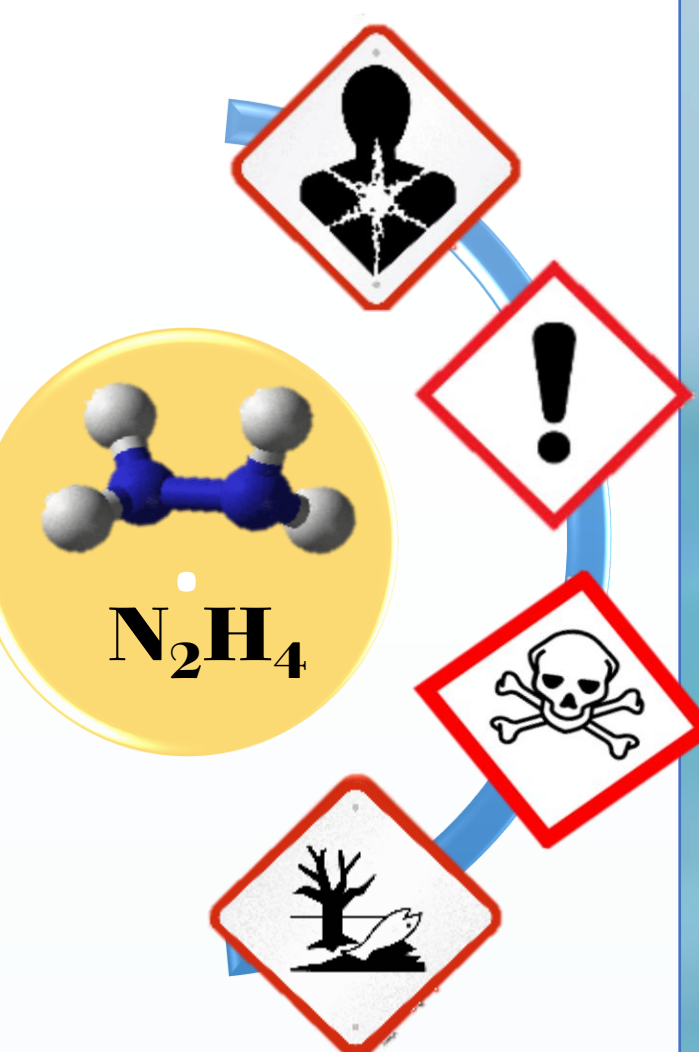


1. Introduction

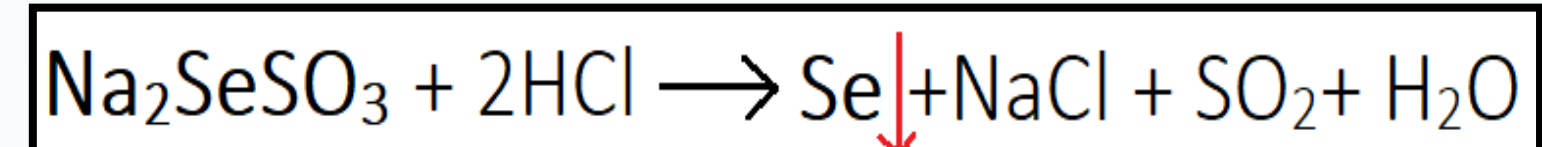
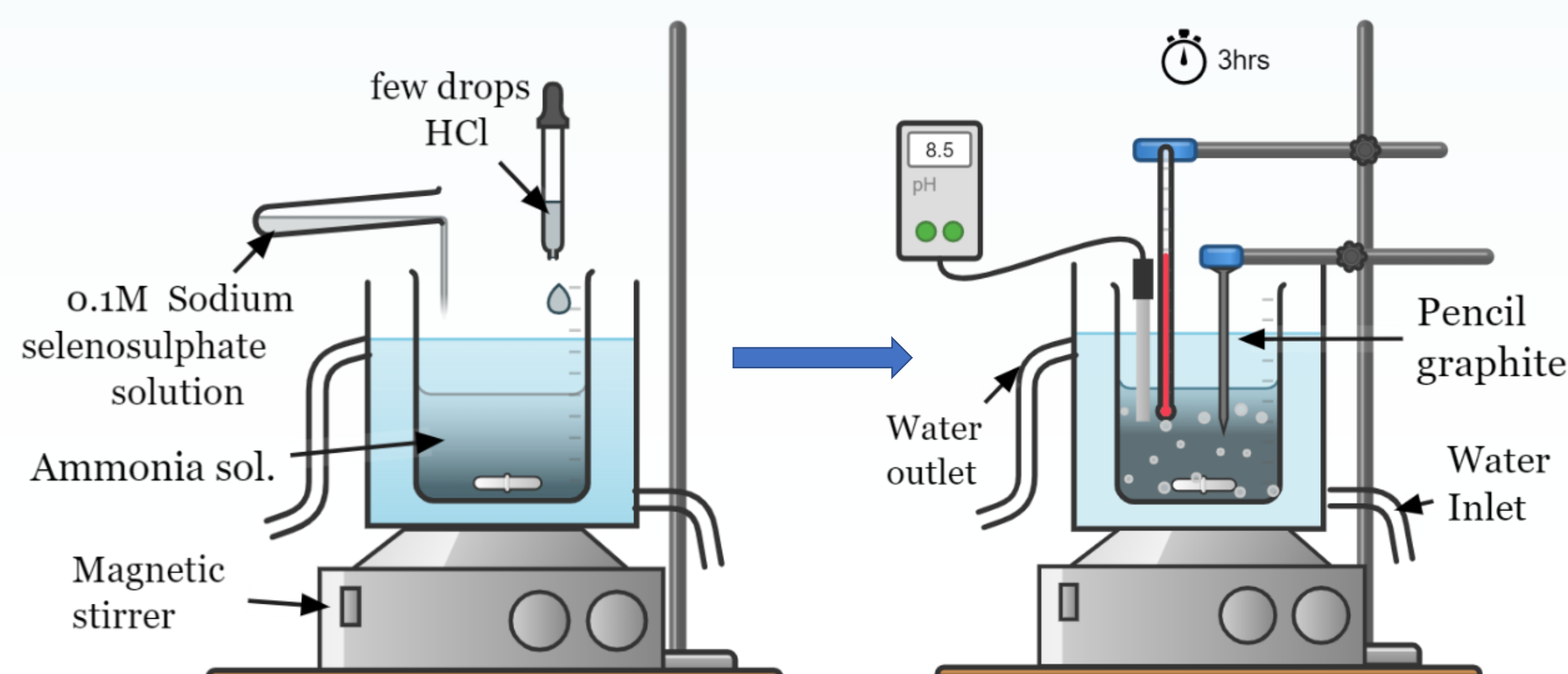
- Determination of water quality parameters are important for clean water supply, urban planning, agriculture.
- Electrochemical sensors provide on site cost effective and simple analysis tool.
- United States Environmental Protection Agency (**US EPA**) considers **Hydrazine (HZ)** as human carcinogen.^[1]



- It is crucial to detect its presence in water as it is hazardous for human health.^[2]
- This work addresses the goal 6 of UN SDGs **"CLEAN WATER AND SANITATION"**

