

*Title:* **Study about the effect of antioxidants treatments and aging in degraded manuscripts.**

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Ancient manuscripts are potentially important documents due to their artistic value and multidisciplinary information contained. Furthermore, they have allowed us to study the historical traceability of humanity. However, they are within the reach of time and, therefore, vulnerable of being degraded. The chemical reaction of iron sulphate (II) and gallic acid to form ink, generate sulfuric acid and iron (II) ions as subproducts. These two species cause degradation of cellulose paper: acid hydrolysis or oxidation, which is catalysed by iron (II) ions through Fenton reaction.

The main objective of this project is to study the effect of iron (II) and total iron, related to antioxidation treatments in degraded real manuscripts. As a starting point, a procedure for the dissolution of manuscript paper using  $H_2O_2$  has been established in order to determine the total amount of iron by ICP-OES technique.

The second step has been reproducing humidity conditions along a long period of time, extracting, with water, iron (II) and analyse its content in treated manuscripts. Also, a study of the reproducibility of the established procedure has been carried out expressing the amount of iron per weight, area and centimetre of ink.

From the analysis of total amount of iron, it can be concluded that iron is not extracted when the deacidification, antioxidation and combined treatments are applied, what is more, there is no influence on the method in which they were applied; either by immersion, with a brush or an airbrush. This fact implies that iron (II) has a low extraction kinetic because total iron amount remains constant in all treated and untreated manuscripts studied.

The study of iron water extraction (II) on manuscripts treated, shows that the percentage of iron extracted is significantly lower in deacidifying treatments than in antioxidants themselves. This fact suggests that pH might influences in iron fixation to the support and works more efficiently to delay oxidation processes than antioxidation treatments themselves.

Finally, it has been concluded that GEOL generates low iron(II)-fixing effect on paper support.

**Keywords** manuscripts, degradation, antioxidant treatment, iron extraction, ICP-OES.