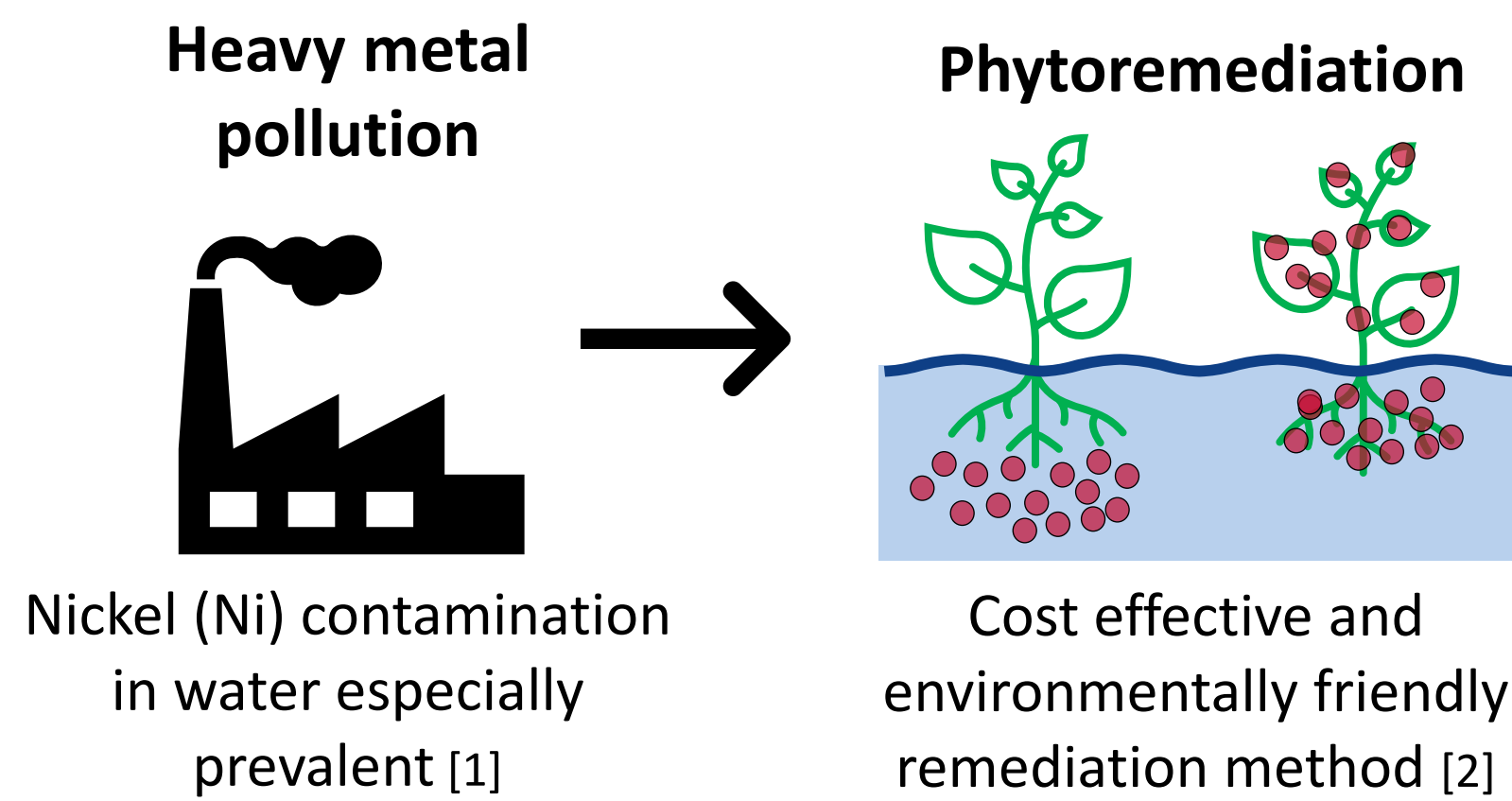


Introduction

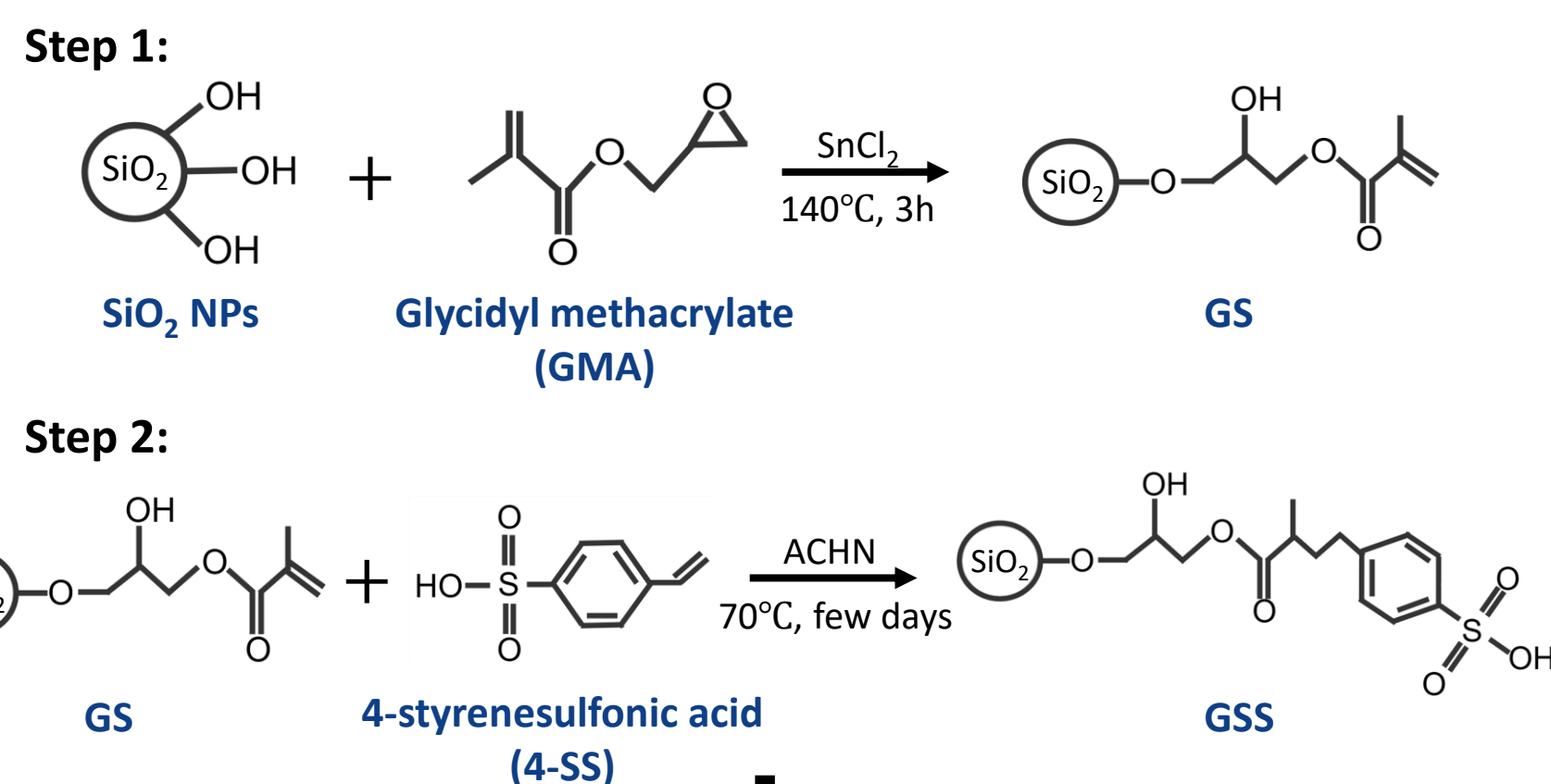


Objectives

- Surface modify SiO₂ NPs with 4-styrenesulfonic acid (4-SS) (forming product known as GSS)
- Characterise the modified product
- Analyse the adsorption behaviour of GSS towards Ni(II) ions including the effects of pH, adsorption isotherm, and adsorption kinetics
- Evaluate the potential of GSS in enhancing phytoremediation by assessing its impact on plant growth and Ni uptake

