



Lifetan

Layman's Report

Eco friendly tanning cycle

LIFE14 ENV/IT/000443



Co-financed by EC
in the framework of LIFE programme



INESCOP
CENTRE FOR TECHNOLOGY
AND INNOVATION



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Project: LIFETAN Ecofriendly tanning cycle
Project reference: LIFE14 ENV/IT/000443
Duration: 01-OCT-2015 to 31-DEC -2017
Total budget: 975,506.00 €
EU contribution: 554,867.00 €

Coordinator beneficiary:
ENEA SSPT-PROMAS-TEMAF
Laboratory of Materials Technologies Faenza

Associated beneficiary:
ICCOM-CNR
INESCOP Centre for Technology and Innovation
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LIFETAN PROJECT BACKGROUND

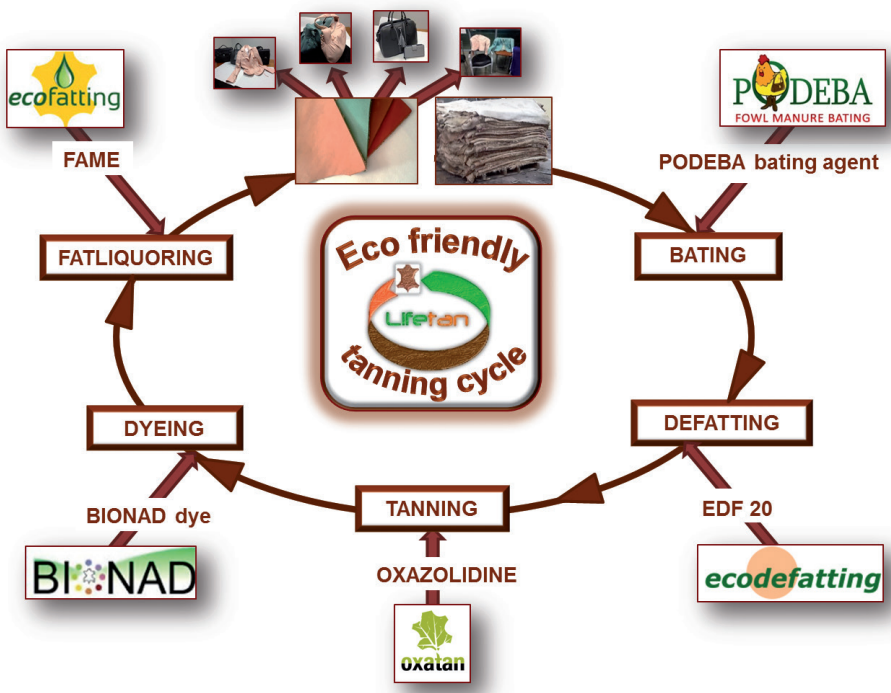
The European Union leather industry represents a significant share of global production, is globally acknowledged for the quality of the leathers manufactured and is an important economic sector for the whole EU. Italy and Spain are the most important locations in Europe for leather sector in terms of establishments, employment, production, and turnover.

The leather industries transform a putrescible waste, the skin, into a material of great resistance and beauty, which is leather, adequate for the manufacture of footwear, bags, garments, upholstery and so on. Even though it was a craft activity at the beginning, it has now achieved a high level of technological development for each of numerous steps of the

entire process. The leather tanning industry has a significant impact on the environment, especially by the generation of wastewater and solid waste, and is subject to constant environmental pressure, which has led to a continuous search for improvements in production processes. In addition, there are difficulties in recycling and disposal of semi-finished or finished products containing toxic metals, in particular chromium.

The whole sector needs to significantly improve the environmental sustainability of its processes, preserving the good quality of produced leather.





THE LIFETAN PROJECT

The project LIFETAN is devoted to a new “Ecofriendly tanning cycle” and was launched thanks to the co-funding of European Commission in the framework of the LIFE Environment Programme. The ENEA Faenza Research Laboratories project coordinator have been working for two years with the Italian tannery Newport, the Spanish tannery TRADELDA and other two research centers, the Italian CNR-ICCOM and the Spanish INESCOP, in order to achieve a green production and a sustainable process for the industry. The project activities addressed the innovation of the defatting, fatting, dyeing, bating

and tanning process substituting the chemical and toxic products with natural, biodegradable products which improve safety and ecosustainability. LIFETAN grown up on the basis of five previous LIFE projects focused only in one phase of the tanning process: PODEBA (www.podeba.eu), evaluated within the 25 best life projects for ecosustainability, for the bating agent, ECODEFATTING (www.life-ecodefattng.com) for the fatting stage, OXATAN (www.oxatan.eu), resulted “Best of the Best 2012”, for the Chromium substitution in tanning stage, ECOFATTING (www.pi.iccom.cnr.it/ecofatting) for the fatting agent and BIONAD (www.lifebionad.com) for the dye.

TECHNIQUES AND METHODOLOGY

The LIFETAN methodology consisted of different actions for demonstrating that the innovative natural products technique could be applied, mainly at a preindustrial scale.

