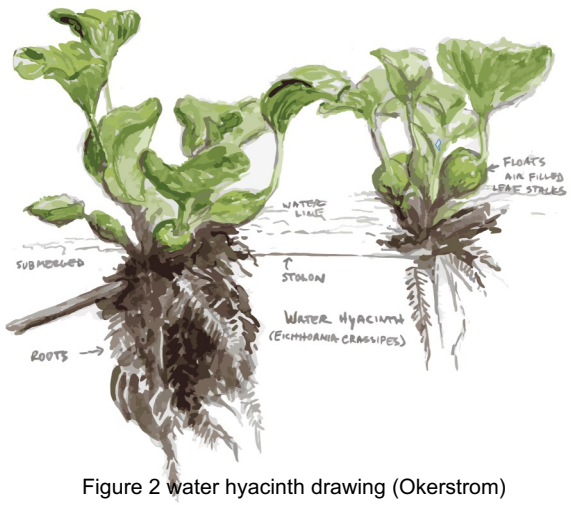

Figure 2 water hyacinth drawing (Okerstrom)

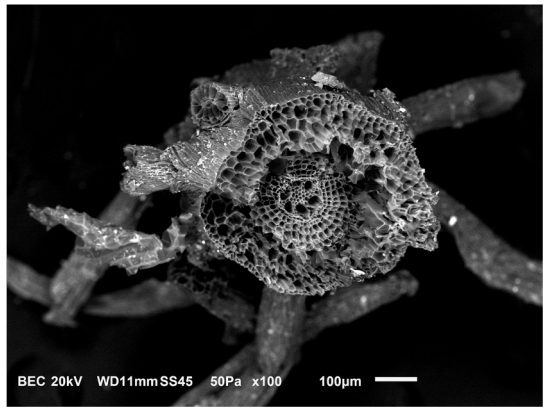

Figure 5 SEM image of water hyacinth root cross-section

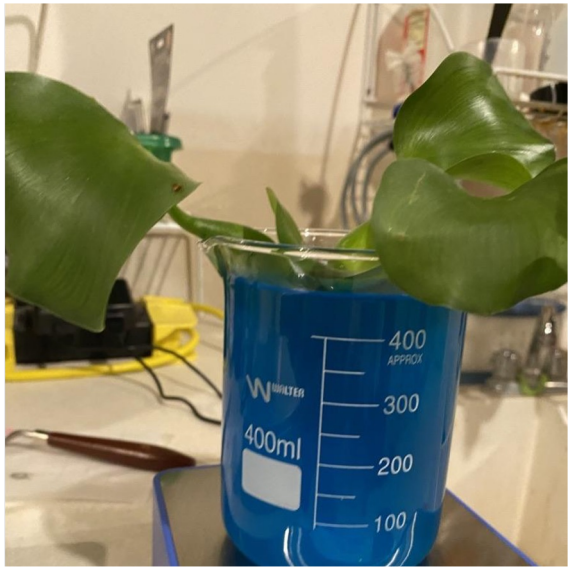

Figure 1 water hyacinth in aqueous e-waste

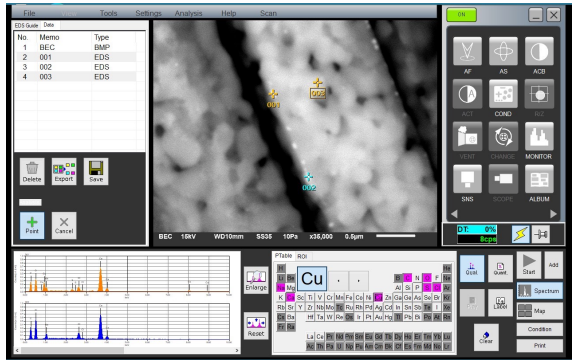

Figure 4 Water hyacinth root showing multiple metal particles extracted from e-waste

