Interpol Review of Paint and Glass Evidence 2016 – 2019
Executive Summary of the following INTERPOL publication:
https://www.sciencedirect.com/science/article/pii/S2589871X20300103

ASCLD Forensic Research Committee
Future Forensics Subcommittee

Interpol review of Paint and Glass Evidence 2016–2019 (Summarized by Jose Almirall and T. Trejos)

In recent years, there have been three significant topics of interest in the paint subdiscipline that have been reported in peer-reviewed manuscripts[1-51] and books[12-18]:

1. Recent trends in the manufacture of paints and how they are examined in casework
2. Assessment of performance and scientific validity of current and emerging analytical methods
3. Statistical interpretation of paint evidence and reporting language

1) The scientific literature addressed the relevance of keeping up with market changes. New trends in architectural[1, 2], and automotive paints were reported[3, 4]. For instance, multipurpose systems are becoming more prevalent in architectural paints. New self-cleaning clear coats, matte clear coats, and four-stage topcoats have become a trend in some vehicles since 2015[5].

2) A focus has been observed for the validation and assessment of error rates for methods typically used in crime laboratories (e.g., microscopy, fluorescence, SEM-EDS, UV-Vis micro-spectrophotometry, FTIR, and Py-GC-MS). Also, Raman spectroscopy's utility is receiving particular attention[21-28, 30-31, 35,37,46,49]; therefore, a more widespread adoption at forensic laboratories is anticipated in the near future.

3) Increased interest was also observed on interpretation and statistical analysis of paint evidence, including multivariate classification methods, likelihood ratios (LR), and the performance assessment of the searching algorithms employed in paint databases (i.e., PDQ and EUCAP).[6-9]

Several ASTM standard test methods, guides, and practices have been reviewed in the past three years and listed in the NIST- OSAC Registry (https://www.nist.gov/topics/organization-scientific-area-committees-forensic-science/osac-registry). The OSAC Trace Subcommittee has drafted a recent document on interpretation of trace evidence (Standard Practice for Interpretation and Report Writing in Forensic Comparison of Trace Materials, https://www.nist.gov/system/files/documents/2020/04/02/ChSAC-Mat_Interpretation_Document_MARCH2020_0.pdf)

In the area of glass analysis and interpretation, the Organization of Scientific Area Committees for Forensic Science (OSAC) approved to place two standard methods for glass analysis on the OSAC Registry within the last 3 years: the "Standard Test Method for Forensic Comparison of Glass Using Micro X-ray Fluorescence (μ-XRF) Spectrometry" (E2926-17) and the "Standard Test Method for Determination of Trace Elements in Soda-Lime Glass Samples Using Laser Ablation Inductively Coupled Plasma Mass Spectrometry for Forensic Comparisons” (E2927-16e1). These ASTM methods were revised during 2016-2019 and approved by OSAC to place on the registry (https://www.nist.gov/topics/forensic-science/organization-scientific-area-committees-osac/osac-registry/osac-approved). Both of the ASTM methods have been supported with fundamental analytical chemistry studies cited within the methods and by several new reports have been published after the methods were placed on the registry. Almirall and Trejos[78] published a paper on LA-ICP-MS and how its application pertains to forensic science for trace elemental analysis.

In addition to these advances in the standardization of taking measurements of elemental composition, significant progress was reported on the objective reporting of the significance of an association between glass comparisons, when one is found. Corzo[52] defended and published her dissertation in 2018 using likelihood ratios on glass samples analyzed by LA-ICP-MS. She, with the help of Hoffman[53], created a database of 420 windshield samples. Corzo et al.[54] reported on the use of databases from LA-ICP-MS data to calculate LRs for casework scenarios including describing the advantages of using LRs in favor of subjective verbal scale.

Corzo et al. used a multivariate kernel model to calculate the LR of 2 different glass databases. They found the rates of misleading evidence was <1.5% for same source evidence and <1.0% for different source evidence.

Hoffman et al.[55] conducted an inter-laboratory exercise with 10 different laboratories. The labs analyzed forensic glass by using the standardized method ASTM 2927-16e1. This was done to evaluate the rate of misleading evidence. Three (3) different background databases were used to calculate LRs with very similar positive results for three (3) different interlaboratory exercises[55]. The first had 34/36 labs associate the known with the questioned correctly, while the other two exercises had all the labs report correct associations. The random match probability was calculated to be ~0.1%.

Akmeeman et al[56] expanded on the use of likelihood ratios demonstrating improvements of the more objective approach of using LRs instead of subjective verbal scales.

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