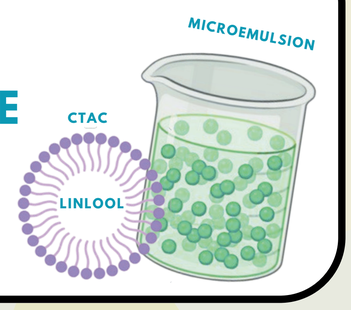
LINALOOL-BASED NANOSTRUCTURED FLUID: A SUSTAINABLE APPROACH FOR THE REMOVAL OF GRAFFITI PAINT FROM OUTDOOR CULTURAL HERITAGE



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INTRODUCTION

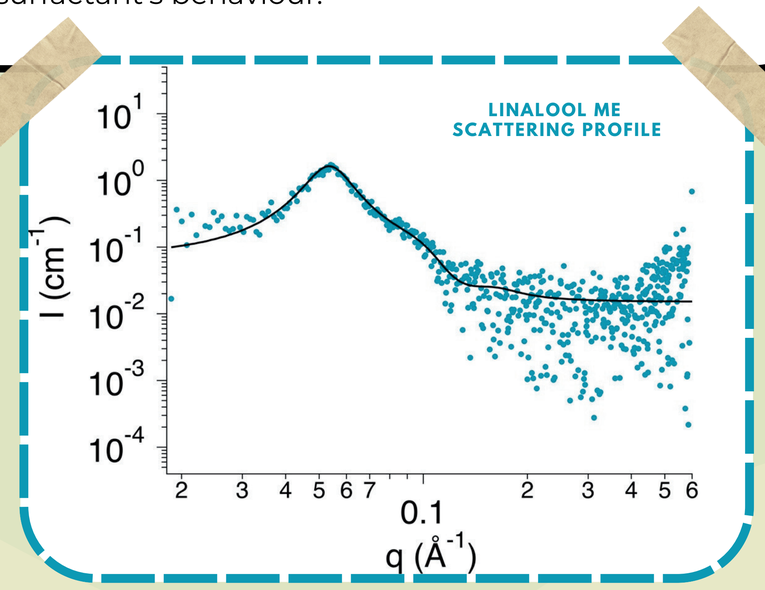
Vandalic inscriptions are one of the most complex types of anthropogenic damage affecting urban outdoor heritage. Spray paints, often based on alkyd resins, are challenging to remove due to their high cross-linking, deep penetration into porous substrates, and chemical affinity with modern mural paints. This study investigates a nanostructured oil-in-water (O/W) microemulsion based on linalool, a bioavailable monoterpene alcohol derived from lavender essential oil, used as a green solvent in the oil phase.

OBJECTIVES AND FORMULATION

The aim of this study is to develop a sustainable cleaning system capable of inducing controlled swelling and selective removal of alkyd spray paints, without altering the original substrate. A ternary phase diagram of the linalool–CTAC–water system revealed a monophasic oil-in-water (O/W) region. Within this domain, a formulation comprising 5.5 wt% linalool, 4.5 wt% CTAC, and 90 wt% water was selected.

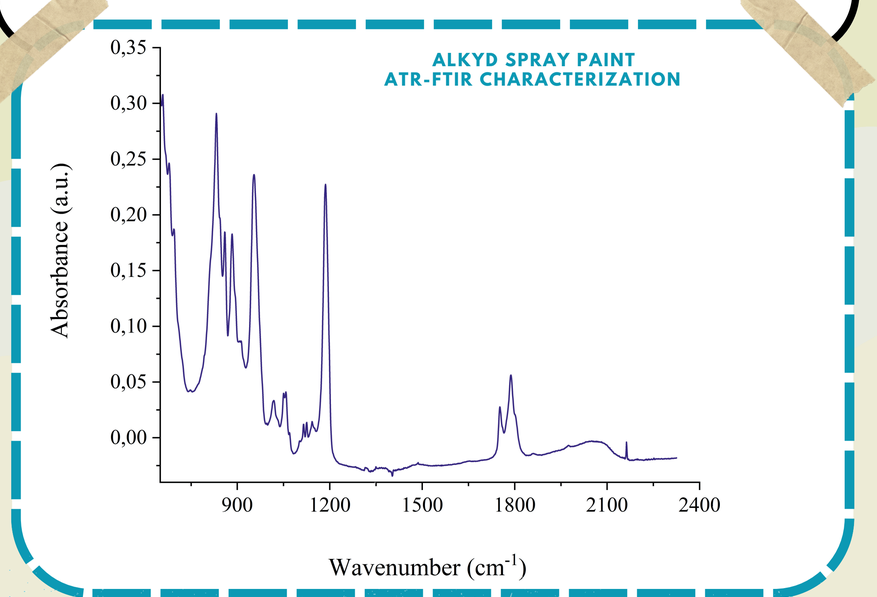
CHARACTERISATION

The selected formulation (Linalool-ME) was characterised by Small-Angle X-ray Scattering (SAXS), which confirmed a bicontinuous core–shell micellar structure, with a core radius of 32–36 Å and a polydispersity index ranging from 0.17 to 0.27. Surface tension measurements of aqueous CTAC solutions were carried out using a K100 tensiometer in order to gain a deeper understanding of the surfactant's behaviour.



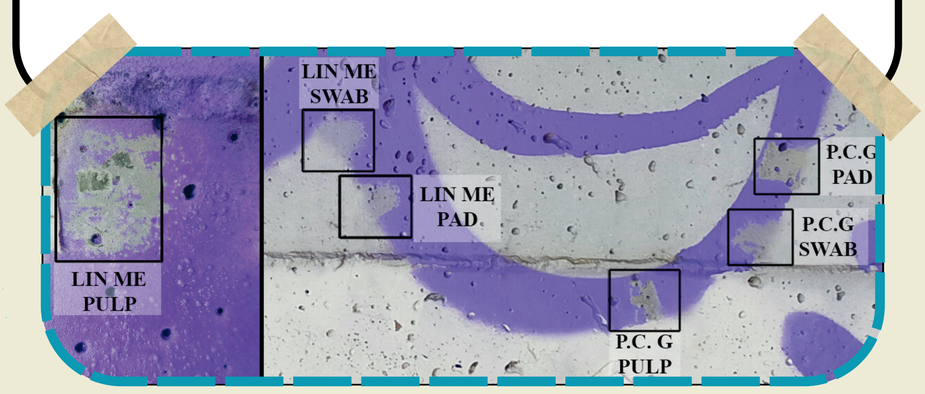
APPLICATION AND ANALYTICAL TECHNIQUES

Linalool-ME was tested both on concrete mock-ups and in situ on the façade of the University Sports Centre in Florence. The chemical composition of the paint layers was analysed by ATR-FTIR spectroscopy. Cleaning efficacy and selectivity were assessed using different application methods, including cotton swabs, cotton pads, cellulose pulp, and the commercial poly(vinyl alcohol)-based hydrogel Nanorestore Gel® Peggy 6.



RESULTS AND CONCLUSIONS

The linalool-based microemulsion demonstrated high effectiveness and selectivity in the removal of alkyd spray paint layers, particularly when applied using cotton pads or hydrogels. Its nanostructure enables a localised solvent action, thereby preserving the underlying hydrophilic substrate. These results underscore the potential of linalool as a green solvent in nanostructured cleaning systems for the sustainable conservation of cultural heritage.



ACKNOWLEDGMENTS

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