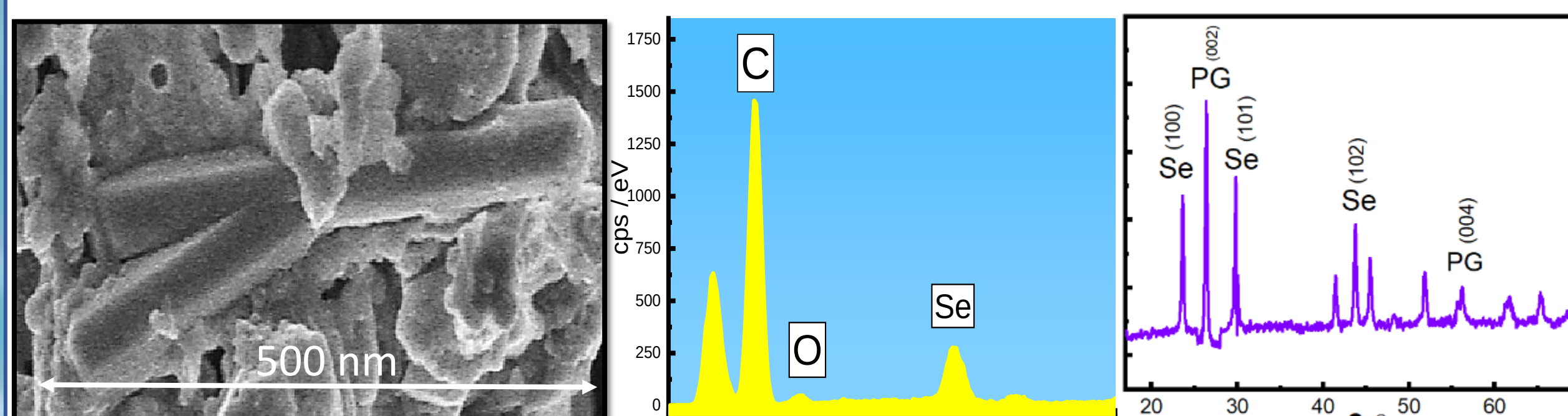
2. Fabrication of Se Nano-beaks at PGE

- Se nanostructures were grown on an inexpensive pencil graphite electrode (Se / PGE) by a **Chemical bath deposition (CBD)** method for the first time.
- Sodium selenosulphate solution was taken as precursor.
- HCl was used as reducing agent.



