Geobotany and Biogeochemical Prospecting

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Sediment and soil functionally show semblance. Without soil no plant can exist. Thus, correlation of plant occurrence on sediment/soil provides vital information about mineral richness in the substratum. Mineral exploration plays an important role for economic growth. Plants that hyperaccumulate metals (Metallophytes) occupy prominent position in bioeconomy. Recent advances highlight the importance of phytoextraction and phytomining of precious metals. Gold phytoextraction discovery has created huge demand for these technologies. The role of “metallophytes” in emerging phytotechnologies (= plant based technologies for environmental management) is discussed in this presentation.

Plants metal interactions can be classified into 4 categories: (a) Hyperaccumulators, (b) accumulators, (c) indicators and (d) excluders. Hyperaccumulators have potential to find buried metal ores and also help to reduce the risks of metal-contaminated substrates. Metallophytes, accumulate very high concentration of metals up to 6% e.g. nickel, cobalt, zinc or copper in their biomass and are called ‘hyperaccumulators’. These plants can be utilized in ‘biogeochemical prospecting’ (locating ore-bodies using indicator species), ‘phytoextraction’ (cleaning up of metal-contaminated soils by removing metals), and ‘phytomining’ (commercially producing metals from phytomass). Growing selected hyperaccumulator plants on sub-economic ore bodies or mineral wastes with subsequent harvesting and incineration generate high-grade bio-ore. Recently, induced phytomining has also been successfully demonstrated for gold. Despite the scientific validation, mining industry is yet to exploit the potential of phytomining in India.

The lecture highlights the following aspects:

(a) The metallophytes—properties, functions and evolutionary significance;
(b) How can metallophytes be applied to mine waste remediation?
(c) The potential of geobotanical studies for phytomining;
(d) Scope for development of polymetallic catalysts.

Recently Noccaea caerulescens and Anthyllis vulneraria are used as starting raw materials to prepare novel poly-metallic catalysts useful for Lewis acid catalyzed reactions. Thus, these new polymetallic catalysts bring new possibilities in Green Catalysis, and are named as “Ecological Catalysts.”

- Laboratory of Analytical Chemistry and Applied Geochemistry, Faculty of Bioscience Engineering – Ghent University, Ghent, Belgium, 2011-2014. Several times;
- Ural Federal University, Ekaterinburg, Russia. Several visits since 2007;
- Botany Department, al-Farabi Kazakh National University, Almaty, Republic of Kazakhstan - 2006 and 2007;
- Centre for Environmental Risk Assessment & Remediation, University of South Australia Mason Lakes Campus, Adelaide, Australia 2005;
- Department of Botany University of Oulu, Finland - 2003 - Finnish Academy
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