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Comparison of Bulk and Micro Sampling Techniques for the Elemental Analysis of SRM 610 and 612

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The glass Standard Reference Materials (SRM) 610 and 612 are frequently used for microanalysis by the forensic and geological communities. However, SRM 610 and 612 were designed and certified to be used as bulk-scale reference materials for the analysis of trace elements in glass [1,2]. This study evaluates the differences in elemental mass fractions obtained using bulk-sampling techniques (inductively coupled plasma optical emission spectroscopy (ICP-OES), instrumental neutron activation analysis (INAA), and cold neutron prompt gamma activation analysis (CNPGAA)) and a micro-sampling technique, laser-ablation inductively coupled plasma mass spectrometry (LA-ICP-MS). E_n scores were used to evaluate the agreement between the bulk and micro-scale measurements, the National Institute of Standards and Technology (NIST) Certificate of Analysis (CoA) values, and community consensus values [2,3]. Lithium and hafnium showed high E_n scores when comparing LA-ICP-MS to the bulk techniques. Monte Carlo (MC) analysis was used to quantify expanded uncertainties for each analytical technique. For LA-ICP-MS, the MC analysis showed high correlations, due to the use of a single calibration standard, and an increase in the overall uncertainty compared to the Guide to the Expression of Uncertainty in Measurement (GUM). For the bulk techniques, the MC analysis identified overly conservative uncertainty estimates, which led to a decrease in uncertainty for some elements compared to GUM. The results of this study highlight the need for new glass reference materials designed for micro-scale trace element analysis.

References

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