

NMR AND MECHANICAL STUDIES OF THE WEATHER RESISTANCE OF UP RESINS, MODERN CONTEMPORARY ART MATERIALS

Georgios Stamatakis¹, Apostolos Spyros¹, Ulla Knuutinen^{2*}, Kai Laitinen², Aapo Häärä²

¹University of Crete, Dep. of Chemistry,

P.O. Box 2208 Voutes, 71003, Heraklion, Crete Greece

²EVTEK University of Applied Sciences, Lummetie 2b, 01300 Vantaa, Finland

* Correspondence: ulla.knuutinen@evtek.fi; Fax +358 9 8237489

Unsaturated polyester resins, UPR, have been used as contemporary art materials within the last 20 -30 years. The identification of these polymer materials is needed for proper collection management, both for optimal storage and display conditions. NMR spectroscopy can be used as a powerful tool for the compositional analyses of multicomponent systems, such as UP resins, at the molecular level. In this paper we present the successful application of ¹H and ¹³C 1D and 2D NMR spectroscopy for the chemical characterization of the UP resins and the subsequent identification of the specific UP resin used in artifacts from two contemporary museum objects.

The definition of a successful conservation strategy for UPR-containing museum artifacts requires also an understanding of the effect of degradation on the physical and chemical state of UP resins. However, the effectiveness of exposure to various weathering conditions in altering the polymeric matrix and its mechanical properties depends strongly on the initial composition of the UP resin. This phenomenon was proved out by the standardised (Standard ISO 4892) breaking strain tests, in which the effect of weathering conditions (humidity, temperature, UVB radiation) to the breaking strain of four different unsaturated polyester products was tested. Destructive mechanical tests were made only for the reference samples of commercial UP resin products.

Furthermore, NMR spectroscopy was used to follow the changes effected by UV aging in the concentration of minor resin components, such as residual solvent (styrene), plasticizers, etc., and whether they correlate with the deteriorating mechanical properties of the UP resins after aging.