GLOBAL MEET ON CLIMATE CHANGES AND SUSTAINABILITY

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Analytical performance of TXRF and ICP-MS in the detection of arsenic and lead in mussels

Abstract: Mussels are widely consumed globally, valued for their nutritional content but can pose a risk as potential sources of toxic compounds such as heavy metals. Analyzing the heavy metals levels is crucial, as it has significant biological consequences due to their ability to interfere with cellular processes and metabolism. This study compares two analytical techniques, Total Reflection X-ray Fluorescence (TXRF) and Inductively Coupled Plasma Mass Spectrometry (ICP-MS), for detecting arsenic (As) and lead (Pb) in mussels. The aim was to determine the faster, more accurate, and cost-effective method for heavy metal detection. Both techniques were validated using a certified reference material (CRM).

TXRF offers a non-destructive approach with fast sample preparation, low chemical consumption, and fast multi-element analysis, whereas ICP-MS is known for its high sensitivity, broad detection range, and low detection limits but requires more complex preparation and is a more expensive method due to gas consumption. The study compared the analytical performance metrics such as detection limits, precision, and recovery rates.

The results showed that TXRF performed well in detecting As, with a recovery rate of 95.97%, slightly better than ICP-MS at 91.64%. However, for Pb, ICP-MS was significantly more effective, achieving a recovery rate of 85.55%, while TXRF's recovery rate was much lower at 39.62%, indicating limitations in Pb detection.

In conclusion, TXRF is a cost-effective and viable option for As detection but is less reliable for Pb analysis. ICP-MS, despite being more expensive and complex, proved to be a more comprehensive method for detecting both elements. Optimizing TXRF's extraction method could potentially improve its Pb detection performance, making it more competitive. The choice of analytical method should therefore be based on the specific element of interest, balancing the required detection sensitivity with considerations of speed and economic efficiency.

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Biography: Nina Nicoleta Lazar completed her PhD at the age of 30 years at `Dunarea de Jos` University of Galati, Romania. She is a research assistant at REXDAN Research Infrastructure. She has published 24 papers in reputed journals, with a cumulative IF of 39,328, having an h-index of 8 on Google Scholar, Scopus, and WOS. She is part of the research team of three Horizon projects, with a research work experience of 6 years in multiple national and international research projects.

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