In situ delineation of point sources and high resolution mapping of polluted sites by X-ray Flourescence field-portable handheld device

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Abstract

In situ or *on site* metal detection methods able to spot on site the extent, the size and heterogeneity of the pollution have gained an important role in site assessment, environmental monitoring and in the follow up of the effects of interventions.

One of the advantages of in situ measurements is the continuous and real time data provision, so that interventions required within the polluted site could be done in time. The field-portable devices allow assessment of large sites and on-site monitoring of remediation technologies. The in situ metal detection methods have lower precision compared to the laboratory analysis, but they make possible performance of more measurements, covering larger areas, therefore providing an immediate overview on the actual condition of the site, which is often more important, then having some accurate laboratory analysis results on a heterogeneous site. The NITON XRF device is able to perform immediate, non-destructive, quick multi-element detection.

In this paper the possibilities and advantages of *in situ* metal detection using a NITON field-portable XRF instrument are presented.

The paper demonstrates the advantages of the NITON XRF instrument and technique via a real case study in the toxic metal polluted area of Gyöngyösoroszi - Toka watershed. As a result of the former mining activity, several million tonnes of mine waste material, flotation tailings, mud tails and precipitates from acid mine drainage treatment are disposed concentrated or diffusely in the Gyöngyösoroszi area. The toxic metal pollution is primarily delivered by the rain water reaching the Toka creek. During springtime due to the regular floods the hobby gardens along the creek are covered by the water transported sediment.

The NITON XRF device was used 1) to delineate point sources, 2) to provide high resolution mapping, 3) to map diffuse toxic metal pollution, 4) to identify transport routes. Distribution of the detected metal concentration within the assessed area was visualised on 3D charts using STATISTICA®6.0 software.

The point sources in the contaminated area, including the mine waste dumps left over in the forest from the abandoned mining activity were delineated by the NITON XRF instrument.

Some of the polluted hobby gardens in the flooding area along the Toka creek have been also investigated. The maps show clearly the distribution of the metal pollution in the area. The effect of the floods occurred along the Toka creek become obvious on the maps; the land-strip near the creek shows extremely high metal concentrations.

The run of mine ore transportation line section from the mine adit to the flotation plant was also mapped by NITON XRF. The measurement profile showed a clear gradient.

According to our results the NITON portable XRF instrument can be employed both to the delineation of point sources and to the mapping of the location of toxic metal pollution dispersed on large areas. This *in situ* method allows mapping of large areas in relatively short time, reducing the amount of the required laboratory analysis and consequently the relevant costs. It can be used during excavation and removal of contaminated waste and soil.

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