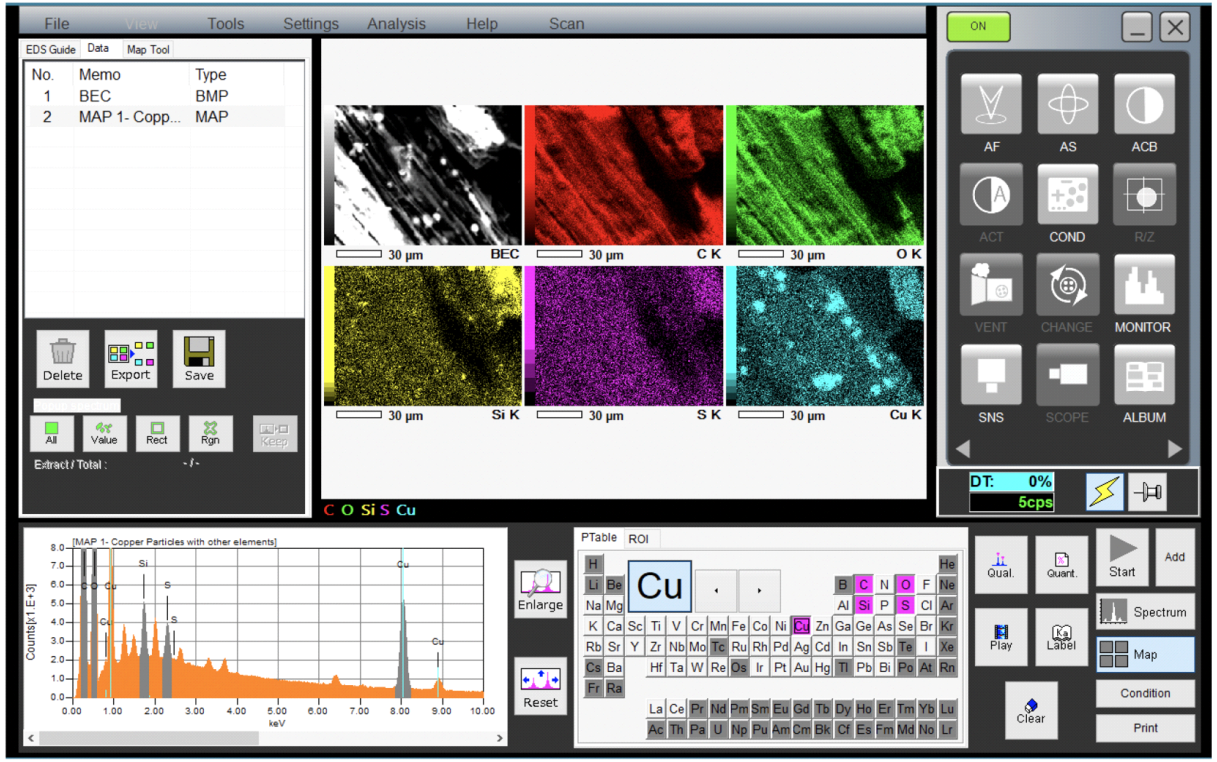

Figure 3 Scanning electron microscope (SEM) X-ray map and spectra of water hyacinth ashed root showing copper particles.

Lichen Labs Submission Summary Slide

Micro-mining e-waste

Our innovation proposes micro-mining critical metals from an aqueous e-waste solution using the water hyacinth (figure 1), a readily available plant. The roots drawn in figure 2 have been demonstrated to uptake copper ions and convert them to particle form (figure 3). Using biomimicry, the method of learning from and emulating adaptations in nature, we will be able to define and mimic the process used by the water hyacinth root. Figure 4 shows a small portion of the ashed root tip found in the scanning electron microscope with a calcium structure consisting of ultra-fine tubes with pores . Copper particles in the range of tens of nanometers were found periodically on each side of a tube. This shows the capacity of the root for a chemical/physical filtration process. Figure 5 suggests that the water hyacinth root is a multi-scale tubular formation. Ultimately, mimicking the water hyacinth's heavy metal mining process would facilitate scaled-up metal recovery from e-waste.