Elemental Analysis of Glass by SEM-EDS, µXRF, LIBS and LAICP-MS

The report documents the continuing interest in the elemental analysis of glass within the forensic community. The report resulted from a Department of Justice grant. The analysis of small quantities of materials has become an important yet underutilized type of evidence at many crime scenes including hit-and-run accidents and other violent crimes. The high expense and sophistication of some of the more reliable mechanism has limited the adoption of this technology by the typical forensic laboratory. The study attempts to compare the discrimination power between the methods used in most forensic laboratories for glass analysis. The aim is to create a more “standard” method that can be used by the operational forensic laboratory and a “match criteria” for use in routine casework situations. Laser induced breakdown spectroscopy (LIBS) was shown to provide excellent discrimination potential for a glass set consisting of 41 automotive fragments recovered from 14 different vehicles. The discrimination power of LIBS was compared to two of the leading elemental analysis techniques, uXRF and LA-ICP-MS, and the results were similar; all methods generated >99% discrimination and the pairs found indistinguishable were correlated across the analytical methods. Also included in this research was an extensive data analysis approach developed by to minimize Type II (false inclusion) and eliminate Type I (false exclusions) errors for LIBS spectral comparisons resulting in the recommendation of 10 ratios to be used for glass discrimination by LIBS.

@article{almirall2012elemental,

title={Elemental Analysis of Glass by SEM-EDS, μXRF, LIBS and LA-ICP-MS},

author={Almirall, Naes, Cahoon, Trejos},

journal={National Criminal Justice Reference Series},

year={2012},

publisher={Department of Justice}

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