CULTURAL HERITAGE CONSERVATION SCIENCE AND SUSTAINABLE DEVELOPMENT
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LES SCIENCES DE LA CONSERVATION DU PATRIMOINE ET LE DÉVELOPPEMENT DURABLE
ACQUIS, RECHERCHE, INNOVATION

Enzymatic cleaning : an improvement to delining methods for paintings

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Introduction

A 1610-1640's painting, object of a conservation graduation degree at the *Institut National du Patrimoine*, was altered by an old traditional lining made with a glue-paste adhesive.

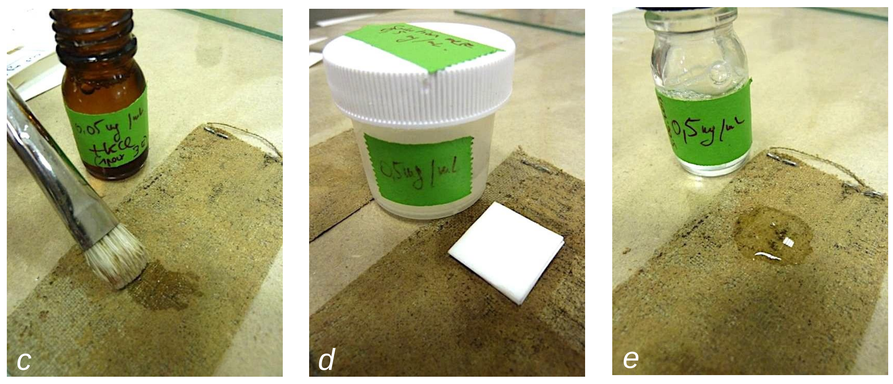
For conservation motivations, the painting was delined. Consequently, we had to remove the old glue from the back of the original canvas.

The removal of old lining adhesives often involves raw and laborious mechanical methods that can further weaken the original canvas and may restrict the options for future treatment and relining. Biological treatments using enzymes had been frequently used for graphic arts and textiles delining and cleanings : starch residues on fragile silk banners, archeological textiles could be cleaned without any damage on the original. Stacked and glued manuscripts or wallpapers could be taken apart in a short time. We tried to adapt enzymatic methods to our painting.

Mechanical delining : detail of the adhesive

Evaluation methods

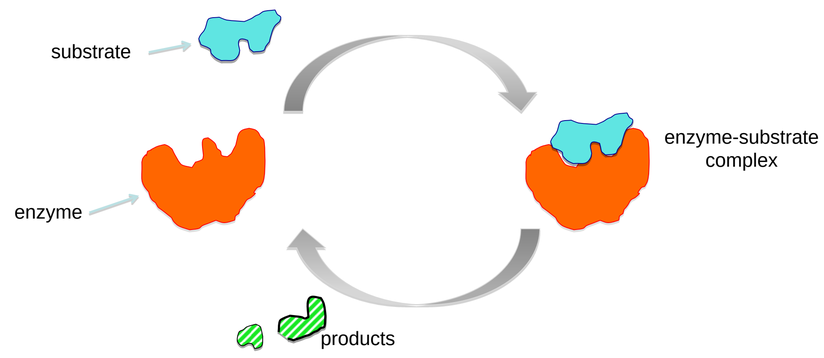
- *Concentrations* : 0.05 mg/mL, 0.5 mg/mL, 1 mg/mL, 5 mg/mL
- *Way of application* : brush *(c)*, blotting paper *(d)*, gel *(e)*
- *Duration* : 20 minutes or 2 x 20 minutes
- *Activators* : KCl or none
- *Removal of digested starch substrate* : blunt blade *(f)* or tweezers *(g)*



Various manners to apply the enzyme solution : (c) brush, (d) blotting paper, (e) gel.
Evaluation tool : blunt blade (f) and tweezer (g).

