# **NATURE**·L<sup>®</sup>

# SUSTAINABLE LEATHER

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# METAL FREE

- BIODEGRADABLE LEATHER ISO 14855 ISO 20136
- VERSATILE AND HIGH PERFORMING
- **COMPOSTABLE**
- CARBON NEUTRAL
- DURABLE AS A TRADITIONALLY TANNED LEATHER



# CONTENTS

SUSTAINABLE LEATHER MOVING LINEAR TO CIRCULAR	5
WHO WE ARE	
OUR SUSTAINABLE DEVELOPMENT GOALS	8
LWG CERTIFICATION	9
OUR SUSTAINABILITY AWARNESS	
1. CHARACTERISTICS OF NATURE-L	
SHEEP	13
GOAT	
COW	
2. DURABILITY	
3. BIODEGRABILITY	
cow	
GOAT	
SHEEP	
4. ENVIRONMENTAL FOOTPRINT PROFILE	
BOVINE LEATHER	
CAPRINE LEATHER	62
OVINE LEATHER	
CARBON NEUTRAL	
5. HIGHLIGHTS	

I

# **SUSTAINABLE LEATHER** MOVING LINEAR TO CIRCULAR



PRODUCTS





Conceria Nuvolari is a family-owned company located in Monte Urano, Italy. The company is specialized in the production of high quality and exclusive leather.

The tannery offers a wide selection of leather types, including goatskins, cross-bred leather and sheep skin for shoes, clothing, soft & hard accessories. All the leathers are produced in conformity to the best protocols and leather regulations and Conceria Nuvolari is committed to invest in innovative technology to support sustainable developments while reducing its environmental impact. Advanced technologies are utilised to provide develop sustainable products without compromising the high quality of the leather.

Thanks to its structured organization and highly skilled technicians, Conceria Nuvolari is well known for the reliability and consistency of its products. This allowed the tannery to build up a large portfolio of clients within the luxury segment of the fashion industry, including well-known medium and large brands.

Conceria Nuvolari, which is synonymus of exquisite taste, is driven by a strong wish to use leather to communicate emotions. "All the colours of the world in just one skin" is what Sara Santori, the tannery's dynamic and strong-willed C.E.O, focuses the company's strategy on, with sustainability being at its core.

# BENEELT Company:

Conceria Nuvolari also presented the sustainability report (ISO 26000) endorsing its commitment to comply with the sustainable development goals of the UN 2030 Agenda, achieving the status of Benefit Company in June 2021: a new way of doing business, which takes care of socio-environmental issues while generating profit. Finally, the company participated in a project about the finished product, made with its own leathers, which obtained the CRADLE TO CRADLE certification.





# OUR SUSTAINABILITY AWARNESS

The themes of Sustainability, circular economy, social & environmental respect have become central key focuses in the current fashion & luxury sector.

Since 2015, Conceria Nuvolari has started his journey towards more sustainable processes, technologies and products with the aim to preserve natural resources while still offering first class products. The tannery focused its strategy on investing in R&D to address the social and environmental issues. The clear strategy and the tannery's internal expertise commitment allowed Conceria Nuvolari to establish itself as a pioneer in the development of alternative tanning techniques, which drastically reduce the amount of heavy metals and hexavalent Chromium in the leather.

In 2018, after intense years of research, an innovative tanning process has been developed, which is currently used to produce a metal free leather, biodegradable up to 80%.

The advanced technique produced high quality leather hides achieving the standard requirements for abrasion resistance, colour fastness, dry and wet crocking, and grab strength for footwear and apparel needs.

# Nature-L<sup>®</sup> is the registered trade mark for this innovative leather.



Currently, we can offer a wide selection of leather types suitable for multiple purposes, including footwear, apparel and accessories leather goods.

We constantly update our wide range of colours based on seasonal trends and we also offer a personalization option for customized colour and finishes.

A metal-free printing procedure has also been developed to offer printed version of the leather, which can be personalized with prints without impacting its main characteristics.

Nature-L<sup>®</sup> hides have been certified compostable in controlled composting conditions according to ISO 14855. The University of Bologna has also supported the technical testing to prove biodegradability, as certified in last report dated July 2018.

In addition to its high grade of biodegradability, Nature-L® brings a range of positive attribute, including:

- Higher reduction of water consumptions than the traditional tanning process
- Reduced impurities in waste waters from the production process, as no heavy metals are used during tanning
- Reduced cut-off waste thanks to the increase of the workable leather (less disposal costs, less pollution as cut off are biodegradable
- Improved leather performances, higher resistant to tears and breakages
- Improved colour intake and reduced amount of needed dye

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# OUR SUSTAINABLE DEVELOPMENT GOALS

The Sustainable Development Goals are the blueprint to achieve a better and more sustainable future for all. They address the global challenges we face, including those related to poverty, inequality, climate change, environmental degradation, peace and justice. The 17 Goals are all interconnected, and in order to leave no one behind, it is important that we achieve them all by 2030.

The Sustainable Development Goals are vital for a recovery that leads to greener, more inclusive economies, and stronger, more resilient societies.





We are committed to achieve the following Sustainable Development Goals:





LWG is an international organization of stakeholders in the leather supply chain, which aims to promote the best environmental practices across the supply chain and the related industries.

Conceria Nuvolari is LWG member, a milestone to demonstrate its ongoing commitment to responsible practices.

## UNIQUE REFERENCE NUMBER: CON 147





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# CHARACTERISTICS OF NATURE-L



# SHEEP

## CHARACTERISTICS OF THE LEATHER COLORE SHEEP

The sample "ART. SHEEP FREEMETAL COL. PINK (DE): O/N 254053 O/N 254055". – SHEEP has been tested by accredited laboratory Accredia Teknochim, Via Macerata scn, 62015 Monte San Giusto – (MC) – Italy, and the obtained results are indicated below:



DETERMINATION	METHOD	RESULTS	REQUIREMENTS
COLOUR FASTNESS TO RUBBING	UNI EN ISO 17700:2006 - Method A	<ul> <li>N.20 BACK AND FORTH MOVEMENTS</li> <li>FELTRE DRY ON DRY SPECIMEN</li> <li>Color transfer on the felt pad:</li> <li>5 degree of the grey scale</li> <li>Sample color variation:</li> <li>5 degree of the grey scale</li> </ul>	<ul> <li>≥ 3 AFTER 20 RUBS TO DRY (ISRAEL PORTION)</li> <li>≥ 3 AFTER 50 RUBS TO DRY</li> <li>≥ 2/3 AFTER 10 RUBS TO WET WITH WATER</li> <li>≥ 3 AFTER 20 RUBS TO WET WITH WA- TER (ISRAEL PORTION)</li> <li>≥ 3 AFTER 50 RUBSTO WET WITH SOLU- TION OF SWEAT (CHINA PORTION)</li> </ul>

COLOUR	LINI EN ISO	N 50 BACK AND FORTH MOVEMENTS	> 3 AFTER 20 RUBS TO DRY (ISRAFI
FASTNESS TO RUB-	17700:2006 - Method	- FELTRE DRY ON DRY SPECIMEN	
BING	A	Color transfer on the felt pad:	$\geq$ 3 AFTER 50 RUBS TO DRY
		5 degree of the grev scale	≥ 2/3 AFTER 10 RUBS TO WET WITH
		Sample color variation:	WATER
		4/5 degree of the grey scale	≥ 3 AFTER 20 RUBS TO WET WITH WA-
			TER (ISRAEL PORTION)
		N.10 BACK AND FORTH MOVEMENTS	≥ 3 AFTER 50 RUBSTO WET WITH SOLU-
		– DAMP FELT WITH WATER ON DRY	TION OF SWEAT (CHINA PORTION)
		SPECIMEN	
		Color transfer on the felt pad:	
		5 degree of the grey scale	
		Sample color variation:	
		5 degree of the grey scale	
		N.20 BACK AND FORTH MOVEMENTS	
		- DAMP FELT WITH WATER ON DRY	
		SPECIMEN	
		Color transfer on the felt pad:	
		5 degree of the grey scale	
		Sample color variation:	
		5 degree of the grey scale	
		N.50 BACK AND FORTH MOVEMENTS	
		- DAMP FELT WITH SWEAT SOLUTION	
		ON DRY SPECIMEN	
		Color transfer on the felt pad:	
		3/4 degree of the grey scale	
		Sample color variation:	
		4 degree of the grey scale	
		Note: In the dry sample is observed a	
		slight wrinkling.	

