Luvig Löwemark + 柯家吟

* **Forensic and environmental application of XRF scanning: a citizen science project**

The XRF core scanning technology has great potential in the fields of environmental protection and forensic geology. For example, the study of leaching and accumulation processes of heavy metals in soils often require both temporal and spatial variations in metal concentrations in soil reactor cells to be assessed. The rapid and non-destructive analysis possible with XRF core scanners allows the leaching, transport, and subsequent redeposition of different elements to be monitored over time periods simulating natural and anthropogenic leaching scenarios as response to various leaching agents. In a study performed by the Department of Bioenvironmental Systems Engineering at National Taiwan University, the leaching and remobilization of Ni, Cd, Pb etc. was studied in artificial soil reactors to address how these elements may behave in nature as a response to acidic precipitation or the release of acidic waste waters.

The recently developed concept of XRF scanning of ion exchange resins for the assessment of environmental pollution of natural waters has the potential to become a standard method for ***large scale monitoring and detection of heavy metal pollution***. In short, ion exchange resin is place in natural waters for a certain period of time, is then retrieved and place in sample holders developed for powdered samples, and then scanned with the XRF core scanners. Because the amount of heavy metals taken up by the resin is directly proportional to the concentration in the water, the XRF core scanner results can be used to identify and quantify sources and distribution of heavy metal pollution in for example river networks and irrigation channel systems. Other potential applications include long term monitoring of water quality of aquacultures, industrial waste water drainage systems, as well as natural river catchments. The low cost and easy handling of the resin samples makes them suitable for large scale ***citizen science projects***. For example, it would be possible to engage local schools in the monitoring of local surface water quality. Resin bags could be sent out to schools who let the students deploy the resin bags in local water streams for a certain time. The resin bags are then collected together with GPS position retrieved by smartphone and sent by regular mail to the lab for analysis. The results could be published online using a GIS system that allows the schools to follow the results more or less in real time.

**GOALS**:

1. Develop a ”citizen science” project with senior high-school students.
2. Examine spatial and temporal variation in heavy metals in surface waters and drainage channels.
3. Identify pollution hotspots related to clandestine industrial activities.

**REQUIREMENTS**:

1. Knowledge and interest in environmental protection and chemistry. Interests in general chemistry, chemical observation, and basic statistical analysis.
2. Basic laboratory skills in chemistry.
3. Reading/writing/speaking capabilities in English.
4. Capability and interest to collaborate with senior high-school students.