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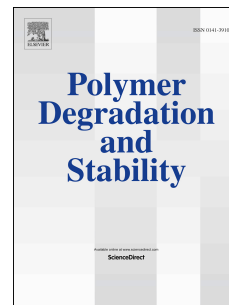
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Abstract

Although degradation of iron gall ink containing paper has been scientifically studied for almost 250 years, we still do not have a good understanding of the kinetics of the process. While many studies focussed on model samples to avoid the inhomogeneity of real historic samples or the need for sampling, this research was conducted on a selection of real documents. Accelerated degradation experiments were performed at six combinations of temperature and relative humidity (RH) in the intervals 50-80 °C / 20-80% RH. The analytical methods were optimised such that sample consumption was minimised and errors and uncertainties were evaluated.

The results show that the rate of degradation, measured as change in the degree of polymerisation of cellulose in paper beneath ink, can be described in Arrhenius terms, and that the apparent activation energy for the process depends on the moisture content in the material. The variation is consistent with the process of hydrolysis becoming less prominent at lower moisture content values, although the results indicate that hydrolytic degradation predominates during natural ink-induced degradation. In the context of the historic samples used in the study, the presence of ink accelerated the degradation of paper by a constant factor of 1.59 in comparison to paper without ink, across the range of experimental T and RH. This indicates that a dose-response function could be developed for ink-induced degradation of paper.

Keywords: Ink corrosion; Cellulose; Viscometry; Conservation; Libraries and archives; Heritage science

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