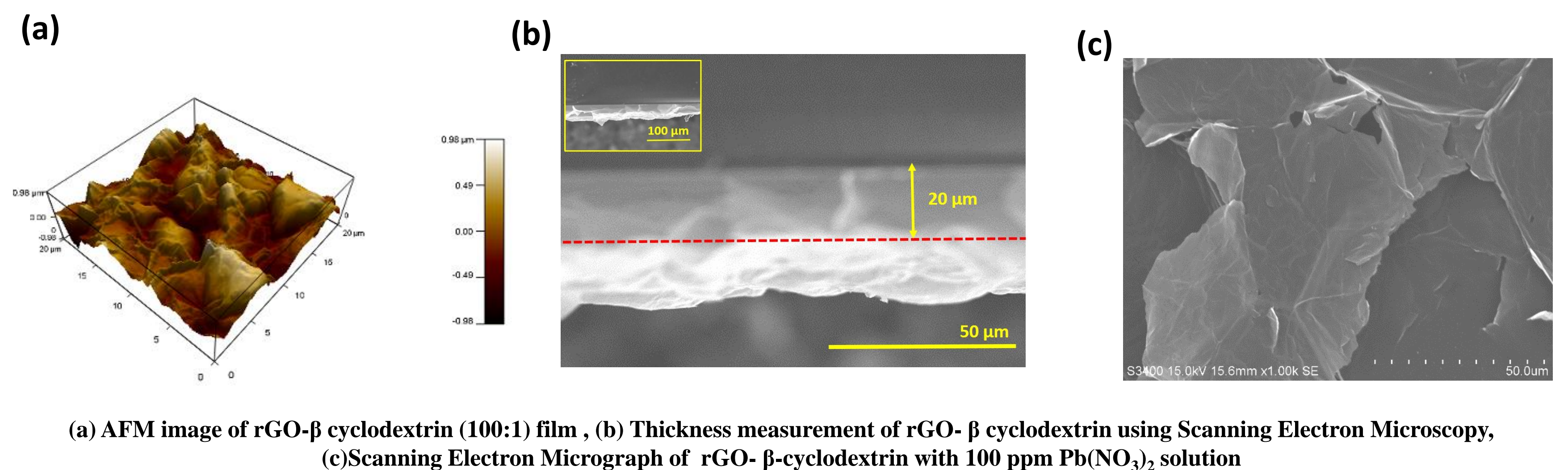
Response of rGO



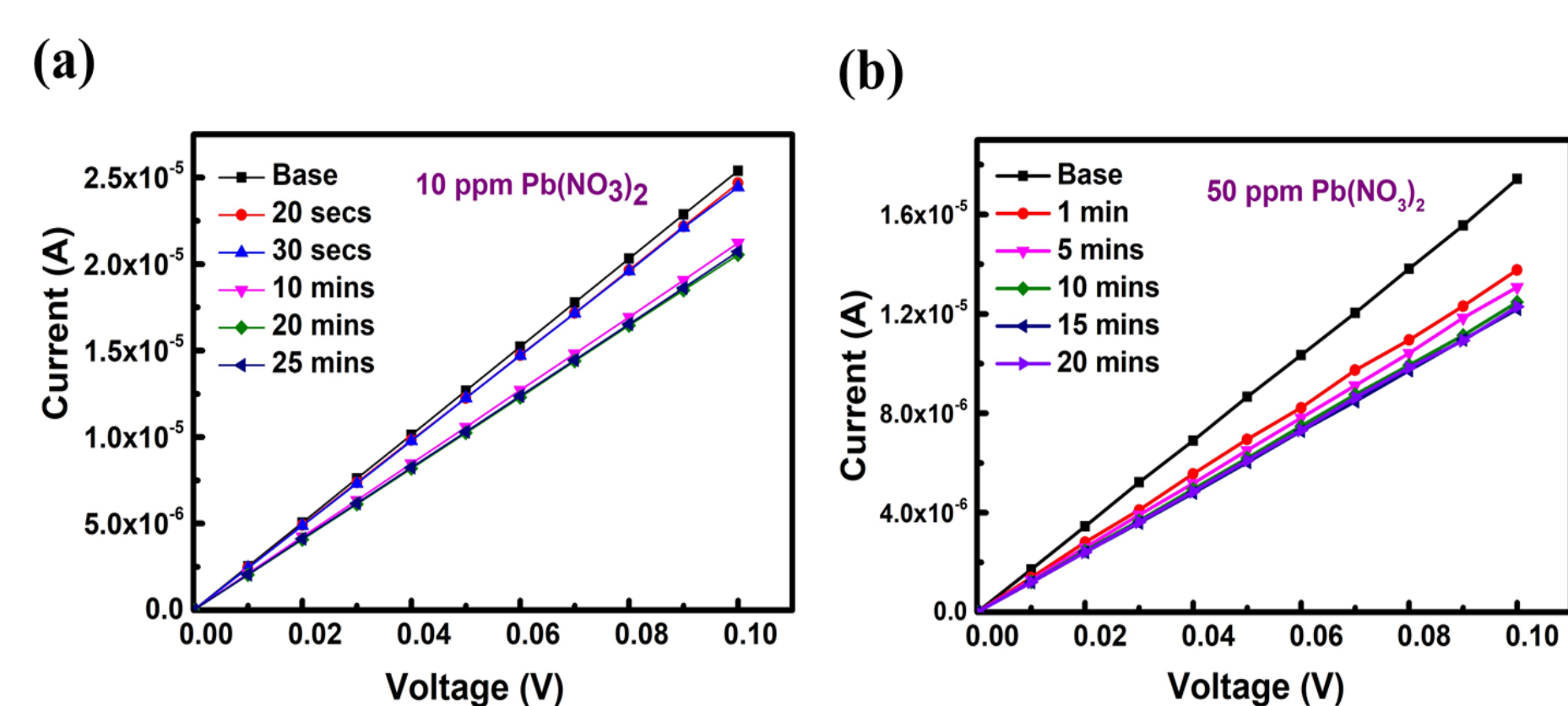
Mechanism of Pb(II) capturing



Characterization of the sensing film

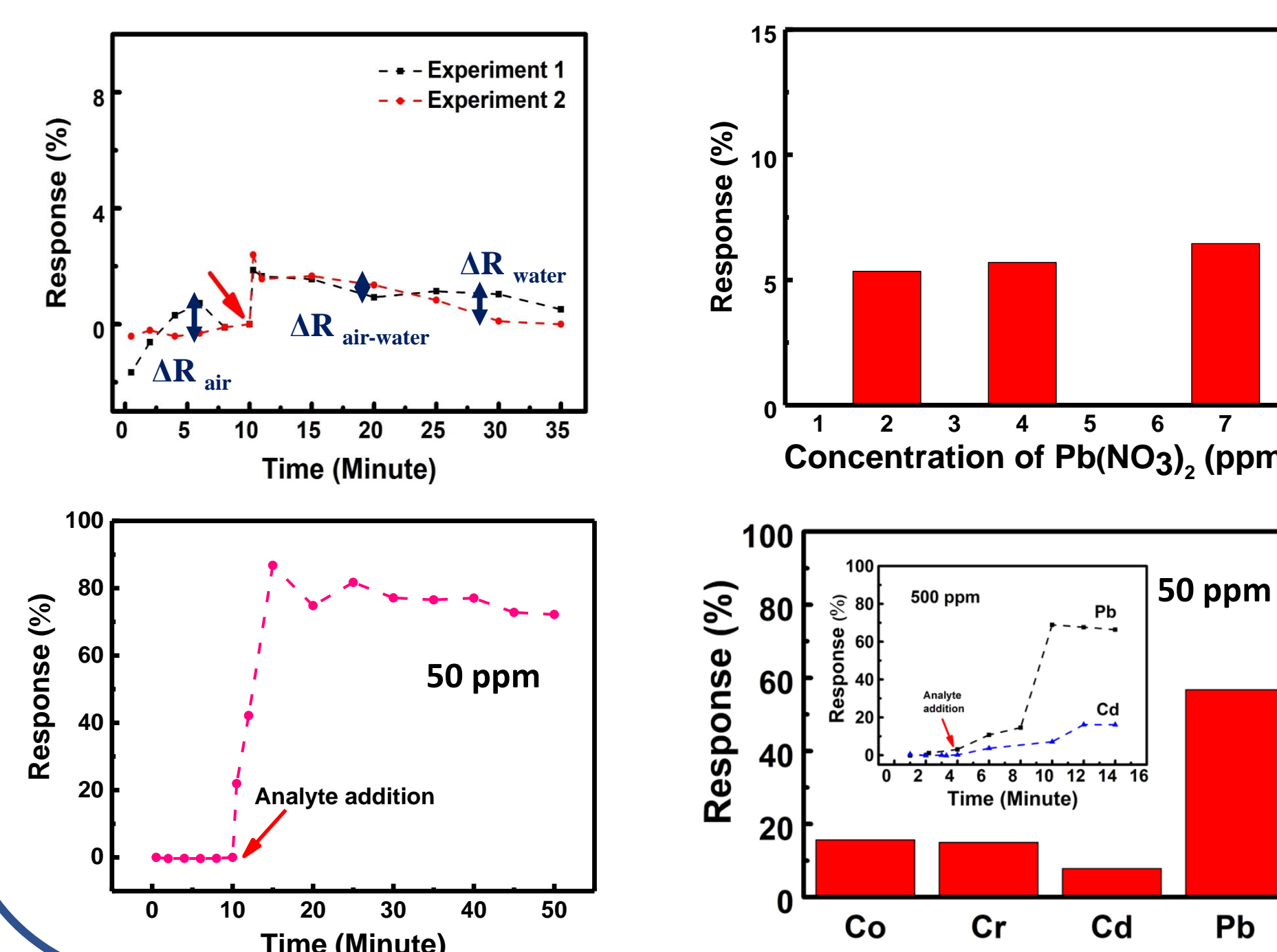


I-V Characteristics



I-V Characteristics for rGO-BCD (100:1) for (a) 10 ppm and (b) 50 ppm $Pb(NO_3)_2$

Response of rGO-BCD(100:1)



Conclusion

- Reduction in conductivity in the presence of Nitrate salt solution of lead might result from the capturing of the ions by the -COOH and -OH groups present on the rGO- β -cyclodextrin film reducing free carriers.
- Functionalization of reduced graphene oxide with β -cyclodextrin has been utilized for binding Pb ions more selectively.
- The bottle neck of this is the repeatability of the sensors, overcoming which, we can have a stable calibration curve for various concentrations of different heavy metals.

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1. Status of Trace & Toxic Metals in Indian Rivers 2019