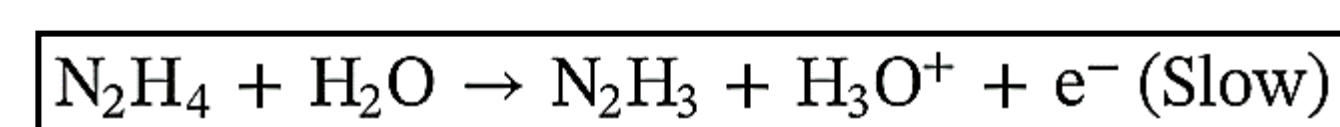
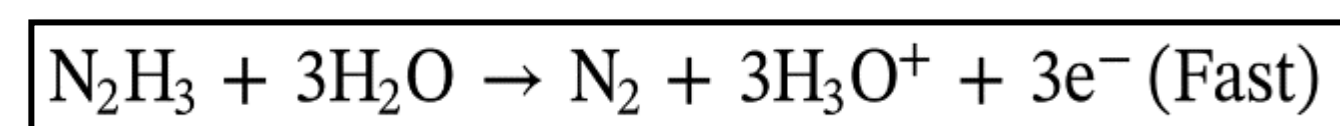
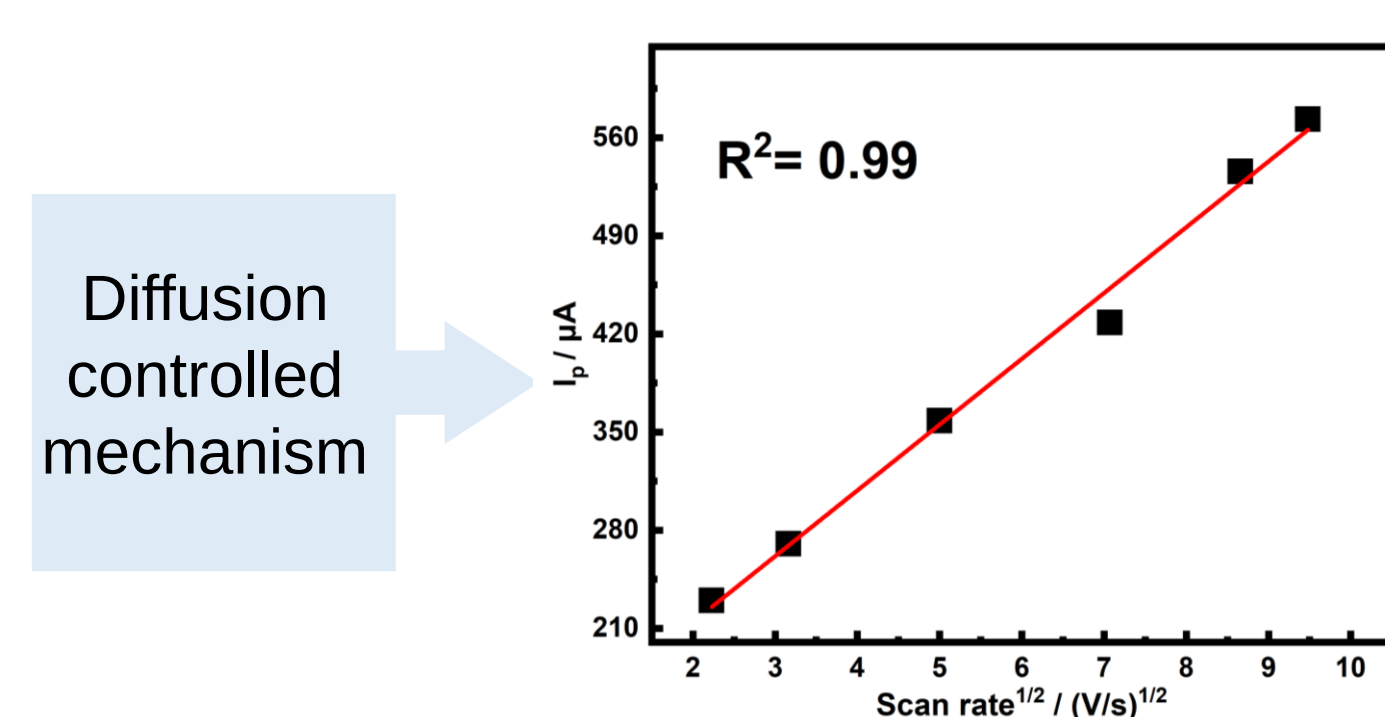
