

## Salvaging Iron Gall Ink Collections from Fungal Attack Affected by Disasters and Climate Change

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### Abstract

This study incorporates more than thirty years of international research into the chemistry, degradation and stabilization of metal-tannic inks applied to documents and drawings on paper. Its aim was to establish the best ways of caring for ink-corroded documents and archival materials containing fungal attack, while at the same time protecting the environment and the health of the conservator and the objects.

Research has greatly improved the conservator's understanding of metal-tannic ink and provided new ways of addressing the preservation problems, which are repeatedly found in various countries. The components of ink corrosion have been investigated and addressed in many publications and safe treatments have been developed for unstable inks on historical ink-inscribed paper. The effects of different aqueous treatments on metal-tannic ink are continuously being studied in the process of finding the right reagents to block ink corrosion mechanisms.

Nevertheless, conservators still struggle in choosing appropriate interventions for mass stabilization and preservation of iron gall ink-inscribed paper. Several material and technical issues, as well as the specific use of the object within a library, archive or museum, make these treatment choices difficult:

- The complexity of metal-tannic ink, i.e. its variability and lack of predictability, making it inherently difficult to treat
- Different condition problems requiring different solutions, rather than a one-treatment-fits-all approach
- Scientific research of metal-tannic ink needs to be applied within suitable and feasible treatment protocols for bench conservators
- There are no clear guidelines and methodologies for ink identification, linking to the history of iron gall preparation through the centuries, including industrially made 20<sup>th</sup> century iron-gall inks, with various available treatment options.

An e-questionnaire, which was completed by more than two hundred and thirty colleagues from forty-one different countries, determined the type of aqueous treatments, which had been or were currently being used by conservators worldwide. The survey respondents were asked what particular bathing solutions, products and/or adhesives had been abandoned over the years and why they were discontinued. The responses revealed a decrease in the use of

calcium phytate/ calcium bicarbonate and magnesium phytate/ calcium bicarbonate with or without ethanol, while also providing answers to why this was the case.

This paper also includes a summary of the results obtained from stabilization treatment protocols dealing with biodeterioration due to fungal infestation. For example, the application of ionizing radiation (e.g. gamma irradiation), or ethanol for disinfection is commonly used in conservation. Bathing with ethanol for treatment, to improve the water absorption and bleeding, is problematic due to the vaporization of the solvent when applied onto objects during an intervention. This may cause high concentration of ethanol in the air and if the concentration of this solvent in the work place is higher than 260 mg/m<sup>3</sup> (TWA 8 hours) the risk of cancer is high. Other methods of collections sterilization for mold infestations under consideration are: ethylene oxide, freezing, and sunlight and artificial light bleaching, among others.  
(477 words)

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