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A novel methodological approach for the assessment of surface cleaning of acrylic emulsion paints

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Abstract

In the present study a novel methodology was developed for the assessment of surface cleaning treatment of acrylic emulsion paints, with the use of Pyrolysis–Gas Chromatography/Mass Spectrometry (Py–GC/MS). In order to assess the degree of invasiveness of surface treatments applied on acrylic emulsion paints, Py–GC/MS was employed for the direct analysis of the cleaning extracts, aiming to simultaneously detect the main organic components of the acrylic emulsion paints extracted from the paint during cleaning. Commercial acrylic emulsion paints were chosen for the study, containing four different synthetic organic pigments: Hansa yellow (PY3), diketopyrrolopyrrole red (PR264), phthalocyanine blue (PB15) and phthalocyanine green (PG7). Mock ups of paint films were prepared and subjected to artificial soiling and thermal ageing. Py–GC/MS and Fourier Transform Infrared Spectroscopy in Attenuated Total Reflection mode (FTIR–ATR) were used for the identification of the main organic components found in the prepared acrylic paints. Cleaning tests were conducted simulating actual surface cleaning treatment conditions, using a set of different types of wet cleaning systems, including water, aqueous solutions with chelating agents, water in oil (w/o) microemulsion and a siloxane based w/o emulsion. For an integrated physicochemical and aesthetic approach towards the evaluation of the cleaning tests, in parallel with the Py–GC/MS analysis carried out on the cleaning extracts, the degree of soil removal was comparatively evaluated through visual observation and documented in macro and micro scale. Moreover, statistical analysis was performed in the aim of correlating the aesthetic and the physicochemical cleaning assessment results. The study showed that Py–GC/MS is very useful tool for assessing the cleaning of acrylic emulsions and the action of different cleaning systems, making possible to detect minor quantities of the paint's components, through the direct analysis of the cleaning extracts. Some new information on the impact of cleaning treatments on emulsion paints as regards the synthetic organic pigments and the acrylic binder is presented.

Keywords: acrylic emulsion paints; synthetic organic pigments; surface cleaning; Py–GC/MS; statistical analysis

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