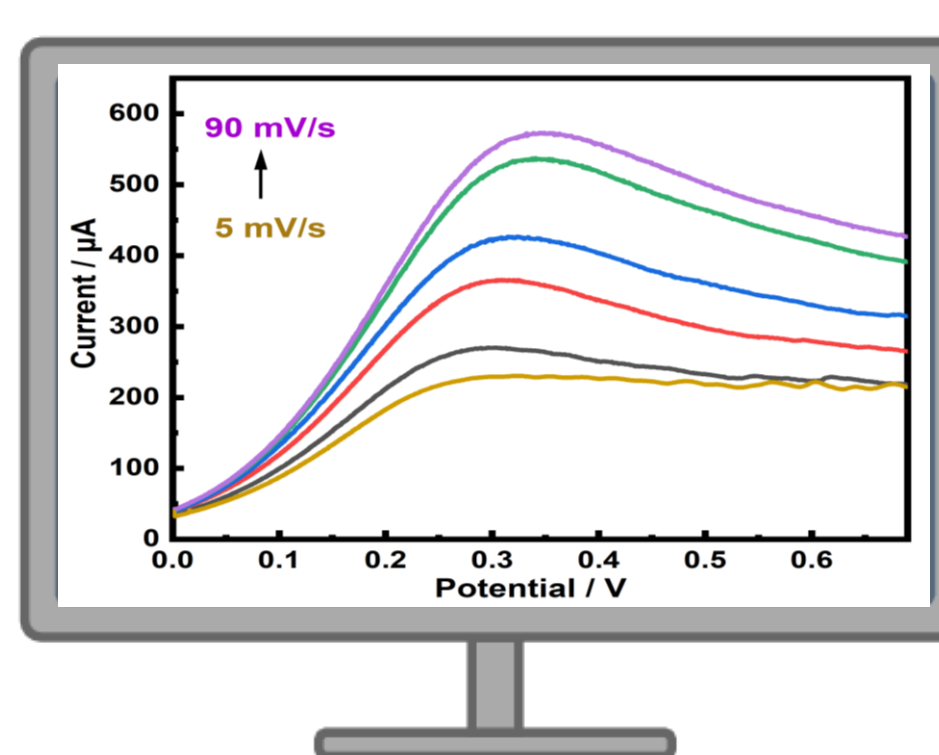
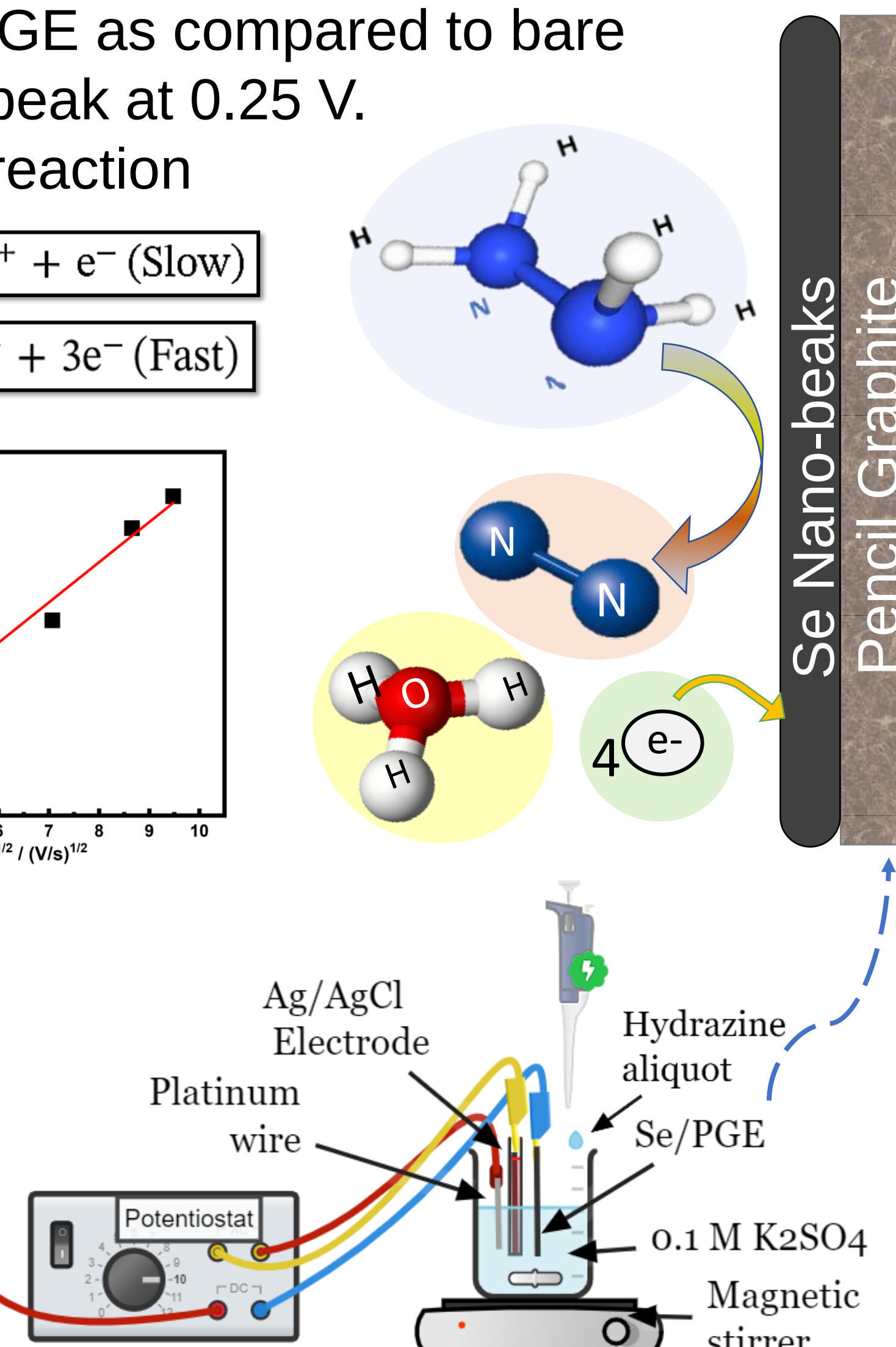
3. Characterization of Se Nano-beaks at PGE

