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Metal Threads Conservation Methods and Their Influence on Textiles

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Abstract

The cleaning of historical textiles with metal threads presents technical and ethical problems, because it is not only removing dirt but also removing the corrosion products of the metals. The mechanical and chemical cleaning methods which are used in conservation of metals are potentially damaging the surrounding textile. In this poster four types of commonly used treatments on metal threads and their influence on cotton textile are discussed. The influence of EDTA solution (ethylenediaminetetraacetic acid), ciric acid and solution of propan-1-ol/aqua with thiourea and formic acid was studied. The physical-mechanical properties of cotton were tested before and after artificial ageing for treated and non-treated samples. The properties of cotton were determined by means of polymerization degree of cellulose, colorimetry, FTIR spectroscopy and tensile strength was measured.

Experiment

Cotton textiles were treated by four “cleaning agents”. Degradation of treated, treated washed and untreated cotton textiles was studied after different artificial ageing. The properties of the cotton textiles before and after artificial ageing were compared.

Treatment agents:

5% aqueous solution of EDTA

2% thiourea, 3% formic acid in propan-1-ol

2% thiourea, 3% formic acid in water

5% aqueous solution of citric acid

The influence of different ageing conditions on total **color difference** (ΔE) of cotton textiles is significant. Generally the biggest color differences were observed after the heat-humid ageing. The negative influence of treatment agents was observed. This negative influence on color of cotton is decreased by rinsing (Fig.1).

The **polymerization degree of cellulose** was measured by a viscosimetric method using iron-natrium-tartarate complex solvent. The decrease of the polymerization degree of cellulose occurred not only after the ageing but it is also remarkable after the treatment by some agents (citric acid) (Fig. 2). The decrease of the polymerization degree of unwashed treated samples is more significant than the decrease of majority washed treated samples. The biggest decreases occurred after the light ageing.

The influence of different ageing conditions on the mechanical properties of cotton textiles can be observed (Fig. 3). It was not possible to measure the tensile strength after light ageing for samples treated by citric acid. Generally, there is a positive influence of the proper rinsing on the tensile strength (washed samples).

FTIR spectroscopy confirmed the positive influence of good rinsing of treated samples on the cotton textiles properties (Fig. 4). It is possible to see the bands at 1724 cm^{-1} in spectrum of samples treated by citric acid but in the spectra of washed samples citric acid is not observed.

Conclusions

From the gained results it is possible to determinate the positive influence of treatment agents rinsing on the degradation of cotton textiles. But the question is: Is it possible to rinse off completely the treatment agents from the real samples? Because if the treatment agents are not washed, they can have the negative influence on textiles. If we compare the ageing types, corresponding to our presumptions, the light and heat-humid ageing degrades the cotton textiles more than heat ageing.

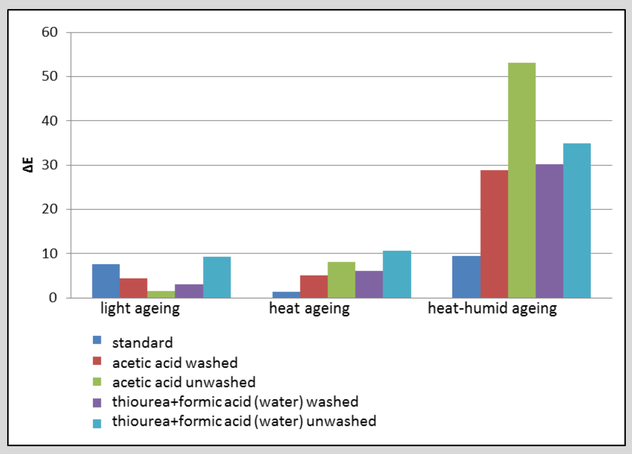


Fig. 1: Total color difference

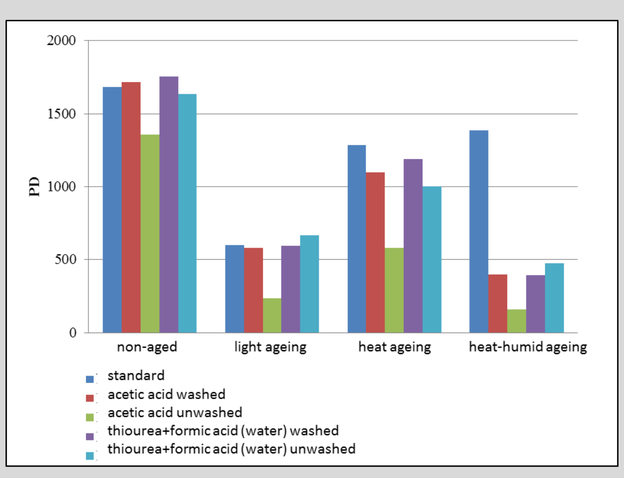


Fig. 2: Polymerization degree of cellulose

Ageing conditions

- *heat ageing*

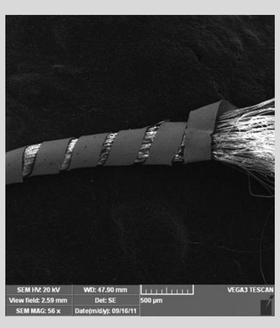
90 °C, 0 % RH, 21 days, darkness

- *heat-humid ageing*

90 °C, 80 % RH, 21 days, darkness

- *light ageing*

70 °C, UV 1W.m^{-2}, 5 days



SEM picture of metal strip wound around a cotton core

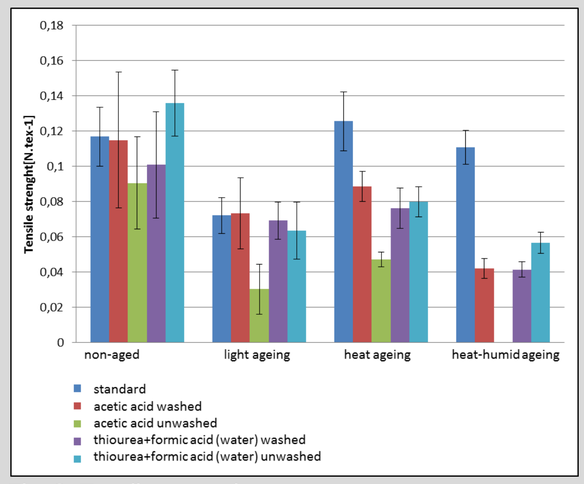


Fig. 3: Tensile strength

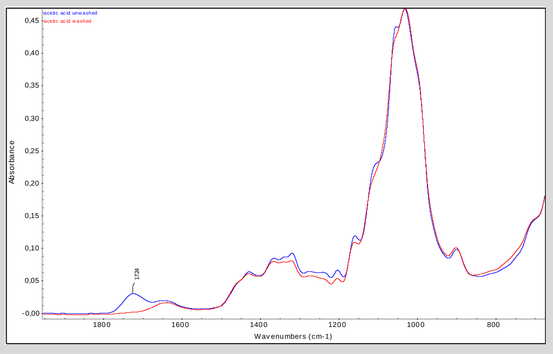


Fig. 4: FTIR spectra