SUPPLEMENTARY MATERIAL

Preliminary study on analysis and removal of wax from a Carrara marble statue

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This preliminary study has mainly focused on the waxes identification by NMR and removal. Waxes were used for many purposes in the field of art as protective coatings on wooden, stone or metal objects. From the comparison of the spectra HNMR and in particular with the correspondence of the resonance peaks of the samples taken from the statue and beeswax and paraffin, we can conclude that the wax applied on the statue surface is beeswax.

From our data, it can be concluded that, to remove the beeswax, from any stone support, the more effective solvent is the mixture cyclohexane/ethyl acetate. The removal percentages ranged from 19 to 99%. Lower percentages of removal have been observed in the case of yellow marble, probably because of its high porosity. We can affirm that, this solvent mixture can be employed in real art objects using cotton swabs to remove protective waxes.

Keywords: Wax; NMR; Cultural Heritage; Cleaning

Table 1. ¹H NMR spectral data for bee wax samples in CDCl₃

protons		δ _H mult.
CH ₃ -CH-O(COR)-R	ester ω-1 alcohol	4.90 m
R-CH-O(COR)-R	ester 2° alcohol	4.80 m
R-CH ₂ O-COR	ester 1° alcohol	4.04 t
R-CH ₂ COOH	carboxylic acid	2.38 t
R-CH ₂ COO-	α-methylene ester/ carboxylic acid	2.29 t
R-CH ₂ -CH ₂ -COO-	β-methylene ester/ carboxylic acid	1.62 m
R-CH ₂ -R	methylene	1.25 m
R-CH ₃	methyl	0.88 t