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COLOUR FASTNESS TO PER- SPIRATION	UNI EN ISO 11641:2013	<ul> <li>WITH ACID SWEAT SOLUTION:</li> <li>Color transfer on acetate: 4/5 of the gray scale</li> <li>Color transfer on cotton: 4/5 of the gray scale</li> <li>Color transfer on polyester: 5 of the gray scale</li> <li>Color transfer on acrylic: 5 of the gray scale</li> <li>Color transfer on wool: 4/5 of the gray scale</li> <li>Color transfer on wool: 4/5 of the gray scale</li> <li>Sample color degradation: 5 of the gray scale</li> <li>Color transfer on acetate: 4/5 of the gray scale</li> <li>Color transfer on acetate: 4/5 of the gray scale</li> <li>Color transfer on acetate: 4/5 of the gray scale</li> <li>Color transfer on acetate: 4/5 of the gray scale</li> <li>Color transfer on acetate: 4/5 of the gray scale</li> <li>Color transfer on nylon: 4 of the gray scale</li> <li>Color transfer on acrylic: 4/5 of the gray scale</li> <li>Color transfer on wool: 3/4 of the gray scale</li> <li>Sample color degradation: 5 of the gray scale</li> </ul>	≥ 3 COLOUR STAINING ≥ 3/4 CHANGE IN COLOUR
ABRASION RESISTANCE	ISO 17704:2004	ABRASIVE MEDIUM: ABRASIVE CANVAS TEST DURATION 6.400 CYCLES (DRY) After 1.600 cycles: The specimen has no abrasion. The specimen has a slight darkening. After 3.200 cycles: The specimen has no abrasion. The specimen has a slight darkening. After 6.400 cycles: The specimen has no abrasion. The specimen has a slight darkening.	SLIGHT DAMAGE AFTER 6.400 CYCLES TO DRY TEST

DETERMINATION OF TENSILE STRENGTH AND ELONGATION	UNI EN ISO 3376:2012	<ul> <li>DIRECTION: X</li> <li>Specimen width = 0,8 mm</li> <li>Tensile strength = 15,1 N / mm2</li> <li>Tensile strength = 126,0 N</li> <li>Elongation = 53,8%</li> <li>DIRECTION: Y</li> <li>Specimen width = 0,7 mm</li> <li>Tensile strength = 24,9 N / mm2</li> <li>Tensile strength = 181,5 N</li> <li>Elongation = 50,6%</li> <li>Note: In both directions is observed rupture of finishing before the complete rupture of the specimen.</li> <li>In the X direction, this phenomenon is more evident and occurs with an average force of 103.5 N, while for the Y direction it was not possible to identify this value in the graph.</li> <li>The average value reported is relative to the complete rupture of the specimen.</li> </ul>	≥ 75 N
STRESS RELIEVING AND TEN- SILE STRENGTH OF A LEATHER FLOWER (BURST TEST) (*) (§)	ISO 3379:2015	Crack resistance of the flower = 210 N Measurement of flower cracking distension = 9,6 mm	≥ 200 N



### CHARACTERISTICS OF THE LEATHER LACERAZIONE SHEEP

The sample "FODERA SHIP FREE METAL BLACK". – SHEEP has been tested by accredited laboratory Accredia Teknochim, Via Macerata scn, 62015 Monte San Giusto – (MC) – Italy, and the obtained results are indicated below:



DETERMINATION	METHOD	RESULTS	REQUIREMENTS
TEAR RESISTANCE	UNI EN ISO 3377-2:2016	<b>DIRECTION X:</b> Specimen thickness = 0,8 mm Tear resistance= 28,2 N	≥20 N (Leather uppers & leather linings)
		<b>DIRECTION Y:</b> Specimen thickness = 0,90 mm Tear resistance = 27,4 N	



## CHARACTERISTICS OF THE LEATHER METAL FREE SHEEP

The sample "ART. SHEEP FREEMETAL COL. PINK (DE)" SHEEP has been tested by accredited laboratory Accredia Teknochim, Via Macerata scn, 62015 Monte San Giusto – (MC) – Italy, and the obtained results are indicated below:



DETERMINATION	МЕТНОД	RESULTS	REQUIREMENTS
CHROME	UNI EN ISO 17072-2:2011	26,6 mg/kg	<b>TOTAL METAL:</b> Cr, Al, Ti, Zr, Fe ≤ 0,1 % (1000,0 mg/kg)
ALUMINIUM	UNI EN ISO 17072-2:2011	118,4 mg/kg	Leather Metal-free
TITANIUM	UNI EN ISO 17072-2:2011	15,9 mg/kg	
IRON	UNI EN ISO 17072-2:2011	131,9 mg/kg	
ZIRCONIUM	UNI EN ISO 17072-2:2011	24,4 mg/kg	



### CHARACTERISTICS OF THE LEATHER COLOR FASTNESS TO DRY CLEANING

#### WEAR LINE: WASHING TEST

The sample "ART. NAPPA NATURE-L WEAR FREE METAL BIODEGRA-DABLE DRY WASH" has been tested by accredited laboratory Accredia Teknochim, Via Macerata scn, 62015 Monte San Giusto – (MC) – Italy, and the obtained results are indicated below:



DETERMINATION	METHOD	RESULTS	
COLOR FASTNESS TO DRY CLEANING •	UNI EN ISO 11643:2009	Color degradation Color transfer on Wool Color transfer on Acrylic Color transfer on Polyester Color transfer on Polyamide Color transfer on Cotton Color transfer on Acetate	3/4 grade of the grey scale 3 grade of the grey scale 4 grade of the grey scale 4/5 grade of the grey scale 4 grade of the grey scale 4/5 grade of the grey scale 4/5 grade of the grey scale

PHYSICAL LABORATORY PROT.: 3945/20/FM TEST CARRIED OUT FROM 24/11/2020 TO 02/12/2020 TESTS CARRIED OUT AT TEKNOCHIM SRL CONDITIONING AND TEST CONDITIONS (EN 12222:1997): 23 ± 2°C, 50 ± 5% R.H. Sampling done by the client.

The report expandend uncertainty is based on a standard uncertainty multiplied by a coverage factor k=2, which for a normal distribution provides a level of confidence of approximately 95%.

#### Legend/grey scale:

5: NO CHANGE/LOSS OF COLOR

1: maximum variation/loss of color.

• Test carried out by external laboratory.



