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Abstract

Introduction: Advances in benchtop micro-XRF allow for the potential expansion of 2D exposure assessment for epidemiological and toxicological samples down to a spatial resolution of 10um for simultaneous 30+ element quantification. We aimed to identify the advantages of this method in comparison to other more traditional methods. Methods: We used a comparison of methodologies between synchrotron XRF at the Advanced Photon Source at Argonne National Lab, laser ablation inductively coupled plasma mass spectrometry (LA-ICP-MS), and micro-XRF using a Bruker M4 Tornado system in order to measure sectioned human tibia bone samples, paraffin embedded rat lung, and sectioned human teeth samples to identify potential variations among the techniques by specimen type, limits of detection, and quantification. Results: We found strong agreements between the quantification results from each method (>90% agreement for samples). For a 1 second dwell time, we identified a detection limit of 4.8 ppm for a single 10um pixel. Using a longer dwell time or summation of pixels results in correspondingly lower detection limits. Quantification differences between approaches, particularly with LA-ICP-MS where data is normalized to a major element, did not have broad impacts on the data. Conclusion: The detection limit of the micro-XRF was within range to analyze teeth and bone effectively with short measurement times. For tissue based toxicological studies, the time per pixel will need to be increased to take advantage of the 10um resolution, but for many epidemiological tissues such as teeth, the benchtop XRF can accurately quantify exposures. Micro-XRF has significant advantages over LA-ICP-MS sample destruction or the necessity for beamtime at a synchrotron source.

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Final Program

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