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

Conservation Treatment of Newsprint Paper by Polysiloxanes. Study of interpenetrating networks for strengthening and deacidification (CoMPresSil project)

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Introduction

Acidity is the main factor in the deterioration of paper, resulting in a loss of material and therefore of the information conveyed.

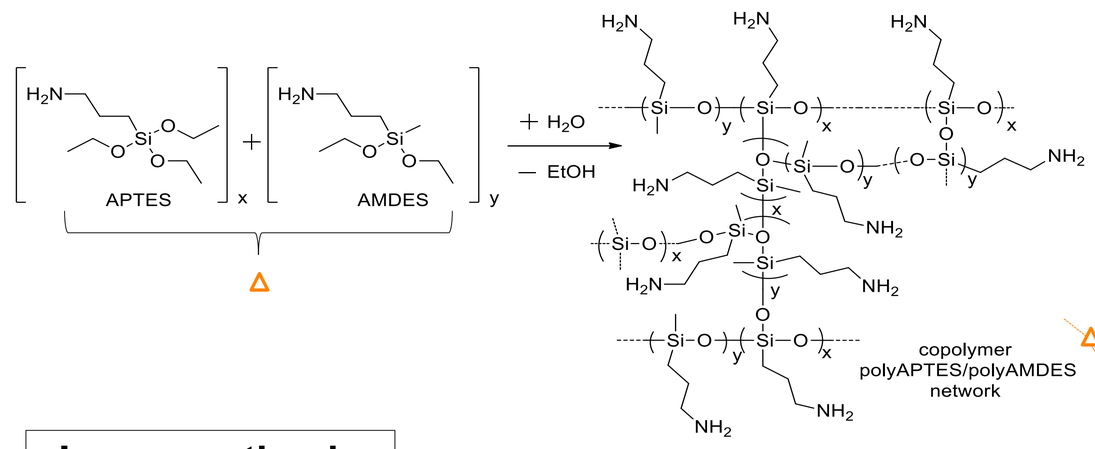
Current methods for the stabilization and mass treatment of paper are based on the neutralization of acids and deposition of a mineral buffer in the fibrous network, called alkaline reserve, which helps the paper fighting future acidity arising during the natural aging process.

The CoMPresSil project aims at developing a new innovative treatment methodology based on the incorporation of aminoalkylalkoxysilane polymers (AAAS) (ex. polyAMDES) and copolymer networks (ex. polyAPTES/polyAMDES) in the paper fibers.

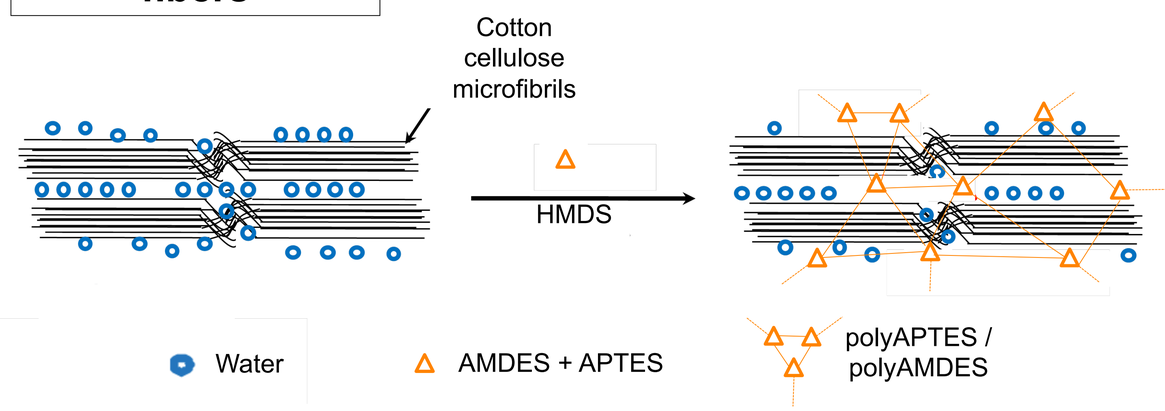
The treatment not only provides alkalinity (amine function), but also physical reinforcement of the cellulosic fibers (in-situ polymerization), thereby inducing a significant improvement of the mechanical properties of paper.

The methodology mainly targets very degraded documents such as newsprint collections, which are prone to rapid acidification due to their chemical composition.

