Could henna help catch criminals?

Henna has been used since the Bronze Age to dye hair and adorn skin with temporary tattoos. Used to celebrate festivals and identify individuals undergoing rites of passage such as marriage, it may now become the latest way for police to identify criminals.

Renee Jelly

STORY **KITTY DROK**
PHOTOGRAPHY **JAMES ROGERS**

RENEE JELLY, a PhD student in the Forensic and Analytical Chemistry Group within the Department of Chemistry at Curtin, is investigating whether the staining property of henna can help police detect fingerprints at crime scenes.

Fingerprints have been used to help solve crimes since the 1890s. Visualising fingerprints on smooth sealed surfaces such as glass is easy, using fine powders that stick to the water or oil in the fingerprint residue. But what do you do when the surface is porous, like paper, and absorbs the fingerprint residues?

Luckily fingerprints also contain small traces of amino acids, and these bind quite strongly to the cellulose in paper. Chemicals such as ninhydrin react with these amino acids and turn them pink/purple, allowing police to visualise the print. Fingermarks over 40 years old have been successfully visualised with amino acid-sensitive reagents.

Ninhydrin and similar compounds are now routinely used by the police for fingerprint detection, and have revolutionised the technique over the past 40 years.

However ninhydrin has limitations, as Jelly explains: 'These treatments stain fingerprints a pink colour – it's often not a very good contrast against the background. The newer compounds also use photoluminesce, which improves sensitivity, making prints much easier to see when viewed with appropriate light sources. Unfortunately, background fluorescence can also interfere, caused by the whiteners, brighteners and dyes in modern papers.'

Jelly's 'eureka' moment came when she thought about the way that some natural dyes can stain skin, giving her the idea to test them on fingerprints. 'The active ingredient that makes henna dye skin is thought to be a chemical called lawsone, and I wondered if it would react with fingerprints on paper. We tested it, and discovered that it does, and turns them a purple-brown colour.'

One advantage of this new reagent is that the colour is darker and produces a better visual contrast than ninhydrin on many surfaces. It is also strongly photoluminescent without further treatment. 'It has a bit of an advantage here,' says Jelly. 'It luminesces at a longer wavelength than ninhydrin and the other compounds in common use, which may avoid some of the interference caused by native background fluorescence.'

Jelly's supervisor, Associate Professor Simon Lewis from Curtin's Forensic and Analytical Chemistry Group, explains that this new research doesn't aim to replace existing fingerprinting technologies. 'It's about offering a range of complementary fingerprint reagents that are different colours and luminesce at different wavelengths. The police need a broad range of options depending on the nature of the surface, the age and condition of the fingerprint, and any background interference.'

There are always new challenges in fingerprint detection, such as the recent transition from paper to polymer banknotes. 'Some of the most difficult surfaces to visualise fingerprints can be common things like the brightly coloured labels on some types of drink bottles,' says Lewis wryly. 'So we're not trying to replace the tools in the toolbox, we're aiming to increase the number and variety of tools available to the forensic investigator.'

Jelly's findings are particularly exciting because they open the possibility of a whole new class of useful compounds that may lead to further improvements in fingerprint detection. 'Lawsone is a napthoquinone, so we've looked at other napthoquinones and they've all worked too,' Jelly says. 'So now we're testing related compounds to see which others may be useful. We're also systematically working out the best way to apply and use these new reagents.'

THE research has been done in collaboration with the Australian Federal Police, Forensic Science South Australia, and the Western Australian Police, to make sure that these new developments fit the working requirements of forensic teams, and can be tested under realistic conditions. Not only do these techniques need to be sensitive enough to detect very small quantities of amino acids (down to about 10 nanograms) against a range of background materials and contaminants while preserving the pattern of the fingerprint, but their potential interactions with other forensic techniques must also be known. For example, if lawsone is applied to a document using a solvent that makes ink run, other important information on a piece of evidence could be lost.

'The expertise provided by the police has been invaluable,' Lewis says. 'They've been very willing to help us put this research in the context of what they actually do, so we can contribute to the overall body of knowledge on fingerprint detection.'

It is a collaboration that should prove profitable. Fingerprints collected at crime scenes or on items of evidence remain the most commonly used forensic evidence worldwide. Fingerprint databases are growing by the tens of thousands daily and fingerprints are used to make more positive identifications of people worldwide than any other system.

People use hair dyes and temporary tattoos to draw attention to and individualise themselves. Soon police will be using the same compounds to identify where individuals have been. C