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Article: New Approaches to Cleaning Works on Paper and Photographic Materials  
(Abstract)

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# New Approaches to Cleaning Works on Paper and Photographic Materials

Michelle Sullivan and Shannon Brogdon-Grantham

*Presented at the 2015 PMG Winter Meeting in Cambridge, Massachusetts.*

## Abstract

During Fall 2013, second-year graduate students in the Winterthur/University of Delaware Program in Art Conservation completed a course entitled “Conservation Cleaning Methods” led by Professor Richard Wolbers. This course explored approaches to controlled cleaning of works of art and artifacts using gels, microemulsions, and silicone solvents, as well as the optimization of aqueous cleaning systems through pH-adjustment and the addition of chelators, enzymes, and surfactants. This talk will discuss two studies undertaken by students specializing in the conservation of works on paper and photographic materials as an extension of this course and in collaboration with scientists and conservators at the Winterthur Museum, Garden & Library to address specific problems within their disciplines.

The first study explored the reduction of foxing stains in paper-based materials utilizing a combined chelator-enzyme solution delivered locally using rigid gels. As the exact nature of foxing remains an area of debate among conservators and scientists, students first demonstrated that the foxing in the paper samples selected for the experiment is related to both metal oxidation and biological growth. Foxed samples were subjected to a histological staining protocol to confirm the presence of fungi, and x-ray fluorescence spectroscopy (XRF) was performed to determine the relative metal concentration in affected areas. With the source of foxing established, an experiment was devised to explore the combined and independent treatment effects of the chelator hydroxybenzyl ethylenediamine (HBED), the enzyme chitinase, and the rigid agarose gel. The contribution of each to stain reduction was assessed using colorimetry, semi-quantitative XRF, and visible and ultraviolet photography. The preliminary data collected indicates both the chelator *and* enzyme contribute to improved foxing reduction. This gel-based delivery system, while still experimental, is promising as an effective stain reduction treatment for severely foxed works of art on paper and photographs with single-layer structures such as salted paper and platinum prints.

The second study explored the use of a silicone solvent to protect the surface of cyanotypes during local gel-based cleaning and as a method for reducing sooty surface grime on the emulsion of fiber-base, silver gelatin developed-out photographs. While silicone solvents have been used successfully in art conservation to protect porous architectural materials during treatment and consolidation, there are few published findings regarding their use in paper and photograph conservation. The first goal of this study was to determine the residency time of octamethylcyclotetrasiloxane solvent, also known as D-4 silicone solvent, in cyanotypes and fiber-base, silver gelatin prints using gas chromatography-mass spectrometry (GC/MS) on expendable samples of photographic papers. The GC/MS results demonstrated, after a 24-hour period, the D-4 solvent reaches an undetectable level in the cyanotype paper and is recorded as less than one part per million (0.0001%) in the fiber-base, gelatin silver paper.

Results from subsequent cleaning tests showed that D-4 was effective in minimizing the formation of visible tidelines on cyanotypes during local gel-based cleaning and effective in reducing sooty surface grime on the emulsion of fiber-base silver gelatin prints while minimizing swelling and surface-related damage.

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