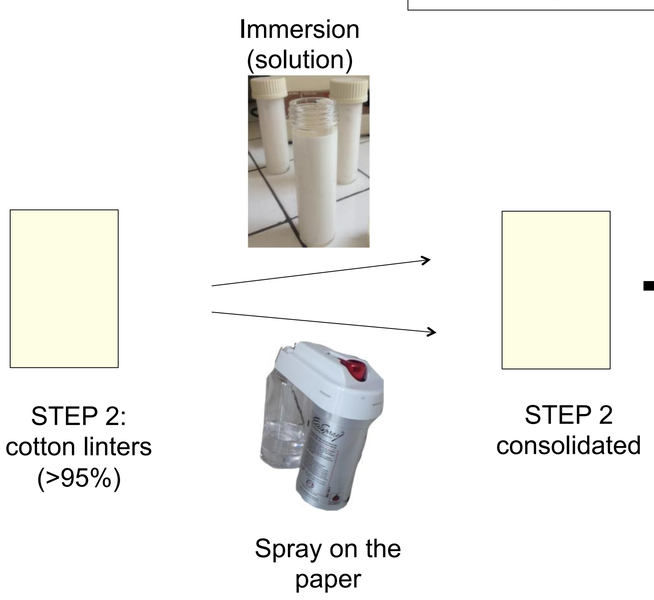
AAAS network synthesis



Incorporation in the cellulose fibers



Methods

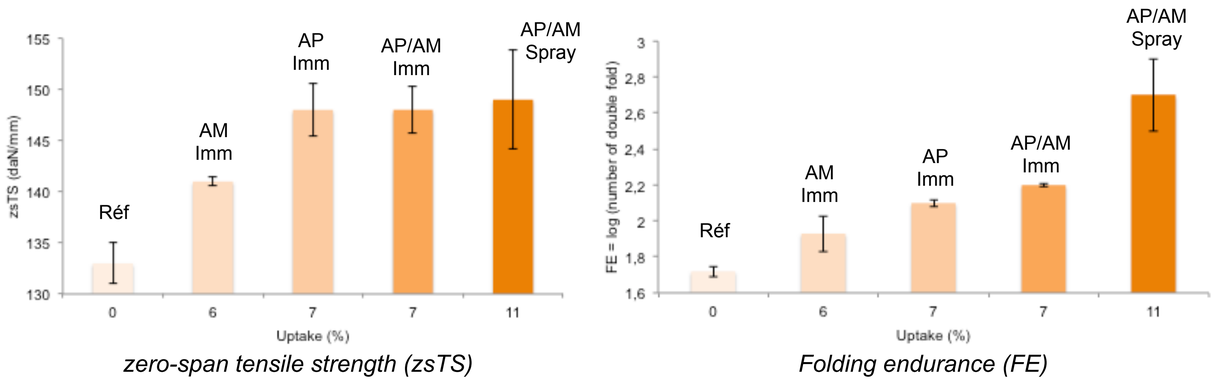


Evidence of formation of the silicone networks in the paper by the determination of the soluble fraction after Soxhlet solid-liquid extraction with CH_2Cl_2

$$SF = \frac{w_{after} - w_{before}}{w_{before}} \times 100$$

≤ 5%: Copolymer network formed

Characterization of STEP 2 papers (cotton linters (>95%))

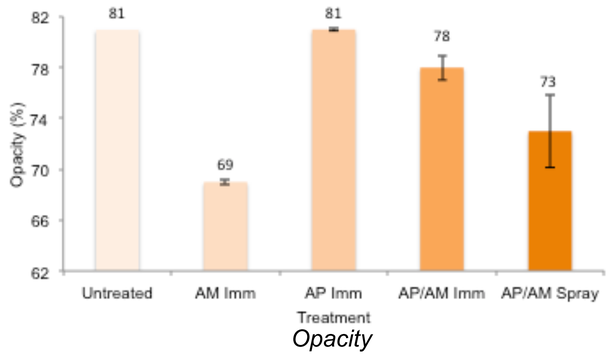


zero-span tensile strength (zsTS) — *Folding endurance (FE)*

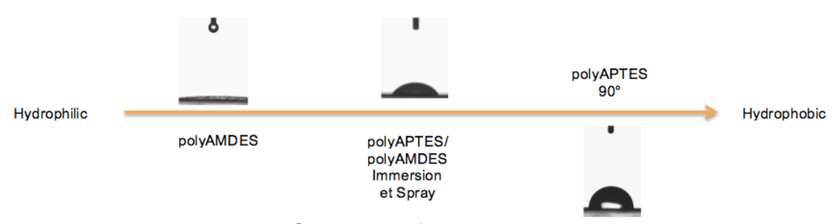
Improved mechanical properties (zsTS: intra and inter-fiber strength, FE: plasticity and deformability of fibers)

Samples	Alkaline reserve (meq ($0H^-$)/100g)	Uptake (wt/wt %)
	Immersion	
polyAMDES	33	7
polyAPTES	32	7
polyAPTES/polyAMDES	28	6
	Spray	
polyAPTES/polyAMDES	114	21

Alkaline reserve is proportional to the uptake



Less opacity loss with AAAS networks than with AMDES alone



Decrease of hydrophilic character with AAAS networks

Conclusion and future work

- **Improved inter and intra-fiber strengthening**
- **Improved plasticity and deformability**
- **Deposition of an alkaline reserve**
- **Study other AAAS networks**
- **Work with other types of paper : newsprint (highly lignified)**
- **Evaluate the long-term behavior of treated papers (artificial aging)**

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