Assessing the evidential impact of LED light sources for the detection of forensic evidence

Investigating the evidential impact that LED-based alternative light sources can have on the detection of forensic evidence during crime scene investigations.

Key details

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Police region	West Midlands
Level of research	PhD
Project start date	April 2022
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Research context

There are a wide range of commercially available alternative light sources (ALSs) covering the visible and ultraviolet regions of the electromagnetic spectrum that can be used for investigative purposes (Marin and Buszka, 2013; Mackenzie and Jenny, 2014).

Many body fluids and biological substances contain naturally fluorescent chemicals that allow them to be visualised under different wavelengths of light, when combined with barrier filters (Sterzik and others, 2016; Harte, Cassella and McCullagh, 2020).

However, there is no definitive answer regarding which light source should be deployed when searching for different types of trace evidence. Furthermore, research by Smith (2014) and Szeremeta and others (2019) has demonstrated that the ability to distinguish between trace

evidence and non-evidentially valuable substances is critical in criminal investigations, and can ultimately expedite the crime scene investigation process.

The researcher will attend live crime scenes with Staffordshire Police. After a scene has been processed by investigators, target areas will be re-examined using the selected light-emitting diode (LED) light sources and techniques discovered during the experimental work. Any additional evidence found by the researcher will be recovered by the investigator.

The data acquired during the second inspection will be anonymously recorded and used to examine the influence of the light sources and experimental findings in comparison to the control scene examination. The control scene examination was searched following normal crime scene investigation procedure.

Preliminary research has discovered that many factors influence the fluorescence intensity of trace evidence, including the:

- absorbency and colour of the material or surface (Wee Chuen, Bee Ee and Abdullah, 2016)
- wavelength range of the ALS deployed (Sterzik and others, 2016)
- time since trace evidence deposition (Miranda and others, 2014)

Previous research discoveries highlight the necessity for further investigation into these influential factors.

Project aims

The aims of the project are to:

- improve the search and recovery rates of various trace evidence types during an investigation
- improve existing crime scene processing procedures using ALS technology
- minimise the disturbance of a crime scene using ALS equipment
- determine which light source is most effective for detecting each of the trace evidence types on different materials/surfaces

Research methodology

The research aims will be achieved by completing a comprehensive laboratory examination. This will be documented as the work is being conducted, using a variety of materials and surfaces and

trace evidence types, including body fluids, hair fibres, drug residues and finger-marks.

Light sources

The following light sources will be employed, each coupled with sensible barrier filters.

- Forensic Investigation Torches (FIT) by CopperTree Forensics covering blue (437-458nm, 4W) and green (510-540nm, 1W) regions.
- Labino Nova torches covering purple (400nm, 144mW) and cyan (505nm, 136mW) regions.
- Mercury UV torch (365nm, 0.5W).

During the experimental work, the Foster and Freeman VSC 8000/HS will be used on the IR and white light settings to mimic an infared (IR) and white light torch.

Research techniques

The following phases will be carried out in order to achieve the overall research goal.

1. Collect a variety of trace evidence types, as well as false positives.
2. Gather a wide range of materials and surfaces in a variety of colours.
3. Photograph and document the materials and surfaces before and after a controlled amount of trace evidence is applied to them.
4. Images will be captured in a controlled dark room setting of each trace evidence type on each material and surface using every accessible light source. ImageJ software will be used to score these photos based on fluorescence intensity values.
5. Statistical analysis techniques will be employed on the fluorescence intensity data to analyse and determine which light source is most effective for detecting each of the trace evidence types on the different materials and surfaces.
6. Validation studies will also be performed with trace evidence types placed in a ‘typical’ room and car setting, including ‘typical’ items in these locations. Trace evidence and false positives will be placed on multiple items in the rooms and light sources will be employed.

Target sample size

At this stage, the sample size will be at least five males and five females providing any of the body fluids and biological substances (hair samples and fingerprints and/or palmar residue).

Ultimately, at least five of each body fluid and biological substance will be required from each sex.