UNIVERSITY OF KENT PHD QUILT

Postgraduate Community Experience Awards
Graduate School

Katy Bruce

Cosmetics are often overlooked as a form of forensic trace evidence. I want to see how reliably I can discriminate between cosmetic foundation samples, using Raman microspectroscopy.

Abstract

THE MAKEUP OF MAKEUP
Raman Spectroscopic Characterisation of Facial Cosmetics as Associative Trace Evidence

The recovery and analysis of cosmetic traces in crime scene investigation is not a well-documented practice, despite its significant potential to provide associative evidence. Investigators are not only unsure how to recover and process cosmetic trace evidence encountered at crime scenes, but they are also unclear as to how a forensic scientist might analyse such a sample or interpret resultant data [1].

Raman spectroscopy offers many advantages over other analytical techniques and has been selected for the discrimination of cosmetic foundation samples in this study (Fig. 1). These advantages include, but are not limited to, its non-destructive nature, microscopic imaging ability, high sensitivity and reproducibility, and the lack of need for chemical pre-treatment.

Only three studies discovered thus far, detail the forensic analysis of cosmetic foundation or skin complexion samples, but none of these involve Raman spectroscopic techniques [2-4]. It is therefore proposed that the combination of forensic analysis, cosmetic foundation evidence, and Raman spectroscopy is novel.

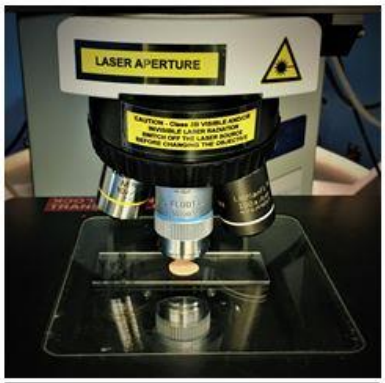

Figure 1: Experimental setup - Raman microscope stage with foundation sample in situ.

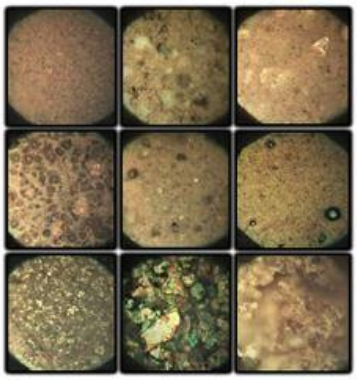

Figure 2: Raman microscopic images of selected cosmetic foundation samples.

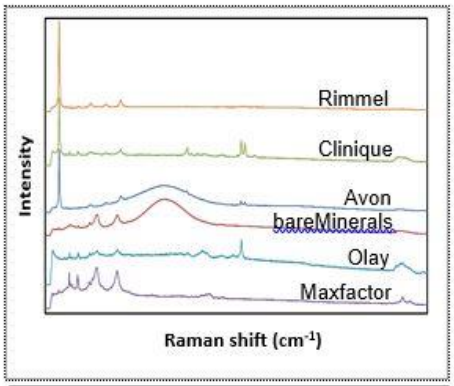

Figure 3: Stacked Raman spectra of six foundation samples, depicting differences in mineral, polymer, fat and oil content.

An initial level of discrimination between the samples was achieved by visually comparing colour photomicrograph images (Fig. 2). Subsequent Raman spectra highlighted further differences between the samples (Fig. 3). It was found that the majority of the samples yielded consistent results and, therefore, a representative Raman spectrum could be defined, and used to create a statistical model. However, a minority of the samples were too heterogeneous to provide a standard spectrum, and work is currently underway to address this problem.

The development of this technique into a robust experimental method, could offer valuable insight to cases where there is either a lack of traditional evidence at the crime scene, or the type of cosmetic found is particularly uncommon. This technique could also be tailored to analyse other forms of trace evidence.

References:

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[2] Gordon, A., Coulson, S. 2004. *Journal of Forensic Sciences,* **49(6)**, 1244-1252.
[3] Ricci, C., Kazarian, S.G. 2010. *Surface and Interface Analysis,* **42**, 386-392.
[4] Kulikov, E., Latham, K., Adams, M.J. 2012. *X-Ray Spectrometry,* **41**, 410-415.