

A STANDARD-LESS CALIBRATION METHODOLOGY FOR ENERGY DISPERSIVE X-RAY FLUORESCENCE (EDXRF) MEASUREMENTS BASED ON FUNDAMENTAL PARAMETERS

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X-ray fluorescence (XRF) is an elemental analysis technique with unique capabilities including highly accurate determinations for major elements and a broad elemental survey of the sample composition over a wide dynamic concentration range, from PPM (parts/million) levels up to virtually 100% by weight. In general, calibration of an instrument by checking the instrument against known reference standards is crucial to verify the measurements are realistic and to obtain the uncertainties within the measurements. For some cases such as geological or biological samples, standards with similar matrices may be difficult to prepare. Recently, Fundamental Parameter (FP) method has been developed to come up with solutions for this problem. The objectives of this work were to contribute for developing XRF technology for identification of geological and biological samples by establishing a standard-less manual calibration method based upon fundamental parameter technique and investigate the validity of the EDXRF (Energy Dispersive XRF) analytical system available at Atomic Energy Authority (AEA), Colombo, Sri Lanka. The geometric factor of the EDXRF was obtained using the statistical relationship between intensity and concentration of x-ray fluorescence for infinitely thin samples with known concentration by neglecting any enhancement or absorption effect. Three reference materials: IAEA Lake sediment SL-1 (uncontaminated soil), NIST SRM 2710 (highly contaminated soil), and IAEA-PT09 (Proficiency Test sample 09) were prepared as intermediate thick pellets and were next analyzed by using the XRF spectrometer based on Emission Transmission (E-T) method using a multi-element target consists of Ti, Mn, Zn, and Pb. Dilution and absorption corrections were made where necessary. While it has not been possible to use a multi-element target containing many elements due to lack of resources we worked with, it was possible to obtain the concentrations of elements Ti, Mn, Zn and Pb only. The values of concentrations were satisfactory within an order of magnitude to its standard value of concentration. It can be used to quantify major and trace elements simultaneously. However, this FP based method of calibration is highly useful when the instrument is not compatible with software, where it can be calibrated automatically or to check errors that may encounter when working with hardware and software. Since, this is a highly significant area of exploratory study we hope that this work will stimulate further investigations in this field.