Methodology

Surface modification



Characterisation

- Scanning/Transmission Electron Microscopy (SEM/TEM)
- Fourier transform infrared spectroscopy (FTIR)
- X-ray photoelectron spectroscopy (XPS)
- Zeta potential analysis

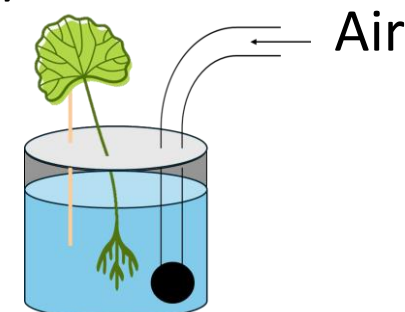
Adsorption behaviour

- Batch adsorption experiments
 - Effect of pH
 - Adsorption isotherm
 - Adsorption kinetics
- Adsorption capacity: $Q_e = \frac{V(C_0 - C_e)}{m}$

Impact on plant growth and Ni phytoremediation

- *Centella asiatica* (L.) Urban in deep water hydroponic system (1 week treatment)

Treatment	Ni(II)	GSS
C		
T1	✓	
T2	✓	✓



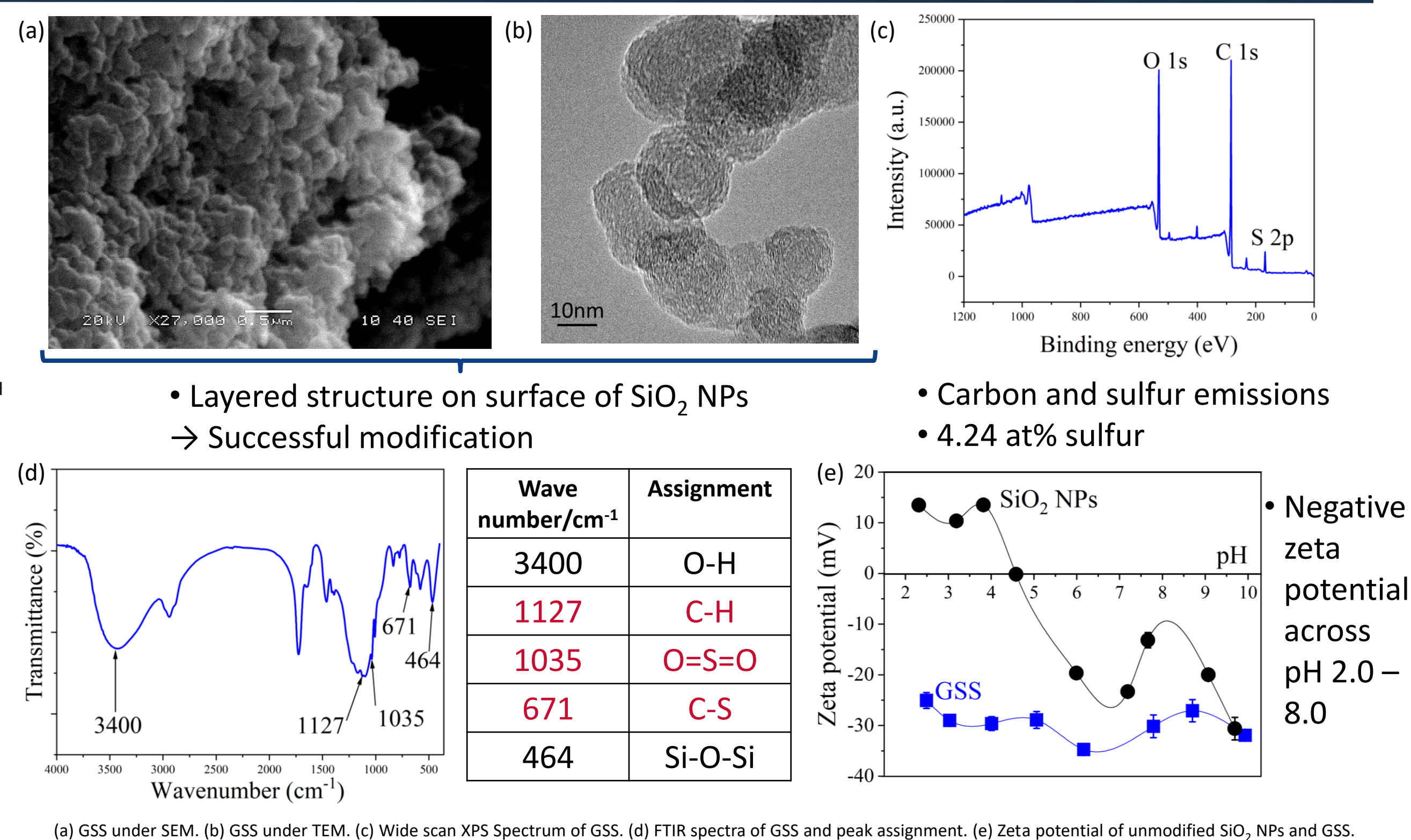
- % change in root and shoot lengths
- Ni(II) concentration in plants
- Bioconcentration Factor (BCF)/Translocation factor (TF)

