The problem

NANOMATERIALS FOR THE CONSOLIDATION OF IRON-TANNATE DYED TEXTILES



Aim

This study investigated the use of calcium carbonate nanoparticles for deacidification and nanocellulose and nanosilica for the consolidation of fragile iron-tannate dyed textiles.

Methods

Iron-tannate dyes

Textile degradation

BUT

The results showed that deacidification Different nano particles' functionalizations and mixtures were is crucial in combination with any tried in isopropanol and water. The consolidation treatment. The tested nanomaterials were applied by nanomaterials successfully slowed nebulization in order to test a suitable down the degradation and consolidated method for delicate fragile textile the textiles when proper weight uptake was achieved. The results also objects. The test textiles were subjected to artificial ageing and were validated nebulization as a controlled application method of these characterized using tensile testing, nanomaterials, especially on fragile surface pH measurements, delicate substrates. spectrophotometric colour measurements and secondary electron microscopy with energy dispersive Xray spectroscopy (SEM-EDS).

Conclusions

- Deacidifier and proper weight uptake necessary to exploit consolidation
- No improvement of extensibility
- No pH buffer from SNPs
- Effectiveness of nebulization (uniform coverage)
- Acceptable color variation



Future perspectives

- Further characterization (photoluminescence, XRF)
- Use of less diluted dispersions
- Addition of antioxidants
- Tests with different amount of material and ageing regimes
- Tests on different substrates
- Investigation of adhesion NPscellulose
- Working with conservators

Similarities with iron-gall inks Deterioration of paper and parchment Loss of information

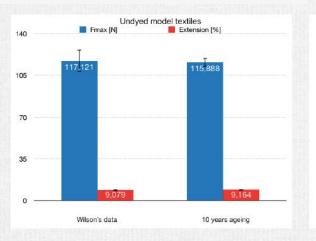
Black-brownish color to textiles for thousands of years

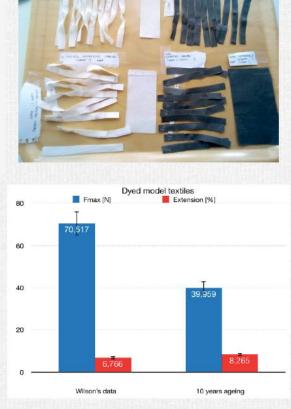


Starting point

Cotton dyed with iron-tannate dye 10 years previously.

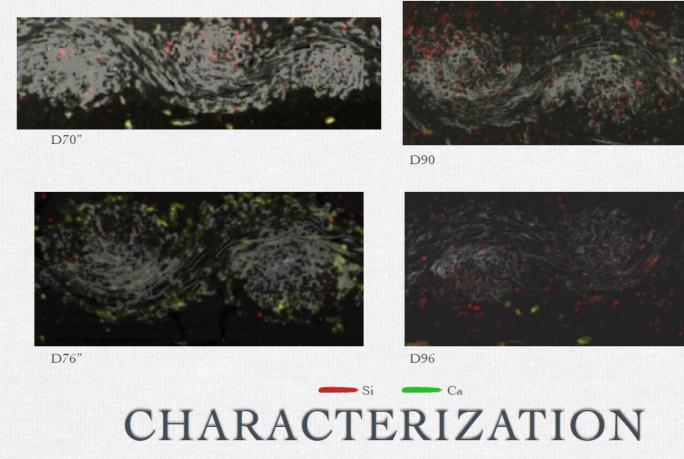
Undyed cotton showed no significant change while the dyed models were clearly degraded.





Results





SEM-EDX of cross-sections Better penetration of CaCO₃ NPs by brushing and upon ageing

Consolidation treatments

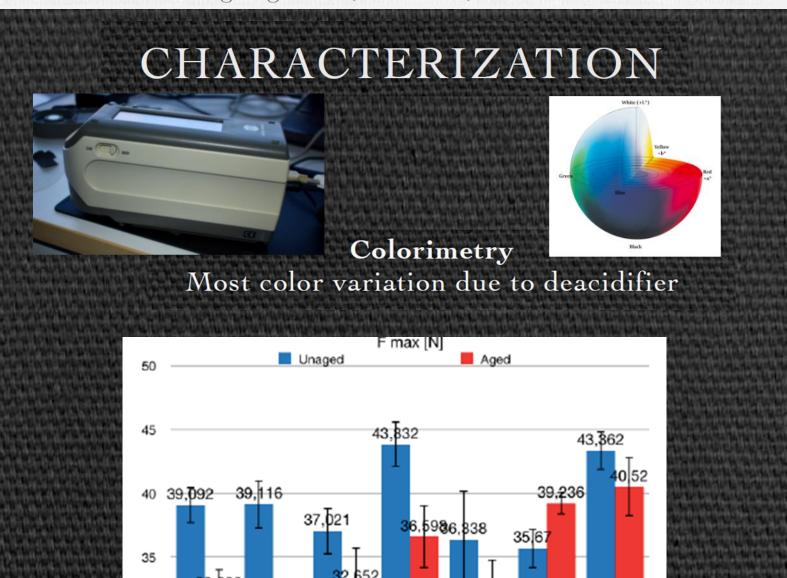
 Calcium carbonate nanoparticles (CSGI II)
Nanosilica (SNP) stabilzed with polyvinylpyrrolidone (PVP) or carboxymethylcellulose (CMC)
Nanocellulose (CNC)

- 6: CSGI II (CaCO₃ NPs)
- 7: CSGI II + PVP@SNP +CNC
- 8: CSGI II + CNC
- 9: CSGI II + CMC@SNP
- 7": 7 but by brushing
- 3": PVP@SNP + CNC by brushing





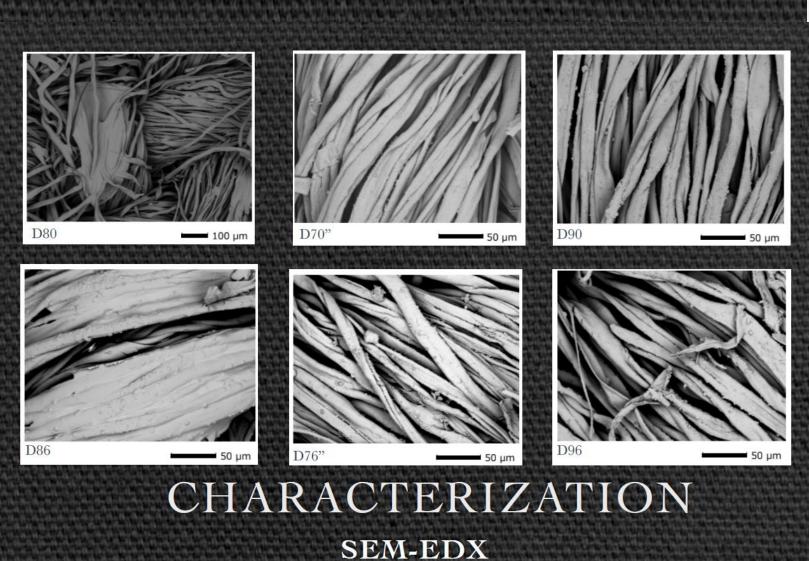
Application by nebulization Ageing: 70°C, 50% RH, 1 week



Tensile tests

Best results for 7" and 9

pH Deacidifier effective also upon ageing



Uniform materials deposition <u>at surface</u>