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# Characterisation of oil and aluminium complex on replica and historical 19<sup>th</sup> c. Turkey red textiles by non-destructive diffuse reflectance FTIR spectroscopy

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## Abstract

This work investigates historical and replica Turkey red textiles with diffuse reflectance infrared (DRIFT) spectroscopy to study the coordination complex between cellulose, fatty acids, and the aluminium ions that form the basis of the colour lake. Turkey red was produced in Scotland for around 150 years, and is held in many museum and archive collections. The textile was renowned for its brilliant red hue, and for its fastness to light, washing, rubbing, and bleaching. This was attributed to its unusual preparatory process, the chemistry of which was never fully understood, that involved imbuing cotton with a solution of aqueous fatty acids and then aluminium in the following step. Here we show, for the first time, a characterisation of the Turkey red complex on replica and historical textiles. The development of techniques for non-destructive and *in situ* analysis of historical textiles is valuable for improving understanding of their chemistry, hopefully contributing to better conservation and display practices. The results show the fatty acids condense onto the cellulose polymer via hydrogen bonding between the C=O and OH of the respective compounds, then the aluminium forms a bridging complex with the fatty acid carboxyl. This contributes to an improved understanding of Turkey red textiles, and shows the useful application of handheld diffuse FTIR instruments for heritage textile research.

Keywords: Diffuse reflectance spectroscopy, Turkey red, textiles, in situ analysis, heritage conservation science, metal carboxylates

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