Conclusion

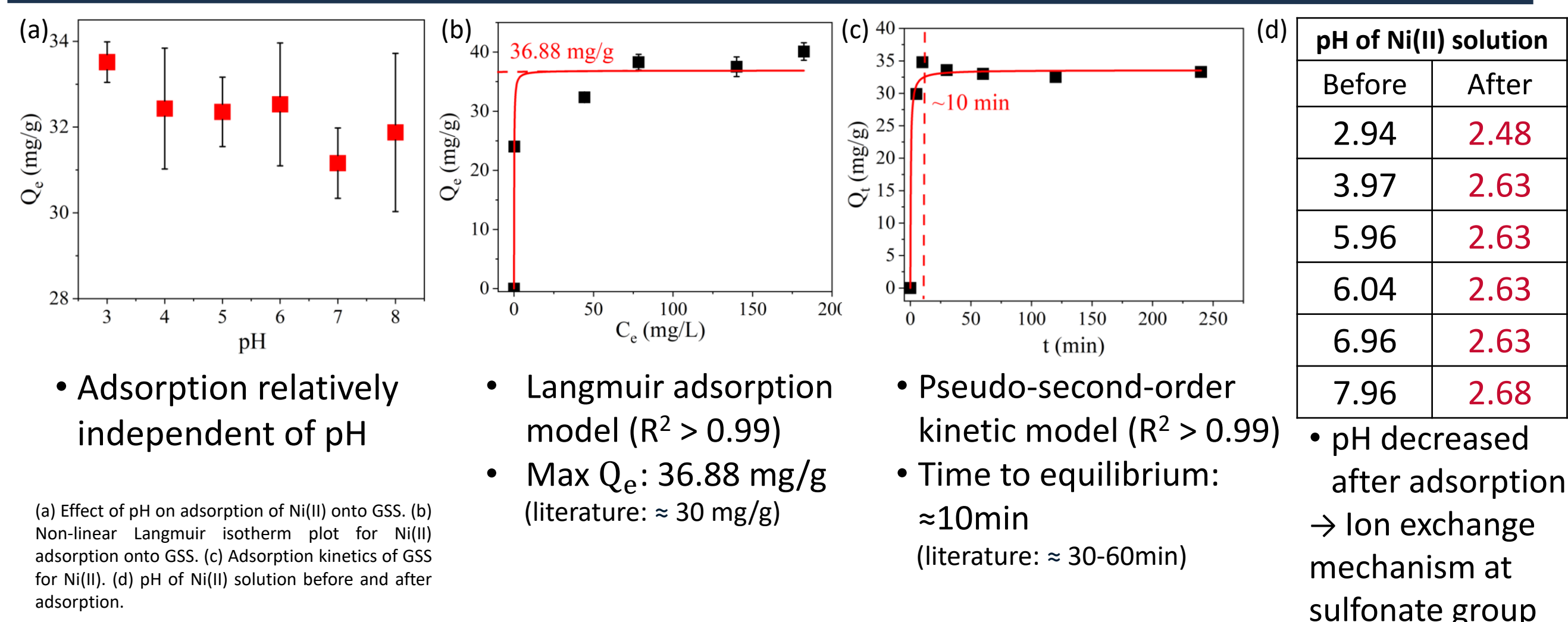
- Adsorption of Ni(II) on GSS is independent of pH, well fitted to Langmuir adsorption model & pseudo-second-order kinetic model
- GSS reduced BCF, TF and Ni(II) concentration in plants. GSS mitigated Ni stress and promoted plant growth. GSS can also act as a carrier for Ni, providing alternate an pathway for uptake
- GSS remains a potential material in enhancing phytoremediation by promoting plant growth