- PXRD** • Metallic Selenium identified by peaks at 23.5°, 29.7°, 41.4°, 43.7°, 45.4°
- SEM analysis** • Nano beaks formed, Average size: 70 nm
- EDX spectrum** • Signals for C, O and Se
- UV-Vis. analysis** • Absorbance at 290 nm



4. Electrochemical Sensing of HZ at Se / PGE

- Current response was improved for hydrazine oxidation with Se / PGE as compared to bare PGE with oxidation peak at 0.25 V.
- 2 step HZ oxidation reaction

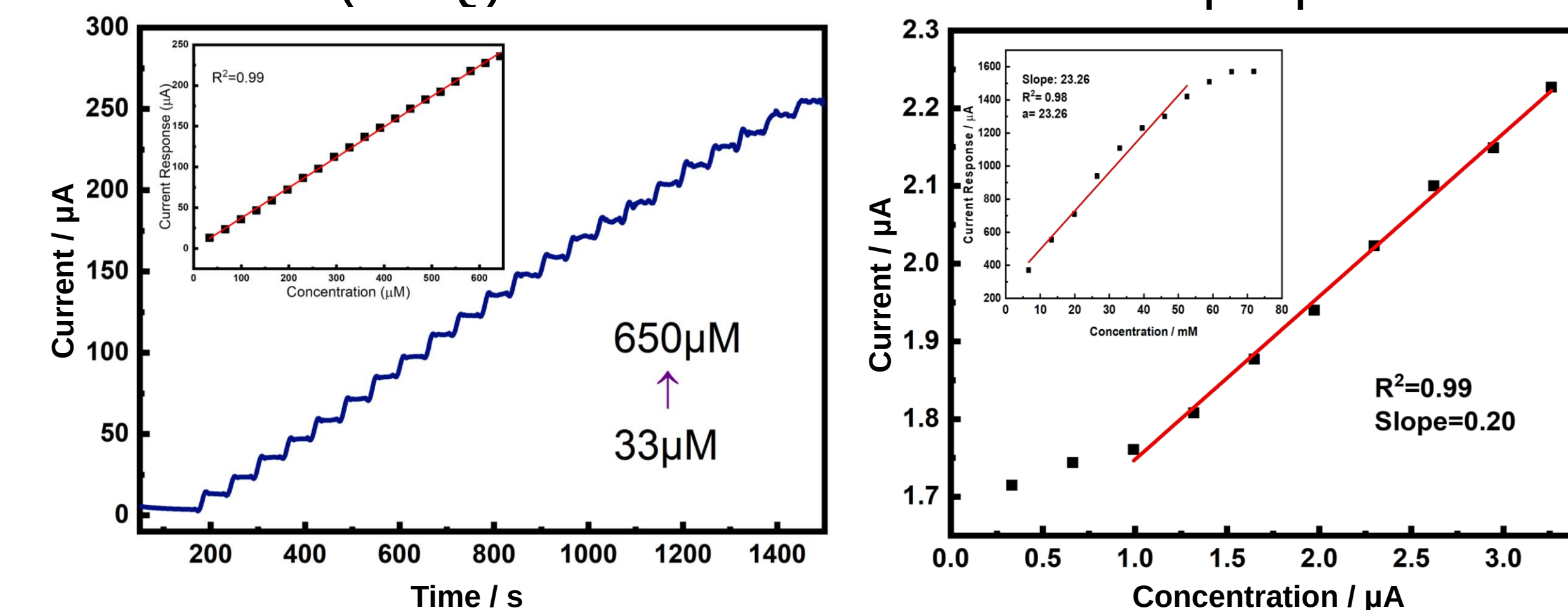


5. Amperometric Response of the Sensor

- Highly sensitive response towards hydrazine oxidation
- Response current reaches 95% steady-state within 3 s