The sample "ART. COL. NUDE FREE METAL20". GOAT has been tested by accredited laboratory Accredia Teknochim, Via Macerata scn, 62015 Monte San Giusto – (MC) – Italy, and the obtained results are indicated below:



DETERMINATION	METHOD	RESULTS		
AZODYES	UNI EN ISO 17234- 1:2015	According to the analysis as carried out, azo colorants which release the listed aromatic amines were not detected.		
		4-aminobiphenyl (CAS 92-67-1) 3,3'-dimethylbenzidine (CAS 119-93-7) benzidine (CAS 92-87-5) 4-chloro-o-toluidine (CAS 95-69-2) 5-nitro-o-toluidine (CAS 99-55-8) p-cresidine (CAS 120-71-8) 2- naphthylamine (CAS 91-59-8) 4,4'-methylene-bis-(2-chloro-aniline) (CAS 101-14-4) o-aminoazotoluene (CAS 97-56-3) 4,4' - oxydianiline (CAS 101-80-4) 4-methoxy-m-phenylenediamine (CAS 615-05-4) 4,4'-thiodianiline (CAS 110-80-4) 4-chloroaniline (CAS 139-65-1) 4-chloroaniline (CAS 110-47-8) o-toluidine (CAS 110-47-8) o-toluidine (CAS 119-90-4) 4,4'-methylenedi-o-toluidine (CAS 838-88-0) 4,4' methylenedianiline (CAS 101-77-9) 2,4,5 trimethylaniline (CAS 117-17-7) 3,3'-dichlorobenzidine (CAS 91-94-1) 4-aminoazobenzene (CAS 60-09-3) 4-methyl-m-phenylenediamine (CAS 95-80-7) o-anisidine (CAS 95-68-1) 2,6-xylidine (CAS 87-62-7)	<ul> <li>≤ 30 mg/kg</li> </ul>	< 30 mg /kg

CARCINOGENIC DYES (§) (*)	Extration in Metha- nol – 70°C – 30 min – Ultrasounds TCL/LC-DAD / LC-MS	Acid Red 26 (CAS 3761-53-3) Basic Res 9 (CAS 569-61-9) Direct Black 38 (CAS 1937-37-7) Direct Blue 6 (CAS 2602-46-2) Direct Red 28 (CAS 573-58-0) Disperse Blue 1 (CAS 2475-45-8) Disperse Yellow 3 (CAS 2832-40-8) Basic Violet 14 (CAS 632-99-5) Disperse Orange 11 (CAS 82-28-0) Basic Blue 26 (CAS 2580-56-5) Basic Green 4 (CAS 569-64-2) Basic Green 4 (CAS 2437-29-8) Basic Green 4 (CAS 10309-95-2) Dimethyl Yellow (CAS 60-11-7) Solvent Yellow 3 (CAS 97-56-3) Solvent Yellow 14 (CAS 842-07-9) Basic Violet 1 (CAS 8004-87-3) Direct Blue 15 (CAS 2429-74-5) Acid Red 114 (CAS 6459-94-5) Acid Red 114 (CAS 6459-94-5) Acid Violet 49 (CAS 1694-09-3) Solvent Yellow 1 (CAS 60-09-3) Direct Blue 218 (CAS 28407-37-6) Direct Blue 218 (CAS 6227-04-9)	Not Detectable Not Detectable	Sum < 50 mg/kg
DETERMINATION OF TOTAL PB CONTENT	UNI EN ISO 17072- 2:2011	Basic Violet 3 (CAS 548-62-9/603-48-5/14426-25-6 < 0,25 mg/kg	Not Detectable	< 100 mg/kg
DETERMINATION OF TOTAL CD CONTENT	UNI EN ISO 17072- 2:2011	< 0,25 mg/kg		< 100 mg/kg
DETERMINATION OF TOTAL AS CONTENT	UNI EN ISO 17072- 2:2011	< 0,25 mg/kg		< 100 mg/kg
DETERMINATION OF TOTAL HG CONTENT	UNI EN ISO 17072- 2:2011	< 0,02 mg/kg		< 1 mg/kg

DETERMINATION OF EXTRACTABLE PB CONTENT	UNI EN ISO 17072- 1:2011	< 0,13 mg/kg	< 1 mg/kg
DETERMINATION OF EXTRACTABLE CD CONTENT	UNI EN ISO 17072- 1:2011	< 0,13 mg/kg	< 0,1 mg/kg
DETERMINATION OF EXTRACTABLE AS CONTENT	UNI EN ISO 17072- 1:2011	< 0,13 mg/kg	< 1 mg/kg
DETERMINATION OF EXTRACTABLE SB CONTENT	UNI EN ISO 17072- 1:2011	< 0,13 mg/kg	< 30 mg/kg
DETERMINATION OF EXTRACTABLE HG CONTENT	UNI EN ISO 17072- 1:2011	< 0,01 mg/kg	< 0,02 mg/kg
DETERMINATION OF EXTRACTABLE NI CONTENT	UNI EN ISO 17072- 1:2011	0,293 mg/kg	< 4 mg/kg
DETERMINATION OF EXTRACTABLE CO CONTENT	UNI EN ISO 17072- 1:2011	< 0,13 mg/kg	< 4 mg/kg
DETERMINATION OF EXTRACTABLE CU CONTENT	UNI EN ISO 17072- 1:2011	0,893 mg/kg	< 50 mg/kg
DETERMINATION OF EXTRACTABLE ZN CONTENT	UNI EN ISO 17072- 1:2011	54,75 mg/kg	< 50 mg/kg
PRE-AGING OF LEA- THER (*)	Method A2 - 24h, 80 °C, 10 % U.R ISO 10195:2018	/	

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CHROMIUM VI AFTER AGING	UNI EN ISO 17075- 1:2017	Cell lenght = 1 cm Volatile matter = %** Recovery Rate = % Chromium VI = < 3,0 mg/kg		< 3 mg/kg
ALKYLPHENOLS AND ETHOXYLATE ALKYLPHENOLS	ISO DIS 18218- 2:2012	Sum 4-tert-Octylphenol (CAS 104-66-9) 4-Nonyphenol (CAS 84852-15-3) Octylphenolethoxylates (CAS 9002-93-1) Nonyphenolethoxylates (CAS 9016-45-9)	< 20,0 mg/kg < 20,0 mg/kg < 20,0 mg/kg < 20,0 mg/kg	Sum < 500 mg/kg
PENTACHLOROPHE- NOL (CAS 87-86-5) (§) (*)	UNI EN ISO 17070:2015	< 0,1 mg/kg		< 0,5 mg/kg
2,3,4,5-TETRAHCLO- ROPHENOL (CAS 4901-51-3) (§) (*)	UNI EN ISO 17070:2015	< 0,1 mg/kg		< 0,5 mg/kg
2,3,4,6- TETRA- CHLOROPHENOL (CAS 58-90-2)(§) (*)	UNI EN ISO 17070:2015	< 0,1 mg/kg		< 0,5 mg/kg
2,3,5,6- TETRA- CHLOROPHENOL (CAS 935-95-5)(§) (*)	UNI EN ISO 17070:2015	< 0,1 mg/kg		< 0,5 mg/kg
TRICHLOROPHENOL (SUM) (§)(*)	UNI EN ISO 17070:2015	< 0,1 mg/kg		< 2,0 mg/kg
DETERMINATION OF CHLORINATED PARAFFINS C10-C13 (*) (§)	ISO18219: 2015	< 10 mg/kg		< 500 mg/kg

