Rapid Cycling \textit{Brassica rapa}: A Novel Phytomining Plant


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Materials & Methods

\textit{Brassica} rape plants were grown hydroponically in gold ion solution (50µM or 500µM HAuCl$_4$ in 50% standard Hoagland solution) or gold nanoparticle (AuNP) solution (5mg/L or 50mg/L gold nanoparticles in 50% standard Hoagland solution). After 14 days of growth, samples from the root, stem and leaf were collected and prepared for TEM analysis. TEM samples were fixed with 4% glutaraldehyde/2% formaldehyde in 0.2M sodium cacodylate buffer, post-fixed with 2% osmium tetroxide, dehydrated in a graded series of acetone, embedded and cured in epoxy resin. TEM sections were collected onto 200 mesh copper grids and imaged unstained with a JEOL JEM-2100.

Results & Discussion

AuNPs were only found in the root of the plant grown in 500µM HAuCl$_4$ in 50% standard Hoagland solution (Figure 1C). None of the plants grown in AuNP solution showed signs of gold nanoparticles in the roots (Figure 1D & E). The size and shape of AuNPs found in the root were similar to AuNPs synthesized by the Turkевич method (Figure 7) in the lab (Figure 2). Stem and leaf samples did not contain gold nanoparticles under any experimental condition (Figures 3 & 4).

Based on these findings, it is believed that \textit{Brassica} rape is capable of phytomining. Furthermore, since there were no nanoparticles found in the tissue of plants exposed to pre-formed nanoparticles, it can be concluded that the AuNPs found within the root tissue are a result of metal ion reduction by the plant. \textit{Brassica} rapa, with its accelerated lifecycle, has the potential to more efficiently decontaminate heavy metal ion polluted soil than other, slower-growing \textit{Brassica} species. Future studies will look to confirm the presence of AuNPs in the plant tissue using X-ray microanalysis. Studies will also be done to determine if additional metal ions can be reduced by \textit{Brassica} rapa.

References


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