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Laser Induced Breakdown Spectroscopy (LIBS) application in monitoring of heavy metals polluted soils

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Soil contamination by heavy metals is today a worldwide problem. Controlled and uncontrolled disposal of waste, accidental and process spillage, mining and smelting of metalliferous ores, sewage sludge application to agricultural soils are responsible for the migration of contaminants into non-contaminated sites as dust or leachate and contribute towards contamination of our ecosystem. As soils play a fundamental role in the regulation of pollutants in ecosystems (either as source or as sink), they constitute the major pathway for human, animal and ecological exposure to environmental contaminants. Consequently, remediation and monitoring technologies are nowadays strongly required both in decontaminating the environmental site and in preserving soil quality and functions. An important objective in monitoring and remediation activities on polluted sites consists in supplying immediate information on the contaminants present in soils although, at present, the characterization phase of polluted soils requires a preliminary evaluation in situ, followed by laboratory analyses (e.g., ICP, AAS). In this connection fast and in situ analytical tools can play important role for both monitoring soils and establishing remediation strategy. The Laser Induced Breakdown Spectroscopy (LIBS) presents, between many analytical techniques that have been employed for the elemental analysis of soils, relevant advantages: i) the fast response and high sensitivity (generally tens of ìg g-1); ii) the simultaneous multi-element detection of major, minor and trace elements; iii) the possibility of making

the analysis without sampling or surface treatment; iv) the flexibility of the experimental set-up configuration leading to compactable and automatic system to perform in situ analysis. Moreover, the LIBS is a non destructive analytical technique based on laser induced plasma. The atomic and ionic plasma emissions are used to identify the sample elements and to perform quantitative analysis of the sample. In this work, several slightly ground soil samples and one sewage sludge sample, all of them prepared as pellets and showing highly variable metal concentrations, have been analyzed by LIBS technique. A comparison with inductively coupled plasma/optical emission spectrometry (ICP/OES) analysis has also been carried out to prove the feasibility of this technique. Preliminary data show a good agreement between the two methods, thus indicating both that a quantitative determination of trace elements on such heterogeneous matrix is possible, and that the different matrices do not affect the elemental determination.