

Real-Time Spatial Mapping of Metal Contamination in Environmental Waters for Sustainable Ecological Monitoring Using a Portable X-Ray Fluorescence Device

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Abstract : The monitoring of metal pollution in environmental waters is crucial for the protection of ecosystems, human health and agricultural activities. Traditional laboratory-based metal analysis methods are time-consuming and expensive, which often leads to delays in the availability of information. This study presents an approach to real-time water quality monitoring using portable X-ray fluorescence (p-XRF) technology coupled with geographic information systems (GIS). Using a custom Python script, p-XRF data is processed and formatted into a GIS-compatible format, facilitating spatial visualization of metal concentrations in QGIS. Field-usable filters, especially bisphosphonate-functionalized thermally carbonized porous silicon (BP-TCPSi), preformed metals such as Mn, Ni, Cu, Zn, and Pb allow direct detection in the field by using p-XRF. Key objectives include robust data collection, spatial visualization and validation processes to ensure accuracy and efficiency. This provides quick and efficient insights into metal contamination trends and allows proactive decision-making.

Keywords : metal concentrations, predictive mapping, environmental monitoring, environmental waters

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