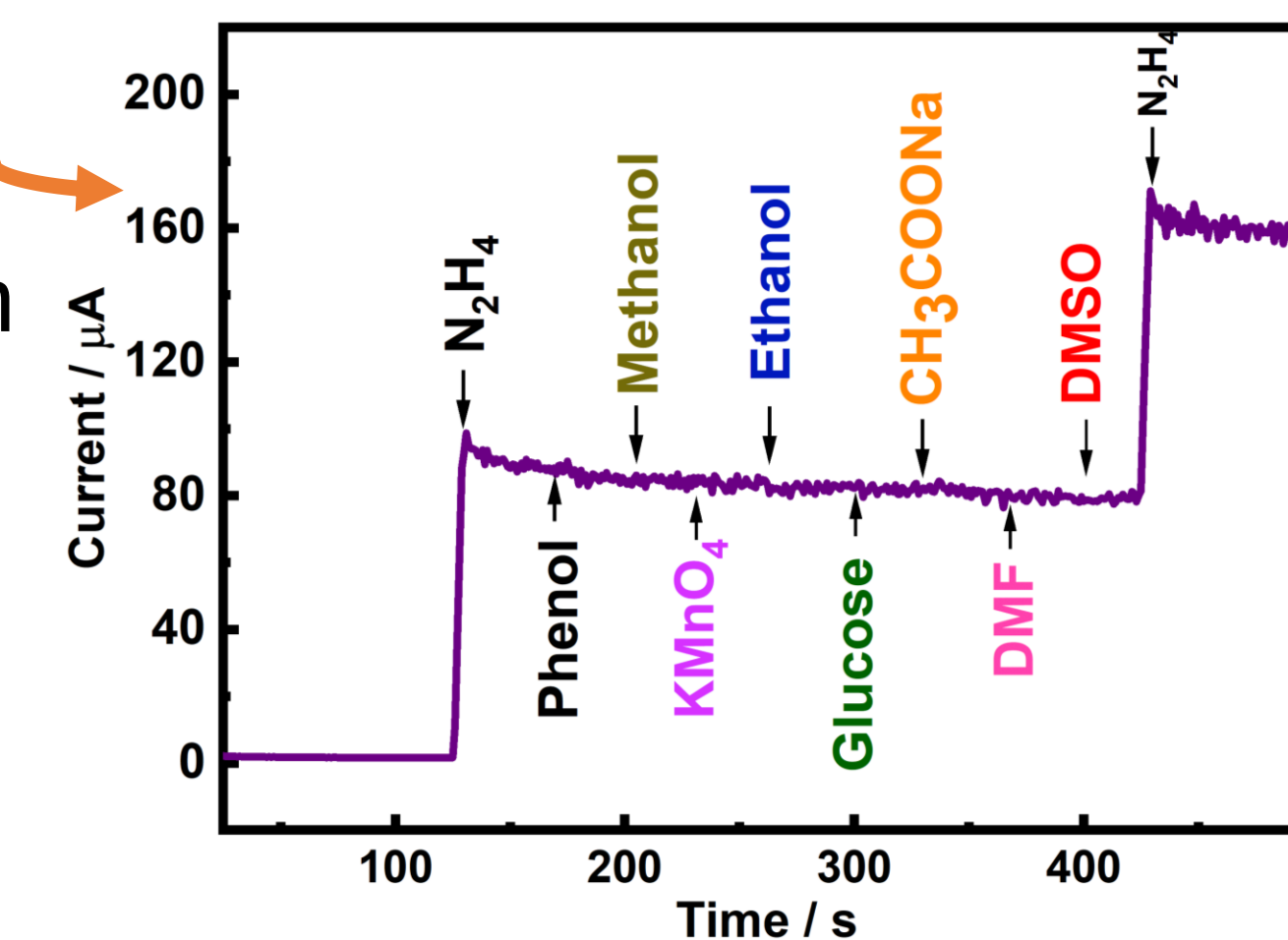
- ✓ Linear Conc. range: 1 μM - 50 mM
- ✓ Limit of quantification (LOQ) : 130 nM

