Fourier Transform Infrared Spectroscopy in the leather quality control: the project LIFETAN: and eco friendly tanning cycle

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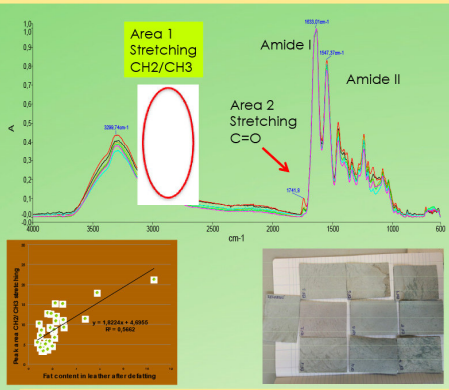
LIFETAN project is aimed at demonstrating the use of innovative natural products and technologies for the bating, defatting, fatting, dyeing and tanning phases in the whole leather tanning process. The main environmental, social and economic goal is the replacement of current commercial chemical and toxic products with natural products in the whole tanning cycle, in order to establish a significantly eco-sustainable and convenient business for companies. The project aim is the production of high quality leather products tanned with the new products and compared with the traditional one. Six new tanning formulations with natural products will be proposed and tested, characterized by higher biodegradability and performance.



B1 Demonstration of the use of the different toxic and chemical products currently used in the EU tanneries. Study of the inteaction of fat agents with leather

Experimental and theoretical results showed that not covalent bonds, which include electrostatic interactions (e.g. ionic bonds between Asp- and Lys+ and hydrogen bonds), hydrophobic interactions and Van der Waals force are involved in the interactions of SCP as well as CPs more than expected. Higher content of Cl groups in CPs favorite these interactions. Sulfonamide covalent bond between –SO2-Cl group of SCP and NH2- group of, Arg and Gln were also observed in several conditions and are fundamental for protein stabilization.

B2 demonstration of natural products. Study of natural FATTING products

In this action the plan is to synthesize and evaluate esterified vegetable fatty acid derivatives as substitute of chlorinated paraffins and sulfochlorinated paraffin. Based on the results of ECOFATTING project the following products have been selected:

- CHLORINATED PALMKERNEL OIL FAME (Lot 130116, 47,5 % m/m Chlorine content).
- SULFO CHLORINATED PALMKERNEL OIL FAME (Lot 130404, 38,0 % m/m Chlorine content 8,6% m/m sulfur content)

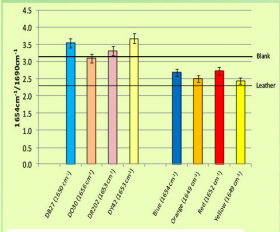
The Palmkernel Oil as the most suitable natural origin substrate to be chlorinated and sulphochlorinated as alternative to currently used chlorination and sulpho-chlorination of n-paraffins. The Plamkernel oil and its derivates was the election natural product chosen for the following applicative actions of ECOFATTING project because of its low cost, its good performance and its low environmental impact.

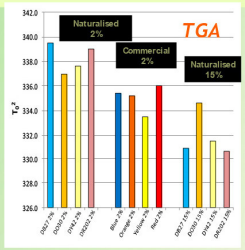
B1 Demonstration of the use of the different toxic and chemical products currently used in the EU tanneries/B2 demonstration of natural products:

A) Study of commercial acid dyes and naturalized dyes

B) Study of commercial products and natural defatting agents

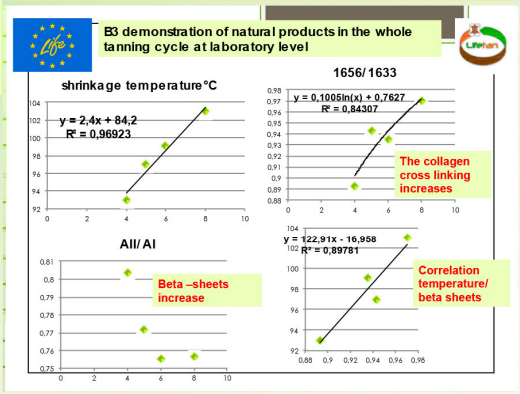
COLLAGEN CROSS-LINKING FT-IR





B3 demonstration of natural products in the whole tanning cycle at laboratory level

Calf leather bated with poultry manure (PODEBA Project), defatted with EDF 20 (Ecodefatting project) and tanned with several percentages of chromium (III) basic sulphate in order to evaluate if poultry manure improve chrome fixation on collagen fibres and reduce the amount of chromium salts (according to the proposal)



CONCLUSIONS

FTIR is a valuable useful technique to investigate at molecular level the interaction of new products with the leather proteins. The FT-IR analysis of amide I band gives information both in terms of the absorbance ratios at two different wavelengths (e.g. the 1654/1690 cm^{-1} absorbance ratio to evaluate the collagen cross linking) and the analysis of the single components found by peak fitting (conformational analysis) [1,2]

References

1. Monti S; Bramanti E; Della Porta V; Onor M; D'Ulivo A; Barone V Phys. Chem Chem. Physics 15 (2013) 14736-14747.
2. Pellegrini D.; Corsi, M.; Bonanni, M.; Bianchini, R.; D'Ulivo, A.; Bramanti, E. Dyes and Pigments, 116 (2015) 65-73.