ORGANOTIN COM- Pounds	UNI CEN ISO/TS 16179:2012	Mono-n-butilstagno (MBT) (CAS 1118-46-3) Di-n-butilstagno (DBT) (CAS 683-18-1) Tri-n-butilstagno (TBT) (CAS 1461-22-9) Mono-n-octilstagno (MOT) (CAS 3091-25-6) Tetra-n-butilstagno (TeBT) (CAS 1461-25-2) Di-n-octilstagno (DOT) (CAS 3542-36-7) Trifenilstagno (TPhT) (CAS 639-58-7) Tri-cicloesilstagno (TcyT) (CAS 3091-32-5) Tri-n-octilstagno (TOT) (CAS 2587-76-0)	< 100 µg/kg < 100 µg/kg	DBT < 2 mg/kg TBT < 1 mg/kg TPhT < 1 mg/kg Others < 1 mg/kg
BENZENE - CHLORORGANIC CARRIERS (*) (§)	54232:2010 Extraction with solvent (Diclhoro- methan) in ultrasounds (20') EPA 25500:2000	1,2 - Dichlorobenzene (CAS 95-50-1) 1,3 - Diclhorobenzene (CAS 541-73-1) 1,4 - Diclhorobenzene (CAS 106-46-7) 1,2,3 - Trichlorobenzene (CAS 87-61-6) 1,2,4 - Trichlorobenzene (CAS 120-82-1) 1,3,5 - Trichlorobenzene (CAS 108-70-3) 1,2,4,5 - Tetrachlorobenzene (CAS 95-94-3) 1,2,5 - Tetrachlorobenzene (CAS 634-90-2)	< 1,00 mg/kg < 0,05 mg/kg < 0,05 mg/kg < 0,05 mg/kg < 0,05 mg/kg < 0,05 mg/kg < 0,05 mg/kg	< 500 mg/kg
	3550C:2000	1,2,3,5 - Tetrachlorobenzene (CAS 634-90-2) 1,2,3,4 - Tetrachlorobenzene (CAS 634-66-2) Pentachlorobenzene (CAS 118-74-1) 2- Chlorotoluene (CAS 95-49-8) 3- Chlorotoluene (CAS 108-41-8) 4- Chlorotoluene (CAS 106-43-4) 2,3- Dichlorotoluene (CAS 32768-54-0) 2,4- Dichlorotoluene (CAS 95-73-8) 2,5- Dichlorotoluene (CAS 19398-61-9) 2,6- Dichlorotoluene (CAS 95-75-0) 2,3,6- Trichlorotoluene (CAS 2077-46-5) 2,4,5- Trichlorotoluene (CAS 6639-30-1) Alfa, alfa, alfa - Trichlorotoluene (CAS 94-99-5) Alfa, 2,4 - Trichlorotoluene (CAS 102-47-6) Alfa, alfa, alfa, 2, - Tetrachlorotoluene (CAS 81-19-6) Alfa, alfa, alfa, 4 - Tetrachlorotoluene (CAS 2136-89-2) Alfa, alfa, alfa, 4 - Tetrachlorotoluene (CAS 5216-25-1) Pentachlorotoluene (CAS 877-11-2)	< 0,05 mg/kg < 0,05 mg/kg	

РН (*)	UNI EN ISO 4045:2008	4,1	3,5 - 7,5
FORMALDEHYDE	UNI EN ISO 17226- 1:2008	3,4 mg/kg	< 75 mg/kg
DIMETHYLFUMA- RATE (*)(§)	ISO/TS 16186:2012	< 0,05 mg/kg	< 0,1 mg/kg
FORMAMIDE (*)(§)	EPA5021A	< 1,0 mg/kg	< 200 mg/kg
N,N-DIMETHTLA- CETAMIDE (DMAC) (*) (§)	EPA 5021A + EPA 8260	< 5,0 mg/kg	< 1000 mg/ kg
DIMETHYLFORMA- MIDE (CAS 68-12-2) (*) (§)	CEN ISO/TS 16189:2013	< 5,0 mg/kg	< 1000 mg/ kg
1-METHYL-2-PYR- ROLIDONE (CAS 872-50-4) (*) (§)	EN ISO 19070:2014	< 1,0 mg/kg	< 1000 mg/ kg



# CHARACTERISTICS OF THE LEATHER METAL FREE GOAT

The sample ART. "PINK CAPRA CRUST" – GOAT has been tested by accredited laboratory Accredia Teknochim, Via Macerata scn, 62015 Monte San Giusto – (MC) – Italy, and the obtained results are indicated below:



DETERMINATION	метнор	RESULTS	REQUIREMENTS
CHROME	UNI EN ISO 17072-2:2011	32,87 mg/kg	<b>TOTAL METAL:</b> Cr, Al, Ti, Zr, Fe ≤ 0,1 % (1000,0 mg/kg)
ALUMINIUM	UNI EN ISO 17072-2:2011	101,5 mg/kg	Leather Metal-free
TITANIUM	UNI EN ISO 17072-2:2011	22,40 mg/kg	
IRON	UNI EN ISO 17072-2:2011	170,9 mg/kg	
ZIRCONIUM	UNI EN ISO 17072-2:2011	1,17 mg/kg	



The sample "ART. FREE METAL / PURE WHITE" – COW has been tested by accredited laboratory Accredia Teknochim, Via Macerata scn, 62015 Monte San Giusto – (MC) – Italy, and the obtained results are indicated below:

These Meter / Pure Whate 830

DETERMINATION	METHOD	RESULTS	REQUIREMENTS
CHROME	UNI EN ISO 17072-2:2011	5,1 mg/kg	<b>TOTAL METAL:</b> Cr, Al, Ti, Zr, Fe ≤ 0,1 % (1000,0 mg/kg)
ALUMINIUM	UNI EN ISO 17072-2:2011	59,1 mg/kg	Leather Metal-free
TITANIUM	UNI EN ISO 17072-2:2011	20,2 mg/kg	
IRON	UNI EN ISO 17072-2:2011	39,4 mg/kg	
ZIRCONIUM	UNI EN ISO 17072-2:2011	4,8 mg/kg	



### CHARACTERISTICS OF THE LEATHER STROFINIO COW

The sample "ART. VITELLO FREE METAL NERO" – COW has been tested by accredited laboratory Accredia Teknochim, Via Macerata scn, 62015 Monte San Giusto – (MC) – Italy, and the obtained results are indicated below:



DETERMINATION	METHOD	RESULTS	REQUIREMENTS
COLOUR FASTNESS TO RUBBING	UNI EN ISO 11640:2013	FLOWER SIDE N.20 BACK AND FORTH MOVEMENTS - FELTRE DRY ON DRY SPECIMEN Color transfer on the felt pad: 5 degree of the grey scale Sample color variation: 5 degree of the grey scale N.50 BACK AND FORTH MOVEMENTS - FELTRE DRY ON DRY SPECIMEN Color transfer on the felt pad:	<ul> <li>≥ 3 AFTER 20 RUBS TO DRY (ISRAEL PORTION)</li> <li>≥ 3 AFTER 50 RUBS TO DRY</li> <li>≥ 2/3 AFTER 10 RUBS TO WET WITH WATER</li> <li>≥ 3 AFTER 20 RUBS TO WET WITH WA- TER (ISRAEL PORTION)</li> </ul>
		Color transfer on the felt pad: 5 degree of the grey scale Sample color variation: 4/5 degree of the grey scale N.10 BACK AND FORTH MOVEMENTS - DAMP FELT WITH WATER ON DRY SPECIMEN Color transfer on the felt pad: 4/5 degree of the grey scale Sample color variation: 5 degree of the grey scale	

#### **N.20 BACK AND FORTH MOVEMENTS**

#### - DAMP FELT WITH WATER ON DRY

#### SPECIMEN

Color transfer on the felt pad:

4/5 degree of the grey scale

Sample color variation:

4/5 degree of the grey scale

#### **SKIVINGS SIDE**

#### Note: Weight on felt 500 g

### N.20 BACK AND FORTH MOVEMENTS

FELTRE DRY ON DRY SPECIMEN
Color transfer on the felt pad:
4 degree of the grey scale
Sample color variation:
4 degree of the grey scale

#### N.10 BACK AND FORTH MOVEMENTS - DAMP FELT WITH WATER ON DRY SPECIMEN

Color transfer on the felt pad: 4/5 degree of the grey scale Sample color variation: 4 degree of the grey scale

#### N.20 BACK AND FORTH MOVEMENTS - DAMP FELT WITH WATER ON DRY SPECIMEN

Color transfer on the felt pad: 4/5 degree of the grey scale

Sample color variation:

3/4 degree of the grey scale









INNOVHUB STAZIONI SPERIMENTALI PER L'INDUSTRIA

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### **OBJECTIVE OF** Effect of microorganisms and weathering aging treatments on two leather samples, THE STUDY: comparison of two different tanning treatments. Tests detailed in the Test Reports: RPT-S-SCCP-181240, RPT-SSCCP-181444 and RPT-SSCCP-190164. **LEATHER SAM-**ARTICLE NATURE-L GOAT; CLASSIC GOAT. **PLES NAMED: TEST CONDI-**The antimicrobial and soil burial resistances were determined according to AATCC TM30 **TIONS:** "Antifungal Activity, Assessment on Textile Materials: Mildew and Rot Resistance of Textile Materials". To verify the environmental conditions effects the following standard methods were applied: "Colour fastness to artificial light: Xenon arc fading lamp test": ISO 105 B02 and "Stability test and thermal cycles in a climatic chamber" (heat aging): ISO 17228:2015 MET. 7°. The samples cut in stripes were submitted to tensile tests according to UNI EN ISO 13934-1 before and after the exposition to the following treatments: soil burial test, artificial light

fastness aging and heat aging.

