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Vibrational spectroscopic applications for detecting of consolidated harakeke fibres in conservation

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Abstract

Traditional Māori textiles are mostly composed of harakeke fibres (*Phormium tenax*, New Zealand flax) and coloured by various natural dyes. Fibres are dyed black (paru) with iron tannate compounds [1]. These textiles are liable to degradation which is believed to occur via acid catalysed hydrolysis and iron catalysed oxidation [1, 2]. To mitigate this degradation, these textiles are treated with different consolidants. There is however a poor understanding of the mode of action of consolidants at a molecular level.

In this study, paru dyed and non-dyed harakeke fibre samples treated with the common consolidants; sodium alginate, zinc alginate, Paraloid B-72™, TriFunori™, and MethocelA4C™ were assessed by bulk Raman and infrared (IR) spectroscopic techniques. These consolidated fibers were artificially aged using light ageing to evaluate for potential protective effects from the consolidants [3]. Also, non-dyed, consolidated fibres were studied by Raman microscopic analysis to detect the consolidant distribution within the sample. These data were analysed using; band integrals analysis, principal component analysis, and true component analysis, was applied to understand subtle variances in the samples of bulk and microscopic analysis (Fig. 1).

Fig. 1: Example of the scores plot of PC1 vs PC3 of principal component analysis for IR data of non-dyed and dyed samples

Keywords : Raman spectroscopy, infrared spectroscopy, paru dyed harakeke fibres, consolidation, chemometrics

References:

- [1] C.A. Smith, R.A. Paterson, B.J. Lowe, and R. Te Kanawa, Consolidation of black-dyed Māori textile artefacts: Evaluating the efficacy of sodium alginate, *Studies in Conservation*, **63:3**, 139-154 (2016).
- [2] V. Daniels, Factors affecting the deterioration of the Cellulosic fibres in black-dyed New Zealand flax (*Phormium tenax*), *Studies in Conservation*, **44:2**, 73-85 (1999).
- [3] B.J. Lowe, C.A. Smith, S.J. Fraser-Miller, R.A. Paterson, F. Daroux, R. Ngarimu-Cameron, B. Ford, K.C. Gordon, Light-ageing characteristics of Māori textiles: Colour, strength and molecular change, *Journal of Cultural Heritage*, **24**, 60-68 (2017).