

Paper Degradation, its detection and mitigation



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The molecular behavior of cellulose-based paper materials over time has important implications for conservation practices. In the present study, cotton paper artificially aged in a humid oven to promote hydrolytic breakdown were examined to develop a description of the degradation of paper-based artifacts on the molecular scale. These samples were used to develop a minimally-invasive desorption electrospray ionization-mass spectrometry (DESI-MS) protocol to detect degradation in naturally aged papers. In an update to Barrow's work, the pH, gelatin content, yellowness, elemental composition, and molecular weight of naturally aged papers were examined to highlight the importance of alkalinity and high gelatin content in maintaining the strength, color, and handling properties of paper. The historic paper project inspired an investigation to understand whether kozo and linen, bast fibers used to manufacture paper, age in the same way as cotton, which is often used as the standard prototype for understanding rag paper degradation. In addition, two projects examined deacidification treatments. In one, the conditions for safely treating oxidized papers in alkaline baths were delineated. In another, the effectiveness of deacidification treatments on the micro-scale is being examined by chemically tagging then using fluorescence microscopy to image the location of carboxylic acid groups in paper fibers. Finally, a study examined the long-term, protective nature of various isolating barriers applied to paper-based rolled tube support cores used for storing large paper artifacts.

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