

‘Metal hyperaccumulator plants – biological curiosities but a valuable phytotechnological resource for soil clean-up and biorecovery of valuable resources’

Abstract:

Hyperaccumulator plants take up and bioaccumulate metallic and metalloid elements in the above-ground biomass, frequently to as high as several percent on a dry weight basis. These biological curiosities have now been discovered in many unrelated plant families from both temperate and tropical regions. Some 700+ are currently known for elements including nickel, zinc, cadmium, manganese, cobalt, arsenic, selenium, antimony, thallium and even the so-called rare earth elements (REEs). Advances in rapid and non-destructive analytical techniques such as hand-held XRF have allowed mass simultaneous screening of herbarium materials for multiple elements in local and regional floras. Synchrotron (EXAFS, XANES) and micro-PIXE investigations are enabling detailed localization studies of hyperaccumulated elements in plant tissues, so providing new knowledge on the uptake and transport mechanisms involved.

This presentation will review the current state of knowledge of these unique plants and how their extreme physiological properties are being harnessed in phytotechnological applications including soil clean-up, ecological restoration of mineral wastes, biorecovery and for phytomining metals of economic importance. In the last years several large-scale nickel agromining trials have been implemented through EU programs targeting ultramafic soils in Albania, Greece, Spain and Austria. A similar program in Malaysia (Sabah) has now led to a commercialized operation for nickel agromining on extensive areas of abandoned agricultural land, so providing much-needed local employment opportunities and a general improvement in soil conditions. Great possibilities exist for the recovery of other important metals and metalloids from low-grade sources using phytotechnologies.