



B106 Evaluation and Validation of a Forensic Chemical Coding System to Assist Law Enforcement

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The goal of this presentation is to present to the forensic community results of a validation study designed to evaluate the performance of an innovative chemical tagging system.

This presentation will impact the forensic community by reporting an evaluation study conducted on the chemical coding system and adding scientific support for the future application of this fingerprint system within the U.S.

Trace evidence can be of critical use in many cases where other types of evidence such as DNA or fingerprints are not readily available. The amount of trace evidence left at the crime scene or the chemical characteristics associated with the exhibits may not be enough to associate an individual to a crime scene, an individual to a particular object or two objects to each other.

SmartWater Technology Ltd. has created innovative chemical coding systems to mark property for subsequent identification or to spray individuals involved in breaking and entering scenarios in order to assist law enforcement in the reconstruction of the crime and to link an individual to a specific event.

Two of the systems developed and evaluated in this study are the SmartWater tracer and the SmartWater index solutions. The tracer is designed for the protection of commercial and personal items, such as jewelry, computers and other types of equipment, while the index system is a spray activated when a break-in is detected, spraying the perpetrator in a controlled manner with a water-based solution. Both products are invisible to the naked eye but their traces are fluorescent under the UV light and can be visualized. The chemical composition of the products can be varied to produce unique chemical combinations for each solution. Millions of combinations are possible resulting in unique chemical taggants for each application and user.

The aim of this work was to validate the method of analysis and recovery of these products and evaluate their discrimination capabilities.

Solution ICP-MS and laser ablation ICP-MS methods were used to analyze the elemental profile of a total of 100 tracer and 50 index solutions. The analyses were performed at our facilities as a "blind test" and compared with the chemical fingerprint of the company's data base to evaluate the discrimination potential.

Tracer and Index standards and blanks were analyzed for quality control purposes. Reagent blanks, working blanks, index blanks and tracer blanks were analyzed in seven replicates in order to estimate the instrumental limits of detection (LOD) and the method limits of detection (MDL). The cut off level to establish absence/presence of the chemical markers was based on the estimation of the method limit of detection.

The combined discrimination power of the chemical components of the solutions was evaluated statistically. The index set consisted on 50 samples, which would form 1,225 possible comparison pairs, or $n(n-1)/2$ pairs where n is the number of samples. The tracer solution can generate a total of 4,950 possible pairs. All tracer and index samples evaluated were distinguished from each other when analyzed either by solution ICP-MS measured or LA-ICP-MS (100% discrimination).

Transfer, recovery and persistence studies were performed on a variety of matrices such as wood, metal, plastic, polymers, fabrics, and human hair. Scraping and swabbing were used as the preferred recovery method. Persistence studies were conducted over a period of a month and after washing fabrics with water and detergents.

The study demonstrated that both Smartwater tracer and index products represent an effective tagging source due to its high discrimination potential, selectivity, ease of recovery, and persistence on objects.

Chemical Tagging, Trace Evidence, Laser Ablation