Title: Analytical LIBS as a tool for developing nations- analysis of soils and sediments for watershed remediation efforts

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Abstract:

Analytical laser-induced breakdown spectroscopy (LIBS) has been developed as an accessible tool for use in developing nations to address important questions. This laser-based sampling/analysis method provides good precision, accuracy and adequate detection of a large number of target analytes for a variety of matrices. Our laboratory has previously reported LIBS methods for the characterization of bulk soil composition and we now report analysis of sediments and sediments on filter paper for the purpose of fingerprinting to determine the source of soil erosion. A Global Water for Sustainability (GLOWS) project at FIU aims to improve water resource management in Rwanda and other developing nations with LIBS data providing the necessary scientific data to make policy decisions on water usage. Soil erosion leads to high sediment load in a river with attendant degradation of aquatic ecosystems and water quality, increased flooding hazard, decreased hydroelectric reservoir capacity and valuable loss of topsoil limiting agricultural productivity.

Soil and sediment specimens were taken throughout the Nyabarongo Upper catchment - the farthest headwaters of the Nile River. Soils were sieved to < 64 μm to be comparable to sediments. A LIBS method was developed. Both LA-ICP-MS and LIBS analyses were performed on all specimens. Both techniques produced good quality data that could be used in mixing models to determine the relative contribution of each soil to the elemental profiles of the sediments at each sampling location.

LIBS performed well and was fit-for-purpose for the analysis of soils and sediments for sediment source determination. LIBS is therefore a suitable technique for elemental analysis applications in developing nations.