A LIBS-based field instrument for fast monitoring of metal contaminated sites.

PINI Roberto[1], BARBAFIERI Meri[1], CASSINA Luca[1], TASSI Eliana[1], CIUCCI Alessandro[2]

[1]Institute of Ecosystem Studies, National Research Council
[2]Geostudi Astier S.r.l. via della Padula, 165, 57124 Livorno

Abstract:
The need for fast, reliable and cheap monitoring of contaminated sites is widely recognized. Whether the goal is to contain the contaminant or to remediate it, the site must be routinely sampled and monitored. Moreover, reliable estimation of the contaminant is critical to ensuring that remediation is proceeding sufficiently to protect human health and the environment. In particular, when plants are used to remove or contain contaminants, as in the case of phytoremediation, the goals are reached in a long time and many analyses are required to evaluate the remediation efficiency with time. Conventional characterization techniques require extensive sampling and analyses, which are costly, time consuming and can result in high levels of personnel exposure. So many operators are turning attention to new technologies in order to optimize (i.e. minimize) remediation costs just starting from an effective, accurate, and low cost characterization. Portable analytical instruments can be a useful alternative to traditional laboratory analyses. We tested a transportable system based on LIBS (Laser Induced Breakdown Spectroscopy) technique for fast multi-element in situ measurements of contamination of heavy metals. The technique is based on the detection of light emitted from a micro plasma produced by a short laser pulse. The high temperature of the plasma ionizes the material of the sample and after few microseconds atomic lines are emitted. No sample preparation is required. An own made procedure to find out trace elements in the sample and to determine the chemical concentration is used. Preliminary data on the application of LIBS technique are reported. LIBS has been used to carry out measurements of metals concentration in soil and dry vegetal samples from different contaminated sites. The same samples have also been analysed by traditional laboratory analyses that comprehend different steps: drying, digestion and metal analysis by Atomic Absorption Spectrometry. Results obtained from LIBS showed a good correlation with data obtained with AAS. In particular, in the case of the contaminated site characterization LIBS makes possible an easy delimitation of areas showing a metals concentration over the legislation limits, where further investigations are required. Speeding up the characterization procedure decreases investigation costs and increases the quantity of data. So more accurate spatial information is obtained, that leads to lower cost of remediation.

Keywords: LIBS, contaminated sites, heavy metals
Topic: A. Methodology for urban and disturbed soils
Sub-topic: A3. Laboratory methods
Presentation type: Poster

Information of corresponding author
Full Name: Roberto Pini
Organization: Institute of Ecosystem Studies, National Research Council
Mailing address: Via G. Moruzzi, 1, 56124 Pisa, Italy
Tel: =+390503152477
E-mail: roberto.pini@ise.cnr.it