A25 Development of New Reagents for the Detection of Latent Fingerprints

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After attending this presentation, attendees will have an idea regarding new derivatives for fingerprint detection obtained by modifying the molecule of lawsone. A comparison analysis between the new developed compounds and currently used ones in the forensic industry is presented.

This presentation will impact the forensic science community by introducing new fingerprint detecting reagents. Additionally, comparing new fingerprint reagents with enhanced properties to the ones currently in use is of great importance.

After attending this presentation, attendees will know that a new class of fingerprint detecting reagents has been developed. These new compounds present a chemical structure derived from the molecule of lawsone (2-hydroxy-1,4-naphtoquinone) and have very favorable chemical and spectroscopic properties. This presentation will impact the forensic community and the general public because the compounds investigated are used for detecting latent fingerprint and represent an alternative to the more commonly used products, such as ninhydrin, DFO and 1,2-indanedione. Fingerprint development is one of the most widely used techniques for indentifying possible offenders in criminal cases. Because not all fingerprints can be detected easily, a wide range of optical, physical, and chemical techniques have been presented for the detection and enhancement of latent (hidden) fingerprints. In particular, fingerprints on porous surfaces (cardboard, paper) demand a chemical development to be examined. Ninhydrin is one of the most widely used chemical reagents in forensic investigation. It reacts with the amino acids in the sweat left behind by the print, producing a dark blue-purple colored print known as Ruhemann's purple. In order to detect high fluorescence, the Ruhemann's purple compounds are treated with metal salts such as zinc (II) and cadmium (II) chloride at very low temperatures. This allows significant gain in sensitivity by improving the contrast on various backgrounds and improving the number of prints which may be visualized. Over 90 ninhydrin analogs have been synthesized, some with improved properties over ninhydrin; however none have shown to be more advantageous than its parent compound, thus not replacing ninhydrin. 1,8-diaza-9-fluorenone (DFO), 1,2,-indanedione, and genipin are some of the most recent examples. DFO is commonly used in forensic investigations because it is very sensitive to latent prints on paper and exhibits high fluorescent yields; however, heat is required for development and a much paler print is produced when compared to ninhydrin. 1,2-indandione has been documented to be promising, but isn't as fluoregenic. The potential of genipin, a natural product produced from the extract of Gardenia fruit, has also been proposed. Genipin offers the advantage of colored/luminescent compounds when reacted with amino acids in a single reaction. However, genipin is costly, the chemical structures of its products are not known to date, and it's only soluble in very polar solvents—which is not ideal for fingerprint analysis on documents since de-inking problems may result.

The latest reagent studied for latent fingerprint analysis on paper surfaces is 2-hydroxy-1,4-napthoquinone, commonly referred to as lawsone. Lawsone is natural and safe. Lawsone is thought to be the compound responsible for the staining properties of henna, which is extracted from the leaves of *Lawsonia inermis*. Lawsone reacts with the amino acids left behind in sweat residue, producing purple-brown impressions of ridge details which are also photoluminescent. This reagent shows to be very promising; however, its drawback is its solubility. A high concentration of polar solvent is required to dissolve the compound, which may cause unfavorable de-inking problems.

The molecular structure of lawsone was modified and a series of derivatives were prepared in order to improve the solubility and to enhance the fluorescence properties. Comparative fluorescence studies between lawsone, the new derivatives, and the commonly used fingerprint detecting reagents were performed. In addition, the mechanism of reaction between lawsone and several aminoacids was investigated both synthetically and computationally.

Fluorescence, Lawsone's Derivatives, Fingerprint Detection

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