The details of the testing conditions applied are reported in Test Reports RPT-SSC-CP-181240, RPT-SSCCP-181444 and RPT-SSCCP-190164.

RESULTS: <u>AATCC 30.</u>	CHAETOMIUM GLOBOSUM				
TEST II	INCUBATION 7 DAYS	INCUBATION 14 DAYS			
Cotton reference 100%	•	•			
ARTICLE Nature-L GOAT	•	•			
CLASSIC GOAT	•	• •			

- Growth on the entire specimen surface.
- Growth on part of the specimen.
- Growth not present.
- Growth of microorganisms different from the inoculated ones.

### PICTURES: SAMPLES TREATED WITH CHAETOMIUM GLOBOSUM FUNGI (AATCC 30 TEST II)

As reported in the table and in the pictures, the sample Classic Goat after 14 days of contact shows a significant growth of the inoculated fungi, while the sample Nature-L Goat does not present any growth of the inoculated fungi, on the other hand growth of fungi different from the inoculated ones can be noted partially for Nature-L Goat sample and more significantly for Classic Goat sample.



RESULTS: AATCC 30.	ASPERGILLUS NIGER				
TEST III	INCUBATION 7 DAYS	INCUBATION 14 DAYS			
Cotton reference 100%	•	•			
ARTICLE Nature-L GOAT	0	0			
CLASSIC GOAT	• •	• •			

- Growth on the entire specimen surface.
- Growth on part of the specimen.
- Growth not present.
- Growth of microorganisms different from the inoculated ones.

PICTURES: SAMPLES TREATED WITH ASPERGILLUS NIGER FUNGI (TEST AATCC 30 III) As reported in the table and in the pictures, the sample Classic Goat after 14 days contact shows a significant growth of the inoculated fungi, while the sample Nature-L Goat does not present any growth of the inoculated fungi, moreover, the sample Classic Goat shows growth of fungi different from the inoculated ones.



RESULTS: AATCC 30. TEST IV	ASPERGILLUS NIGER + PENI- CILLIUM CHRYSOGENIUM + TRICHODERMA VIRIDE
	INCUBATION 28 DAYS
Cotton reference 100%	•
ARTICLE Nature-L GOAT	•
CLASSIC GOAT	•

- Growth on the entire specimen surface.
- Growth on part of the specimen.
- Growth not present.
- Growth of microorganisms different from the inoculated ones.

PICTURES: SAMPLES TRE-ATED WITH A MIXTUREOF FUNGI (AATCC TEST 30 IV) As reported in the table and in the pictures the sample Classic Calf already shows an extended fungal growth after 7 days of incubation, while Nature-L sample after 28 days of contact with moulds under testing conditions only present a partial growth of the inoculated fungi.

	ARTICLE NATURE-L GOAT	CLASSIC GOAT
AFTER 7 DAYS	Mark-s	
AFTER 14 DAYS		
AFTER 28 DAYS		

Conceria Nuvolari: Nature-L

# **CLIMATIC CHAMBER TREATMENTS**

		ARTICLE NATURE-L GOAT			CLASSIC GOAT		
		MAX Force (N)	ELONGATION MAX (MM)	ELONGATION % MAX (%)	MAX FORCE (N)	ELONGATION MAX (MM)	ELONGATION % MAX (%)
NOT	AVERAGE	254,89	36,76	36,76	318,73	52,04	52,04
TREATED SAMPLES	SD	34,20	5,16	5,16	72,32	19,02	19,02
	CV%	13,42	14,04	14,04	22,70	36,55	36,55
AFTER	AVERAGE	292,97	37,14	37,14	301,44	45,43	45,43
LIGHT FASTNESS	SD	47,57	3,58	3,58	83,00	15,55	15,55
AGING TRE- ATMENT	CV%	16,24	9,63	9,63	27,53	34,23	34,23
AFTER	AVERAGE	215,25	34,02	34,02	270,45	46,00	46,00
HEAT AGING TREAT-	SD	35,88	3,59	3,59	61,24	11,08	11,08
MENT	CV%	16,67	10,55	10,55	22,64	24,08	24,08



As a consequence of both aging treatments no significant differences of the tensile properties were determined for both samples. Here following the pictures of the treated samples after the aging treatments.

## **SOIL BURIAL TEST**

		ARTICLE NATURE-L GOAT				CLASSIC GOAT	
		MAX FORCE (N)	ELONGATION MAX (MM)	ELONGATION % MAX (%)	MAX FORCE (N)	ELONGATION MAX (MM)	ELONGATION % MAX (%)
NOT	AVERAGE	254,89	36,76	36,76	318,73	52,04	52,04
TREATED SAMPLES	SD	34,20	5,16	5,16	72,32	19,02	19,02
	CV%	13,42	14,04	14,04	22,70	36,55	36,55
AFTER 4	AVERAGE	201,66	37,66	37,66	286,00	41,89	41,89
WEEKS SOIL BURIAL	SD	28,54	7,58	7,58	75,48	13,13	13,13
TREAT- MENT	CV%	14,15	20,12	20,12	26,39	31,35	31,35
AFTER 16	AVERAGE	209,10	40,72	40,72	296,58	39,58	39,58
WEEKS SOIL BURIAL	SD	21,16	9,39	9,39	37,52	7,97	7,97
TREAT- MENT	CV%	10,12	23,07	23,07	12,65	20,14	20,14

After 4 weeks of soil burial treatment only slight differences are reported for both samples. After 16 weeks significant difference respect the untreated samples are not detected. Therefore, it is possible to conclude that the soil burial treatment does not influence the tensile properties for both leather samples.

The appearance of the specimens after soil burial treatment was analysed, the picture are following reported. After 4 weeks of soil burial both samples show darkening as a consequence of the soil contact. The sample Articolo Nature-L<sup>®</sup> Goat shows significant stains probably due to microbial growth while the sample Classic Goat does not show significant microbial growth.

After 16 weeks the sample Nature-L<sup>®</sup> Goat shows significant presence of stains due to microbial growth, while the sample Classic Goat only shows few stains as consequence of microbial growth.
	ARTICLE NATURE•L® GOAT	CLASSIC GOAT
	NOT TREATED	NOT TREATED
NOT TREATED		
AFTER SOIL BURIAL		w
AFTER 4 WEEKS UPPER SIDE		1
AFTER 4 WEEKS LOWER SIDE		
AFTER 16 WEEKS UPPER SIDE	5-2	
AFTER 16 WEEKS LOWER SIDE		

## **CONCLUSIONS**

The results of fungal resistance tests evidence that CLASSIC GOAT sample is more sensible to surface fungal growth, while sample ARTICLE NATURE-L GOAT only shows light growth of microorganisms different from those inoculated. The climatic chamber treatments (light and heat aging) and soil burial treatments do not influence tensile properties of both leather samples. Nevertheless, a higher microbial attack was evidenced for sample ARTICLE NATURE-L GOAT respect CLASSIC GOAT after soil burial treatments.

