

The Makeup of Makeup: Spectroscopic characterisation of facial cosmetics as associative trace evidence

Katy Bruce¹

Simon W. Lewis², Georgina Sauzier² and Donna Arnold¹

¹ School of Chemistry and Forensic Science, University of Kent

² School of Molecular and Life Sciences, Curtin University

Microtraces of a wide range of physical materials have been used in forensic casework to provide evidence of association, yet cosmetic microtraces remain underutilisedⁱ. It is highly likely that cosmetic microtraces will be transferred between people, locations, and objects in the course of criminal activity; this is particularly true during violent crimes. Therefore, these traces could provide a valuable form of associative trace evidence, especially where the cosmetic source is particularly distinctive, or products have been layered, resulting in unique combinations. Furthermore, cosmetic microtraces may allow interpretation of the circumstances of the transfer event, thus aiding reconstruction of the crime. Cosmetic use is independent of age, gender, ethnicity, and socio-economic status, making research in this area a globally relevant endeavour. Nonetheless, it is vital that cosmetic microtraces are comprehensively investigated and understood in order to be fully integrated into the criminal justice system. Violent crime is a significant societal issue; accordingly, any underutilised forms of trace evidence that might aid an investigation, should be exploited.

This research aims to chemically characterise and compare a substantial selection of decorative facial cosmetics (foundation) for forensic purposes, and assess the impact of sample ageing. The composition of cosmetic products is complex, meaning their analysis benefits from a robust multi-technique approach. Light microscopy and Raman spectroscopy are used as the principal analytical techniques, complemented by infrared spectroscopy, X-ray fluorescence, X-ray diffraction, and scanning electron microscopy. To the best of the authors' knowledge, this is the first study that combines the use of Raman spectroscopy with this cosmetic subclass. The results obtained are combined with chemometric methods to allow discrimination and classification according to cosmetic brand, type, or formulation, and to limit operator subjectivity and unconscious bias. Thereafter, an extensive collection of used sample spectra will be projected onto these chemometric models to identify trends within the data. Our research has highlighted significant differences in sample homogeneity – this is critical information for building interpretation frameworks – and a high spectral variability among samples. It is hoped that this research will increase awareness of and encourage acceptance of cosmetic microtraces in forensic casework, and initiate discussions on the most suitable methods of cosmetic microtrace recovery in the future.

ⁱ R.Chophi, S.Sharma, S.Sharma and R.Singh. Forensic Chemistry, 2019, 14: 100165