X-RAY FLUORESCENCE SPECTROMETRY IN THE ENVIRONMENTAL FIELD: A REVIEW OF SOME RECENT INVESTIGATIONS AND APPLICATIONS

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Metal contamination is one of the most ubiquitous, persistent and complex environmental issues, encompassing legacies of the past (e.g. abandoned mines) as well as current anthropogenic activities (e.g. smelting, fuel combustion or electroplating activities). As a consequence, one of the challenges facing society today is the identification, evaluation and remediation of contaminated areas to protect public health and environment quality. These studies are heavily dependant on observation and quantitative measurements of the amounts and distribution of metals, leading to the necessity of having appropriate analytical methodologies.

Nowadays, X-ray fluorescence spectrometry (XRF) is a well established analytical technique for elemental analysis of a wide variety of samples. In particular, the truly multi-element character, acceptable speed and economy, easy of automation and versatility are the most important features among the many that have made it a very mature analytical tool in the environmental field. The recent development of digital signal processing based spectrometers in combination with enlarged X-ray production using better designs for excitation-detection has added the advantage of increasing instrumental sensitivity, thus improving both precision and productivity. Besides, in recent years, the development and commercialization of benchtop spectrometers, which offer extreme simplicity of operation in a low-cost compact design, have promoted even more the approach of such technique in the environmental field for many analytical problems. However, despite that the rapid advance in spectrometer configurations, direct XRF analysis of some complex environmental samples still entails technical difficulties and chemical strategies for sample preparation are needed prior to XRF analysis. In this sense, it is of great importance to pay attention to the sample preparation procedure used that will affect not only the final quality of the measurement but also the latter type of attenuation correction to be considered to compensate for sample self-absorption.

In this sense, the implementation of different configurations of XRF spectrometers, including laboratory instrumentation and hand-held equipments for on-site analysis, has been evaluated to achieve reliable analytical results for environmental samples analyses at many different scales (from micro to macro). A good sensitivity and lateral resolution were obtained for such instrumentation enabling their application in the environmental filed.