- ✓ Limit of detection (LOD) : 45 nM
- ✓ Sensitivity : 0.366 μA.μM⁻¹



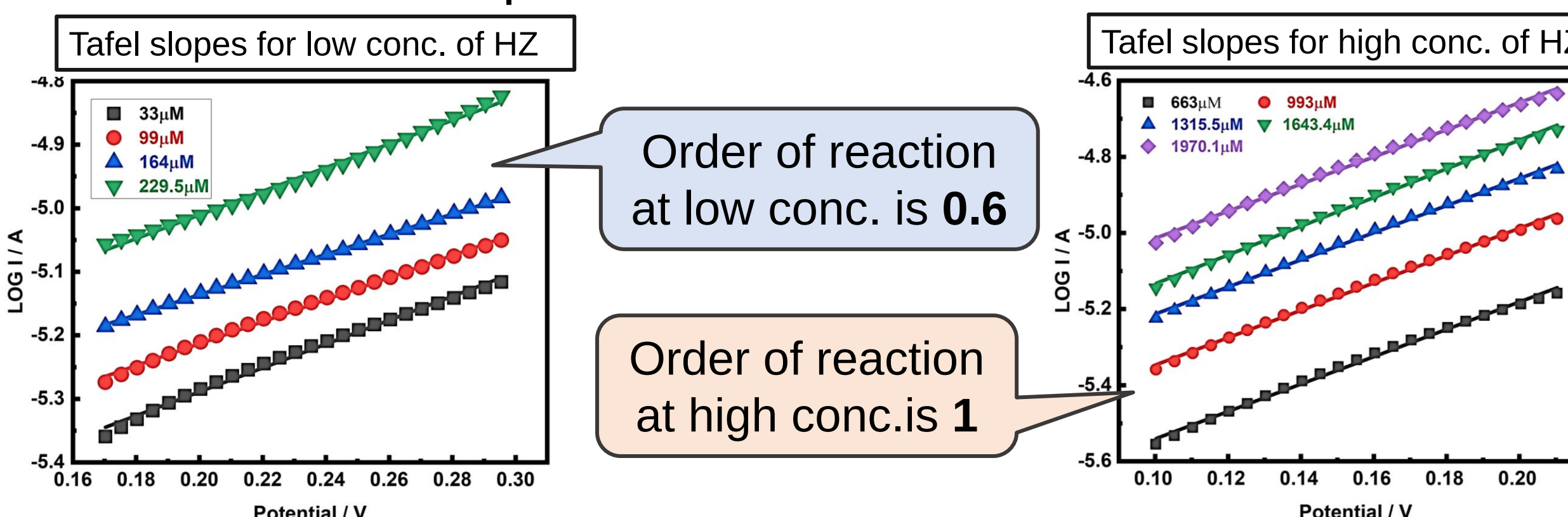
6. Selectivity and Reproducibility of the Sensor

- No current response shown on addition of potential interferences in water.
- Stable and reproducible results with same and different electrodes with ± 5%



7. Tafel Slopes and Order of Reaction

Concentration dependent mechanism for HZ oxidation



8. Real Sample Analysis

- Applicability of the sensor for sensing hydrazine in tap water samples checked with **standard addition spiking method**

- %Recovery : **96.9**

Sample	Added (μM)	Found (μM)	% Recovery
A	3	2.9	96.7
B	30	28.5	95
C	330	327.5	99.2

9. Conclusions

- The Se / PGE exhibited outstanding, reproducible, and selective electrocatalytic activity for hydrazine determination.
- Modifying PGE with Se nanostructures significantly improved the electrochemical active surface area and electron transfer kinetics for hydrazine oxidation.
- Sensor can be employed for trace level detection of HZ with linear detection range of **1 μM - 50 mM**

10. References

- [1] Sohail, M., Altaf, M., Baig, N., 2018. A new water stable zinc metal organic framework as an electrode material for hydrazine sensing. *New Journal of Chemistry*, 42(15), pp.12486-12491.
- [2] Jena, B.K. and Raj, C.R., 2007. Ultrasensitive nanostructured platform for the electrochemical sensing of hydrazine. *The Journal of Physical Chemistry C*, 111(17), pp.6228-6232.

11. Acknowledgements

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