The different tunning treatments for the production of the two leather samples do not result in significant different performances of the samples after soil burial and climatic aging treatments.

**RESPONSIBLE OF THE SECTOR** Graziano Elegir

RESPONSIBLE OF THE AREA PATRIZIA SADOCCO



03

# BIODEGRABILITY

## **METHOD: ISO 14855**



## **TEST REPORT: BIODEGRADABILITY OF NATURE-L®**

**REQUESTING COMPANY:** Conceria Nuvolari SrL, Via Campania 8 63833 Montegiorgio (FM) P. IVA 02013190448

**PRINCIPAL INVESTIGATOR:** Cesare Accinelli, Laboratory A60 - Dipartimento Scienze e Tecnologie Agro-alimentari (Alma Mater Studiorium - Università di Bologna) – Department of Agricultural and Food Technologies (Alma Mater Studiorium - University of Bologna)

SAMPLE ID: Sample A-2018 and sample B-2018

**METHOD:** ISO 14855 – Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions. Part 2: Gravimetric measurement of carbon dioxide evolved in a laboratory-scale test

## BASIC PROCEDURE

Method ISO 14855-2:2007 specifies a method for determining the ultimate aerobic biodegradability of plastic materials under controlled composting conditions by gravimetric measurement of the amount of carbon dioxide evolved. The method is designed to yield an optimum rate of biodegradation by adjusting the humidity, aeration and temperature of the composting vessel.

The method applies to the following materials:

- natural and/or synthetic polymers and copolymers, and mixtures of these;
- plastic materials that contain additives such as plasticizers or colorants; water-soluble polymers;
- materials that, under the test conditions, do not inhibit the activity of micro-organisms present in the inoculum.

In the report summarized here, method ISO 14855-2:2007 was used for estimating thebiodegradability of two leather samples (sample A-2018 and sample B-2018), under controlled composting conditions. More precisely, composting conditions were simulated using aerobic reactors (500 mL volume). Samples were reduced to powder and then a 10-g mass (air-dried bases) was mixed with a mature compost and incubated at 60 °C. MATERIALS: Sample A-2018 and sample B-2018: powder

## MATERIALS AND TEST PA-RAMETERS

REFERENCE MATERIALS: CELLULOSE POWDER COMPOST FROM A INDUSTRIAL COMPOST FACILITY (HERA S.P.A., BOLOGNA, ITALY) 4-MONTH-MATURE COMPOST REACTOR VOLUME: 500 ML PH: 8.3 INCUBATION TEMPERATURE: 60 °C SAMPLE MASS: 10 G (AIR-DRIED BASIS) INCUBATION TIME: 90 DAYS REPLICATES: 3

SAMPLES WERE MIXED AT A 2-3 DAY INTER-

$$D_{t} = \frac{(CO_{2})_{T} - (CO_{2})_{B}}{ThCO_{2}} \times 100\%$$

## **BIODEGRADABILITY (%)**

where:

VAL

(CO2)T is the cumulative amount of carbon dioxide evolved in each composting vessel containing test material, in grams per vessel;

(CO2)B is the cumulative amount of carbon dioxide evolved in the blank vessel, in grams per vessel;

ThCO2 is the theoretical amount of carbon dioxide which can be produced by the test material, in grams per vessel.

If the differences between the individual results are less than 20 %, calculate the average percentage of biodegradation.

#### RESULTS **BIODEGRA-**DATION (%) (MEAN) **REPLICATE 2 REPLICATE 3 REPLICATE 1** CELLULOSE 96.2 93.9 97.4 97.4 SAMPLE A 69.5 73.4 75.1 75.1 SAMPLE B 75.9 70.6 74.3 74.3

VALIDITY PA-RAMETERS:

Biodegradation (%) of the reference material after 45 days of incubation > 70% YES

Differences of biodegradability (%) among replicates (reference material) < 20% YES

**CONCLUSIONS:** 

Under controlled composting conditions for 90 d of incubation, samples A-2018 e B-2018 showed a biodegradability of 75.1% and 74.3%, respectively. On the basis of these results, the two leather samples can be considered as biodegradable.

Bologna, July 24th 2018 DR CESARE ACCINELLI, PHD

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# TEST REPORT: **BIODEGRADABILITY** OF CLASSIC LEATHER

**REQUESTING COMPANY:** Conceria Nuvolari SrL, Via Campania 8 63833 Montegiorgio (FM) P. IVA 02013190448

**PRINCIPAL INVESTIGATOR:** Cesare Accinelli, Laboratory A60 - Dipartimento Scienze e Tecnologie Agro-alimentari (Alma Mater Studiorium - Università di Bologna) – Department of Agricultural and Food Technologies (Alma Mater Studiorium - University of Bologna)

SAMPLE ID: Sample B-2019-Conceria Nuvolari

**METHOD:** ISO 14855 – Determination of the ultimate aerobic biodegradability of plastic materials under controlled composting conditions. Part 2: Gravimetric measurement of carbon dioxide evolved in a laboratory-scale test

## BASIC PROCEDURE

Method ISO 14855-2:2007 specifies a method for determining the ultimate aerobic biodegradability of plastic materials under controlled composting conditions by gravimetric measurement of the amount of carbon dioxide evolved. The method is designed to yield an optimum rate of biodegradation by adjusting the humidity, aeration and temperature of the composting vessel.

The method applies to the following materials:

- natural and/or synthetic polymers and copolymers, and mixtures of these;
- plastic materials that contain additives such as plasticizers or colorants; water-soluble polymers;
- materials that, under the test conditions, do not inhibit the activity of micro-organisms present in the inoculum.

In the report summarized here, method ISO 14855-2:2007 was used for estimating the biodegradability of two leather samples (sample A-2018 and sample B-2018), under controlled composting conditions. More precisely, composting conditions were simulated using aerobic reactors (500 mL volume). Samples were reduced to powder and then a 10-g mass (air-dried bases) was mixed with a mature compost and incubated at 60 °C.

MATERIALS: Sample B-2019-Conceria Nuvolari: powder

## MATERIALS AND TEST PA-RAMETERS

REFERENCE MATERIALS: CELLULOSE POWDER COMPOST FROM A INDUSTRIAL COMPOST FACILITY (HERA S.P.A., BOLOGNA, ITALY) 4-MONTH-MATURE COMPOST REACTOR VOLUME: 500 ML PH: 8.3 INCUBATION TEMPERATURE: 60 °C SAMPLE MASS: 10 G (AIR-DRIED BASIS) INCUBATION TIME: 90 DAYS REPLICATES: 3 SAMPLES WERE MIXED AT A 2-3 DAY INTERVAL

**BIODEGRADA-BILITY (%)**  where:

$$D_{t} = \frac{(CO_{2})_{T} - (CO_{2})_{B}}{ThCO_{2}} \times 100 \%$$

(CO2)T is the cumulative amount of carbon dioxide evolved in each composting vessel containing Test material, in grams per vessel;

(CO2)B is the cumulative amount of carbon dioxide evolved in the blank vessel, in grams per vessel;

ThCO2 is the theoretical amount of carbon dioxide which can be produced by the test material, in grams per vessel.

If the differences between the individual results are less than 20 %, calculate the average percentage of biodegradation.

RESULTS		REPLICATE 1	REPLICATE 2	REPLICATE 3	BIODEGRA- DATION (%) (MEAN)
	CELLULOSE	96.3	97.5	98.0	97.3
	B-2019 - NUVOLARI	8.1	8.9	7.3	7.8

VALIDITY PA-RAMETERS:

Biodegradation (%) of the reference material after 45 days of incubation > 70% YES

Differences of biodegradability (%) among replicates (reference material) < 20% YES

CONCLUSIONS

Under controlled composting conditions for 90 d of incubation, sample B-2019-Conceria Nuvolari showed a biodegradability of 7.8%.

