Use of Compton to Rayleigh Ratio for the Indirect Analysis of Light Elements in Glass Fragments for Forensic Applications

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Micro x-ray fluorescence spectroscopy (μ-XRF) is a standard technique used for the forensic analysis of glass. Nonetheless, a common criticism of the technique is its limited capability of analyzing light elements (atomic number < 11). It is well known that the Compton to Rayleigh (C/R) ratio is related to the average atomic number of the sample. Therefore, the C/R ratio can be used for the indirect analysis of light elements. To date, the relationship between the C/R ratio and the average atomic number of the sample has not been exploited by the forensic community. In forensic casework, the known and questioned glass specimens are typically compared using element intensity ratios, as described in the standard method, ASTM E2926.

This study explores the utility of the C/R ratio for the classification of different types of glass (e.g., soda-lime, borosilicate, aluminosilicate) and as an additional tool for the discrimination of glass sources, which may provide complementary information to the element ratios that are currently used in casework. Moreover, since forensic casework involves the analysis of small (< 1 mm) and irregular glass fragments, this study has investigated the applicability of the C/R ratio for glass fragments of various morphologies. Preliminary results show that the C/R ratio is consistent between bulk samples and irregular, small fragments, demonstrating the usefulness of the C/R ratio in forensic casework.