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Solvent Azeotropes in Art Conservation

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Solvent mixtures are often fine-tuned by art conservators for the difficult tasks of safely removing yellowed varnishes and obfuscating dirt from oil paintings. These two goals are often loosely termed "picture cleaning." Concern has been raised over the impact of differential evaporation rates for solvents in the cleaning mixture. Differential evaporation can lead to changes in the mixture's potency over time and potentially lead to solvent mixtures on the surface of the artwork having solubility characteristics deleterious to artists' oil paints. Azeotropic mixtures of solvents have been proposed as an alternative for maintaining consistent solvent composition. Azeotropes are specific mixtures of two or more solvents that behave as a single solvent and maintain a constant composition at their boiling point. The azeotropes that have appeared in the art conservation literature are taken from tables of azeotropic compositions in the CRC Handbook given at their boiling point. This research examines whether these solvent blends, in particular a hexane/isopropanol combination found to be an effective cleaner in the treatment of painted royal sleighs at the Palace of Versailles, in fact behave azeotropically under room temperature evaporation conditions. For the first time, the actual evaporation behavior of this purported azeotropic mixture will be explored in depth. A range of hexane/isopropanol mixtures around the boiling point azeotrope composition have been assessed for their room temperature vapor pressure and evaporation weight loss kinetics. Aliquots of the evaporating solutions are also being analyzed chemically using gas chromatography of both the liquid phase and the vapor phase in the headspace. This research aims to provide conservators information on the evaporation of purportedly azeotropic solvent blends and to suggest new approaches to the cleaning of oil paintings.