Bologna, September 13th, 2019 PROF. CESARE ACCINELLI

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Organismo di Ricerca Nazionale delle Camere di Commercio di Napoli, Pisa e Vicenza

SUBJECT: REPORT OF FURTHER BIO-DEGRADABI-LITYTESTS ON A SAMPLE OF NATURE - I COW - NS. ORDER CON-FIRMATION PROT. N. 531 OF 21/10/2020

#### NATURE-L COW (MARKED AS RP 390/20)

In order to carry out biodegradability tests according to ISO 20136: 2020 - Leather: Determination of degradability by microorganisms. The tests in this report were conducted through the use of equipment that automatically detects the CO2 developed during the test, in accordance with Method B of the standard method.

In general, "degradation" is defined as the amount of CO2 produced from the substance expressed as a percentage of the theoretical CO2 that it should have produced (ThCO2, Theoretical Maximum Inorganic Carbon), calculated on the basis of the original organic carbon content of the substance (TOC). The sample is degraded by the metabolic activity of the microorganisms contained in a multi-strain inoculum extracted from an activated tannery sludge; in the breathing process, these microorganisms consume the carbon contained in the substance, transforming it into carbon dioxide (CO2), that is therefore measured at regular intervals.

The microorganisms present in the sludge, in addition to producing CO2 starting from the degradation of the organic carbon contained in the sample under examination, also develop CO2 starting from organic substances already present in the inoculum. For this reason, the CO2 produced is subtracted from the total recorded in such a way as to obtain only the quantity of CO2 developed by the degradation of the sample under examination. For this purpose, negative controls composed exclusively of the activated sludge used as inoculum for the test battery are set up. To verify the validity of the test, as indicated by the reference protocols, positive control were also set up: the material used for the execution of the controls is made up of collagen, a substance with known biodegradability.

According to ISO 20136, the test can be considered concluded when the percentage of biodegradability of the positive control (collagen) is equal to or greater than 70%.

The experimental protocol for the determination of biodegradability on the samples sent was based on the use of the following reactors:

2 reactors for the negative control (activated sludge inoculum + culture medium);

- 2 reactors for the positive control (inoculation of activated sludge + culture medium + collagen);
- 2 reactors for the test mixture (inoculation of activated sludge + culture medium + skin).

The leather sample under examination was previously ground in order to favor and catalyze the degradation reaction by the microorganisms of the activated sludge.

The test temperature was maintained at  $23 \pm 2^{\circ}$  C, throughout the duration of the experiment equal to 60 days, starting from 29/09/2021.

Below are the graphs relating to the average degradation of the NATURE - L COW sample and the reference Collagen.



Figure 1. Graph of the Biodegradability of the Nature-L COW sample and of the Negative Sample

For the purpose of determining the Biodegradability value in accordance with ISO 20136, it is emphasized that the sample and the positive control (collagen) showed a biodegradability level of 70% after 34 days of testing, therefore the results of the determinations are as follows:

DETERMINATION	TEST METHOD	MEASURE UNIT	RESULTS
Biodegradability	ISO 20136:2020	%	63,2
Relative Biodegradability	ISO 20136:2020	%	90,4

Based on the above data, the sample called NATURE - L COW has a relative biodegradability of **90,4%** after 34 days and therefore can be considered as BIODEGRADABLE UNDER AEROBIC CONDITIONS according to the ISO 20136: 2020 method.

Labs Manager

pott. G. Colvenese









Organismo di Ricerca Nazionale delle Camere di Commercio di Napoli, Pisa e Vicenza

REPORT OF BIODEGRADA-BILITY TESTS ON A SAMPLE OF NATURE - I GOAT - NS. ORDER CON-FIRMATION PROT. N. 531 OF 21/10/2020

#### NATURE-L GOAT (MARKED AS RP 389/20)

in order to carry out biodegradability tests according to ISO 20136: 2017 - Leather: Determination of degradability by microorganisms. The tests were conducted with the collaboration of the Hygiene Laboratories of the Biology Department of the Federico II University of Naples.

In general, "degradation" is defined as the amount of CO2 produced from the substance expressed as a percentage of the theoretical CO2 that it should have produced (ThCO2, Theoretical Maximum Inorganic Carbon), calculated on the basis of the original organic carbon content of the substance (TOC). The sample is degraded by the metabolic activity of the microorganisms contained in a multi-strain inoculum extracted from an activated tannery sludge; in the breathing process, these microorganisms consume the carbon contained in the substance, transforming it into carbon dioxide (CO2), that is therefore measured at regular intervals.

The microorganisms present in the sludge, in addition to producing CO2 starting from the degradation of the organic carbon contained in the sample under examination, also develop CO2 starting from organic substances already present in the inoculum. For this reason, the CO2 produced is subtracted from the total recorded in such a way as to obtain only the quantity of CO2 developed by the degradation of the sample under examination. For this purpose, negative controls composed exclusively of the activated sludge used as inoculum for the test battery are set up. To verify the validity of the test, as indicated by the reference protocols, positive control were also set up: the material used for the execution of the controls is made up of collagen, a substance with known biodegradability.

According to ISO 20136, the test can be considered concluded when the percentage of biodegradability of the positive control (collagen) is equal to or greater than 70%.

The experimental protocol for the determination of biodegradability on the samples sent was based on the use of the following reactors:

2 reactors for the negative control (activated sludge inoculum + culture medium);

- 2 reactors for the positive control (inoculation of activated sludge + culture medium + collagen);
- 2 reactors for the test mixture (inoculation of activated sludge + culture medium + skin).

The leather sample under examination was previously ground in order to favor and catalyze the degradation reaction by the microorganisms of the activated sludge.

The test temperature was kept at  $30 \pm 1$  °C, while the experiment duration was 42 days, providing for the execution of 7 measurements in this period.

The results relating to the tests carried out are shown below.

ТІМЕ	NATURE-L GOAT
Day	% Biodegradability
0	0,0
7	18,7
14	37,8
21	46,7
28	56,5
35	66.7
42	71,3

## **RESULTS**

Below are the graphs relating to the degradation of the various samples and the negative control.



Figure 1. Graph of the Biodegradability of the Nature-L GOAT sample and of the Negative Sample

For the sample under examination, the graph highlights the achievement of a plateau phase on day 42, corresponding to a biodegradability percentage of 71,3%.

For the purpose of determining the Biodegradability value in accordance with ISO 20136, we underline that the sample and the positive control (collagen) showed a biodegradability content higher than 70% after 42 days of testing. Therefore the results of the determinations were the following:

DETERMINATION	TEST METHOD	MEASURE UNIT	RESULTS
Biodegradability	ISO 20136:2017	%	71,2
Relative Biodegradability	ISO 20136:2017	%	83,5

Based on the above data, the sample called NATURE - I GOAT has a relative biodegradability of 83,5% after 42 days and therefore can be considered as BIODEGRADABLE UNDER AEROBIC CONDITIONS according to the ISO 20136: 2017 method.

Labs Manager

fott. G. Colvenese









Organismo di Ricerca Nazionale delle Camere di Commercio di Napoli, Pisa e Vicenza

#### NATURE -L SHEEP (MARKED AS RP 388/20)

in order to carry out biodegradability tests according to ISO 20136: 2017 - Leather: Determination of degradability by microorganisms. The tests were conducted with the collaboration of the Hygiene Laboratories of the Biology Department of the Federico II University of Naples.