Results & Discussions

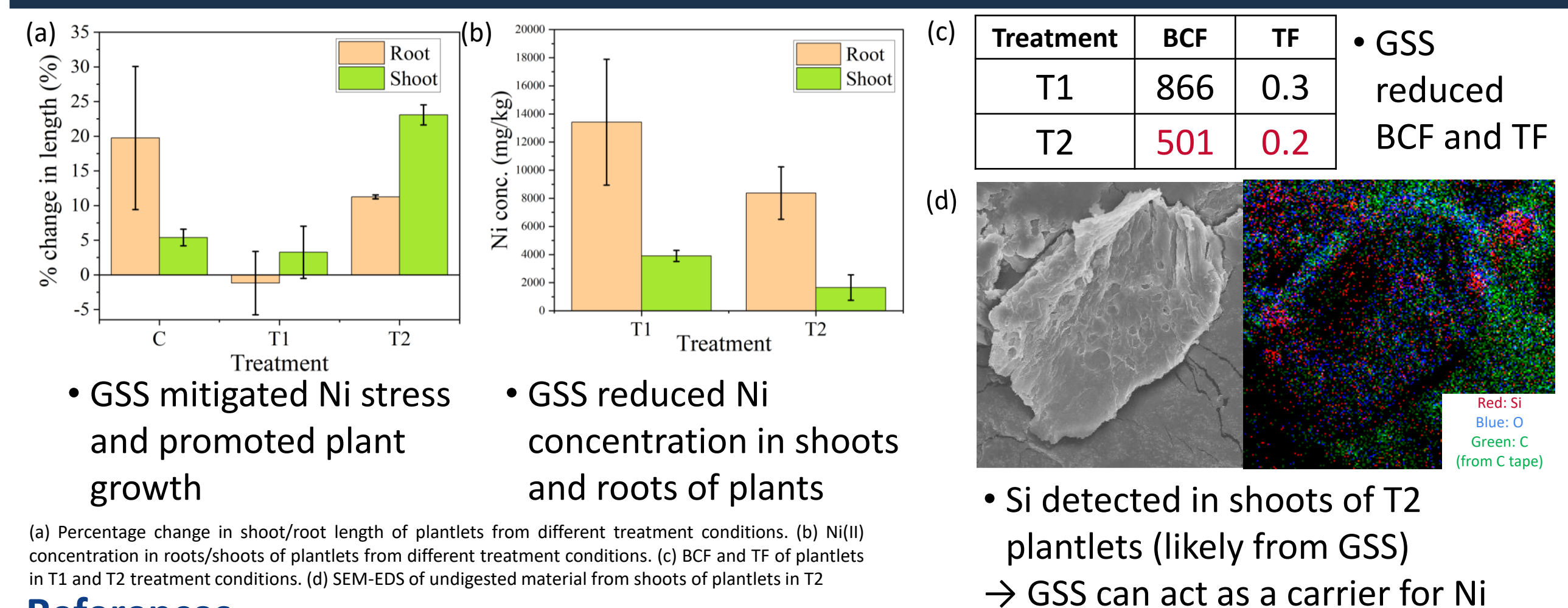
Characterisation of GSS



Adsorption behaviour



Impact on plant growth and Ni phytoremediation



References

- [1] J. M. Costa, J. G. dos R. da Costa, and A. F. de Almeida Neto, 'Techniques of nickel(II) removal from electroplating industry wastewater: Overview and trends', *J. Water Process Eng.*, vol. 46, p. 102593, Apr. 2022, doi: 10.1016/j.jwpe.2022.102593.
- [2] R. Dixit et al., 'Bioremediation of Heavy Metals from Soil and Aquatic Environment: An Overview of Principles and Criteria of Fundamental Processes', *Sustainability*, vol. 7, no. 2, Art. no. 2, Feb. 2015, doi: 10.3390/su7022189.