The project objectives have been validated through pilot-scale tests and the process feasibility was been assessed through:

- study of the interactions of natural products with the collagen fibrils of leather by means of laboratory analysis
- characterization of wastewater from each stage
- quality control of leather by means of physical and chemical tests according to standard test methods
- production of footwear and leather goods
- lifecycle analysis (LCA) of the LIFETAN process.

Process step	New product	Characteristic
Bating	DPM-P120, PODEBA bating agent	Natural product, deodorised poultry manure
Degreasing	EDF20	Naturalised, obtained from lactose
Fatliquoring	Natural oil derivatives	Naturalised, obtained from palmkernel oil
Dyeing	Naturalized pigments	Naturalised, obtained from lactose
Tanning	Oxazolidine	Alternative chemical (of trivalent chromium salts)



New low environmental impact products

First of all were identified the toxic products in the tanning process at the bating, defatting, tanning, fatting and dyeing stages in order to evaluate which products should be removed from the formulations and to find new potential natural substitutes less dangerous and polluting.

- Recycling deodorised poultry manure into the bating stage as an alternative to the use of commercial enzymatic preparations, thus notably reducing the nitrogen content in wastewater.
- Using degreasing products based on waste sugars from the food industry that are more biodegradable and free from restricted substances as nonylphenol

and nonylphenol ethoxylates.

- Using oxazolidine as an alternative tanning agent to the use of trivalent chromium salts, allowing the production of high-quality, more biodegradable leather free from metals that also avoids the possible oxidation to hexavalent chromium.
- Using more natural, highly soluble dyes free from auxiliary chemicals, thus improving the impact on wastewater conductivity.
- Using natural oil derivatives for leather fatliquoring, as an alternative to the use of short-chain chloroparaffins, which are currently restricted.

Products testing with a scale-up approach

The new natural products were tested with a scale up approach and demonstrating the use of the natural products technique and process.

1. Laboratory level

Use of laboratory equipment and materials do demonstrate the new natural products and processes at a laboratory level, as a useful basis for the semi-industrial level tests.



Comparison between traditional and LIFETAN process

Defatting/Bating stage:	Traditional process:	TKN*: 1.650 mg/l
	LIFETAN process:	TKN*: 650-790 mg/l
	Reduction obtained:	↓ 50%
	<i>Expected results:</i>	↓ 30%
Pickling/tanning stage:	Traditional process:	Chromium: 380-545 mg/l
	LIFETAN process:	Chromium: not detected
	Reduction obtained:	↓ 100%
	<i>Expected results:</i>	↓ 100%
Post-tanning stages:	Traditional process:	Chromium: 48-62 mg/l
	LIFETAN process:	Chromium: not detected
	Reduction obtained:	↓ 100%
	<i>Expected results:</i>	↓ 100%

* TKN, Total Kjeldahl Nitrogen

2. Semi-industrial level

Demonstration of the new natural products and process at a semi-industrial scale in pilot tanning drums. Consequently, this allowed for carrying out numerous trials using smaller but representative quantities of leather, water, products and energy than in the case of industrial production. This level was also used for tanners training.

3. Preindustrial

The production of leather using the natural products technique at an industrial scale was directly tested in Italian and Spanish tanneries, up to 1500 kg load of bovine hides.

Results

LIFETAN project is an important breakthrough in environmental protection and sustainable development in the European leather and footwear industries, where the tanning process combines alternative products that allow the production of high-quality, more environmentally-friendly leather free from restricted substances.

The results derived from the development of the LIFETAN tanning technology with natural products showed that the obtained leather had good physical strength and adequate appearance and feel for the manufacture of different articles and

no significant differences respect to leathers processed with commercial products are observed.

Regarding the environmental impact of this technology, the characterisation of the effluents from LIFETAN tanning processes showed similar values to those obtained in chrome tanning. However, oxazolidine tanning effluents are chrome-free and consequently the oxidation of trivalent chromium to its hexavalent state is avoided and the metal-free sludge derived from wastewater treatment is more likely to be reused, e.g. for agriculture.

Environmental benefits

Furthermore, LIFETAN waste waters are more biodegradable than the ones derived from the traditional processes, which reduces the environmental impact of the process and a priori implies a higher feasibility of the biological treatment of waste waters. In the same way, waste, sludge and by-products are free of Chrome.

The main benefit of the LIFETAN technology can be summarized as follows:

- Free of ammonium sulphate salts in the bating phase
- Free of chlorine and sulphochlorinated paraffins (100% reduction)
- Free from synthetic chemical dyes (100% reduction)
- Free from alkylphenol and alkylphenol ethoxilates (100% reduction)
- Higher biodegradability: > 30% (easier biological wastewater treatment)
- Chrome-free leather and leather wastes
- Chrome-free sludge from wastewater treatment

The leather obtained with the LIFETAN process was used to produce some finished products, such as shoes and belts, and meets the requirements relative to the limit content in hazardous substances according to the criteria of the European Ecolabel for footwear. The LIFETAN process dramatically reduces the environmental impact generated during the tanning process and also at the end of the leather lifecycle, either in the form of leather trimmings when different goods are manufactured or when they are disposed of after use.

The LIFETAN project activities have contributed to the environmental European policy also with the direct action to promote the bating stage as an emerging technology, but all natural products are an important example of circular economy practice.



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