Supplementary Information Data

Biogenic Chitosan–Selenium Nanoparticles for Improved Stress Resilience in Rice Seedlings

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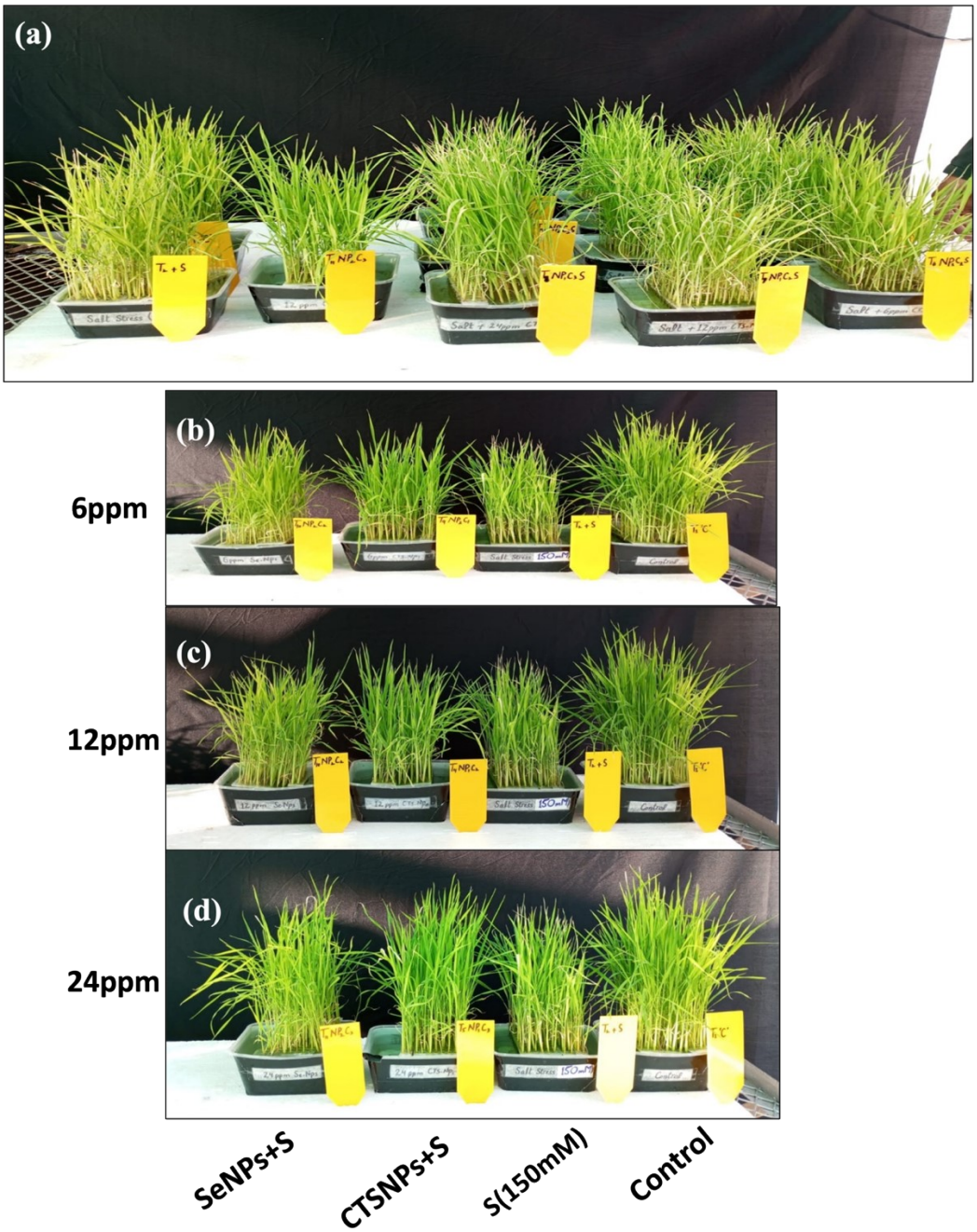

Fig.S1. Comparison of different concentrations of SeNPs & CTSNPs with 150mM salt on Oryza sativa before harvesting (a). Complete experiment (b). 6ppm (SeNPs & CTSNPs) (c). 12ppm (SeNPs & CTSNPs) (d). 24ppm (SeNPs & CTSNPs).

Table S1

Parameters	Se-NPs	CTS-NPs
(a) UV-Vis Spectra		
Peak range	260-280 nm	280-300 nm
Absorption Peak	Sharp and well-defined (plasmon resonance)	Broad peaks (less pronounced plasmon band)
Interpretation	Indicates nanoparticle formation and a smaller size	Suggests a polymeric structure with embedded or coated particles
(b) FTIR analysis (Functional groups)		
-OH, -NH	Present from plant extract as a reducing/ capping agent	Strong signals from the chitosan backbone
C=O, C=C	From phytochemicals (phenolics, Flavonoids)	May arise due to minor modifications or additives
Se-O or Se=O (if oxidized)	Weak peak may appear (~600-700 cm^{-1})	Absent
C-N, C-O	Possible with capping agents	Strong, from the Chitosan structure
(c) XRD Diffraction Pattern		
Crystallinity	Highly distinct peaks indicate a crystalline nature	Low-broad halo pattern indicating amorphous structure
2θ Peaks	Characteristics peaks of elemental Se (e.g., 23´, 30´, 43´)	Broad peak around 20´ (typical of chitosan)
(d) DLS (Dynamic Light Scattering)		
Size range	Typically, 30-100 nm	Typically, 100-200 nm
Polydispersity Index	Low to moderate (0.2-0.4)	Higher (0.3-0.6), due to polymer aggregation
Zeta potential	-20 to -30 mV (moderate stability)	+30 to +40 mV (cationic chitosan provides high stability)
(e) SEM Imaging (Morphology)		

Shape	Spherical or slightly irregular	Rough, semi-spherical, or irregular
Surface Texture	Smooth and slightly agglomerated	Dense and compact polymeric surface
Particle Size	30-80 nm (individual), some clusters	100-200 nm (due to chitosan matrix)
(f) EDS (Energy Dispersive X-ray Spectroscopy) (Key element Detected)		
Selenium (Se)	Strong, confirming elemental Se	Absent
C, O	Present due to the organic matrix	Present in Higher amounts (from Chitosan)
N	Trace or absent	Prominent due to chitosan
Other elements	Possible residual (Na, Cl)	Possibly Na, P, or crosslinking ions (e.g., TPP)
Summary of Difference		
Structure	Metallic, Crystalline	Polymeric, mostly amorphous
Stability	Moderate (negatively charged)	High (positively charged due to chitosan)
Size	Smaller (30-100 nm)	Larger (100-200 nm)
Elemental profile	Rich in Se	Rich in C, N, O (from Chitosan)
Application Stability	Redox activity, stress mitigation	Controlled release, biocompatibility