A155 The Statistical Significance of Common Household Dust Specimens

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After attending this presentation, attendees will understand the significance of household dust specimens and its usefulness in enabling forensic investigators in making Locardian type associations between the people, places, and things involved in a crime.

This presentation will impact the forensic science community by helping to establish the statistical significance and error rate of a common form of trace evidential material often collected at scenes of crimes.

This paper discusses the statistical significance in comparisons of household dust specimens. The results of a microscopic study of over 300 household dust specimens obtained from homes and apartments encompassing the New York City Tri-State region are reported.

The procedure begins with a preliminary visual and stereomicroscopic examination of each dust specimen. The contents of each dust specimen are sorted with the aid of a stereomicroscope into groups of similar looking hairs, fibers, and particulate materials, depending on the composition of each dust specimen's composition. Next, each group is further subdivided into smaller subsets based on their macroscopic physical appearance, primarily color and morphology. Each fibrous and/or particulate subset is mounted on a 7.5 cm x 5 cm microscope slide in High Dispersion (HD) refractive index oil. Finally, each fibrous and/or particulate subset aliquot is characterized and identified utilizing stereo and polarized light microscopy (PLM). Three aliquots were examined from each household dust specimen. Particulates too large to be mounted for PLM examination were studied with other forms of analytical instrumentation, i.e., FTIR, XRF, XRD.

The resulting information for each mounted subset was collected on a dust tabulation sheet specifically designed for this study. Next, the data was subjected to principal component analysis, support vector machines and partial least squares discriminant analysis in order to build statistical models of the composition profiles. These statistical models were then subjected to a test set of randomly selected unlabeled dust samples in order to compute estimates of misidentification rates (error rates). The methods used to compute these error rates were hold-one-out cross validation and bootstrapping.

Statistical, Household Dust, Microscopy

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