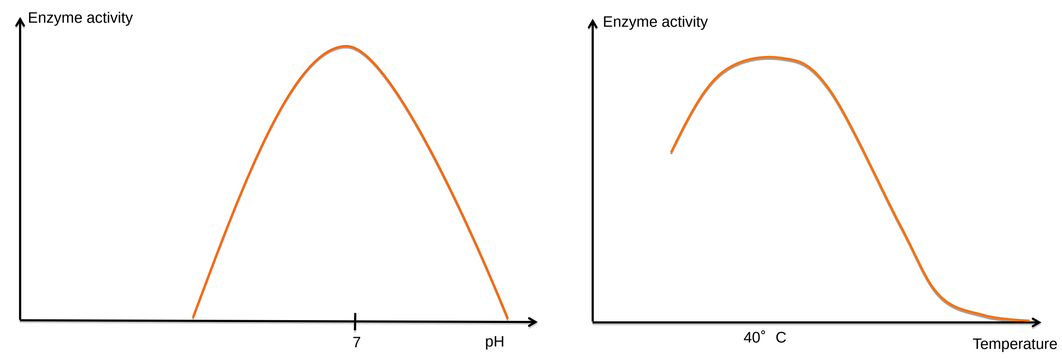
The action of enzymes

Amylase, a specific enzyme to amylose, forms a complex with the starch present in the glue paste. After hydrolysis of the starch into smaller sugars inside the « complex », the enzym can start a new cycle.



The power of enzymes

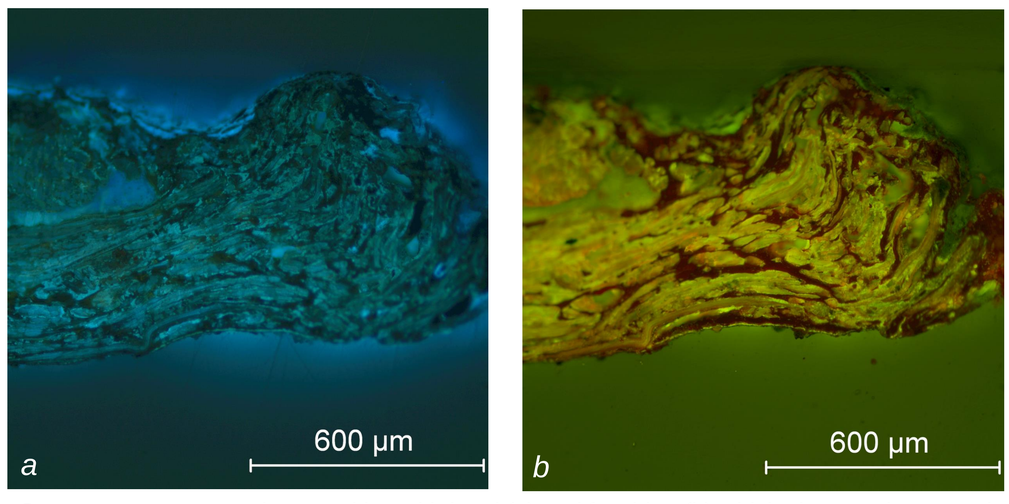
Under controlled conditions of temperature, humidity and environment, enzymes have a catalytic action: they permit high acceleration of chemical reactions. We used this acceleration capability to degrade the amylose part of the adhesive.



Mesure of enzyme activity depending on pH or temperature

Samples

After delining, the original canvas was impregnated by the heterogeneous, crumbly and thick layer of the adhesive. As spot tests made on cross-sections confirmed a starch and protein based glue *(a, b)*, we choose a highly-purified amylase from Sigma Aldrich® to degrade starch.

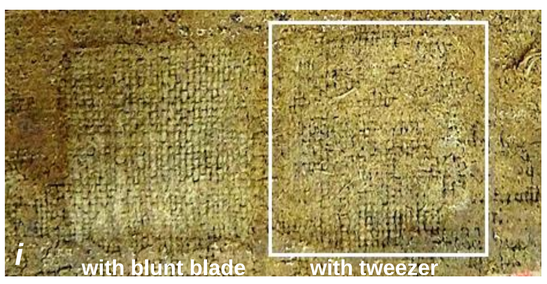


Spot test on cross-section : positive with lugol (a) and fuschine (b) which characterises starch and collagen

Results and interpretation

Our experimentations have gradually revealed encouraging results. Solution at very low concentration of enzymes, 0.05 mg/mL, applied in a blotter paper for twice 20 minutes, allowed to quickly degrade starch. With mechanical tweezers, the glue could be cleared without damaging the fibers of the canvas.
Therefore, researches may be continued and completed, especially to simplify the implementation of tests to improve efficiency and reduce the time required to hydrolyse the adhesive.

Detail of the lining canvas with glue before tests (h)



Best result considering efficiency and damage on canvas (i)