In general, "degradation" is defined as the amount of CO2 produced from the substance expressed as a percentage of the theoretical CO2 that it should have produced (ThCO2, Theoretical Maximum Inorganic Carbon), calculated on the basis of the original organic carbon content of the substance (TOC). The sample is degraded by the metabolic activity of the microorganisms contained in a multi-strain inoculum extracted from an activated tannery sludge; in the breathing process, these microorganisms consume the carbon contained in the substance, transforming it into carbon dioxide (CO2), that is therefore measured at regular intervals.

The microorganisms present in the sludge, in addition to producing CO2 starting from the degradation of the organic carbon contained in the sample under examination, also develop CO2 starting from organic substances already present in the inoculum. For this reason, the CO2 produced is subtracted from the total recorded in such a way as to obtain only the quantity of CO2 developed by the degradation of the sample under examination. For this purpose, negative controls composed exclusively of the activated sludge used as inoculum for the test battery are set up. To verify the validity of the test, as indicated by the reference protocols, positive control were also set up: the material used for the execution of the controls is made up of collagen, a substance with known biodegradability.

According to ISO 20136, the test can be considered concluded when the percentage of biodegradability of the positive control (collagen) is equal to or greater than 70%.

The experimental protocol for the determination of biodegradability on the samples sent

was based on the use of the following reactors:

2 reactors for the negative control (activated sludge inoculum + culture medium);

 2 reactors for the positive control (inoculation of activated sludge + culture medium + collagen);

2 reactors for the test mixture (inoculation of activated sludge + culture medium + skin).

The leather sample under examination was previously ground in order to favor and catalyze the degradation reaction by the microorganisms of the activated sludge.

The test temperature was kept at  $30 \pm 1$  °C, while the experiment duration was 42 days, providing for the execution of 7 measurements in this period.

The results relating to the tests carried out are shown below.

RESUL	TS.
-------	-----

ТІМЕ	NATURE-L GOAT
Day	% Biodegradability
0	0,0
7	22,4
14	45,9
21	51,5
28	60,4
35	66,9
42	70,9

Below are the graphs relating to the degradation of the various samples and the negative control.



Figure 1. Graph of the Biodegradability of the NATURE - I SHEEP sample and of the Negative Sample

For the sample under examination, the graph highlights the achievement of a plateau phase on day 42, corresponding to a biodegradability percentage of 70,9%.

For the purpose of determining the Biodegradability value in accordance with ISO 20136, we underline that the sample and the positive control (collagen) showed a biodegradability content higher than 70% after 42 days of testing. Therefore the results of the determinations were the following:

DETERMINATION	TEST METHOD	MEASURE UNIT	RESULTS
Biodegradability	ISO 20136:2017	%	70,9
Relative Biodegradability	ISO 20136:2017	%	83,1

Based on the above data, the sample called NATURE - I SHEEP has a relative biodegradability of 83,1% after 42 days and therefore can be considered as BIODEGRADABLE UNDER AEROBIC CONDITIONS according to the ISO 20136: 2017 method.

Labs Manager

Sott. G. Covenese



04

# ENVIRONMENTAL FOOTPRINT PROFILE



## NATURE-L BOVINE LEATHER

### **OBJECTIVE OF THE STUDY**

Conceria Nuvolari has evaluated the environmental profile of its metal-free biodegradable leather Nature-L® (bovine) following the Product Environmental Footprint (PEF) method. The project has been performed by Prof. Giovanni Dotelli, Full Professor of Materials Science and Technology at Politecnico di Milano.

### WHAT IS PEF?

It is a well-standardized methodology to perform LCA (Life Cycle Assessment) studies of a product on condition that specific category rules are available. Category rules help perform an LCA study in a way that guarantees reproducibility and comparability.

### WHAT IS THE ENVIRONMENTAL FOOTPRINT (EF) OF A PRODUCT?

EF is a complete picture of the environmental performance of a product including all life stages. In the case of leather products, being intermediate products (i.e. business-to-business), the LCA analysis is cradle-to-gate.

### WHY CHOOSING THE PEF METHODOLOGY TO PERFORM AN LCA?

The PEF methodology has been created by the European Commission (EC) to calculate all the relevant environmental information of products and enable feasible, relevant and appropriate comparisons among products belonging to the same category. This method could be the support of future green policies by EC.

#### WHY PERFORMING A PEF STUDY OF LEATHER?

This is one of the few sectors that have completed the first pilot phase, therefore PEFCR are available. Indeed, the Leather Pilot Technical Secretariat has produced the PEF Category Rules for the leather (PEFCR), which are valid until 31 December 2020. Following these rules is now possible to realize Life Cycle Assessment (LCA) studies fully compliant with the PEF methodology.

## IS THIS NEW ROUTE OF INTEREST FOR THE FASHION INDUSTRY SECTOR?

Yes, it is, the Sustainable Apparel Coalition is leading the new PEFCR project "Apparel", which includes accessories, dresses, hosiery, underwear, leggings/ tights, baselayer, jacket, jersey, pants, shirts, skirt, socks, sweater and cardigans, swimwear, tshirt, boots, cleats, court, dress shoes/ heel, other athletic shoes, sandals and sneakers.





## MATERIALS AND METHODS

Every step of the LCA study has been performed as much in accordance to the PEFCR – Product Environmental Footprint Category Rules for the production of leather, published in April 2018 on behalf of the European Commission's Joint Research Centre.

Nature-L $^{\odot}$  is modelled as bovine leather belonging to the Representative Product category RP2 for footwear and leather goods.

A cradle-to-gate approach is followed in the study: upstream (farming, slaughtering and preservation) and core (tanning) processes have been identified within the system boundary. The core process has been divided into eight unit processes where the main production phases of Nature-L® are performed.

For every unit process, data about the required material, energetic and logistic input and output flows have been collected and modelled using the PEF-compliant datasets included in the Environmental Footprint EF2.0 database.

The obtained information has been processed using the PEF-compliant Environmental Footprint EF2.0 Impact Assessment methods.

The evaluation of the environmental impacts has been mainly based on company-specific data collected from the industrial realities where the leather tanning process for Nature-L® is performed.



Figure 1 - System boundary for the production of Nature-L® with the main unit processes

## RESULTS

Following the PEF guidelines, the environmental impact of 1 square metre of Nature-L<sup>®</sup> is quantified through characterization for every PEF-compliant impact category. However, the PEF Category Rules for leather don't allow the evaluation of the environmental benefit guaranteed by the biodegradability of the product. It is so since leather is an intermediate product and the PEF-compliant cradle-to-gate approach implies a system boundary ending with the production of leather in the industrial facilities, thus not considering downstream processes as B2B distribution, further manufacturing into finished consumer products, distribution to customers, use phase and end-of-life treatment of used products.

IMPACT CATEGORY	UNIT OF MEASURE	TOTAL
Climate change	kg CO2 eq	4.15E+01
fossil		1.72E+01
biogenic		1.56E+01
land use and transformation		8.75E+00
Ozone depletion	kg CFC11 eq	1.86E-07
Ionising radiation, HH	kBq U-235 eq	6.72E-01
Photochemical ozone formation, HH	kg NMVOC eq	6.41E-02
Respiratory inorganics	disease incidence	4.15E-06
Non-cancer human health effects	CTUh	3.11E-05
Cancer human health effects	CTUh	6.48E-07
Acidification terrestrial and freshwater	mol H+ eq	5.48E-01
Eutrophication freshwater	kg P eq	4.73E-03
Eutrophication marine	kg N eq	1.54E-01
Eutrophication terrestrial	mol N eq	2.32E+00
Ecotoxicity freshwater	CTUe	1.20E+02
Land use	Pt	3.70E+03
Water scarcity	m3 deprived	2.22E+01
Resource use, energy carriers	MJ	1.73E+02
Resource use, mineral and metals	kg Sb eq	6.33E-05

Table 1 - Results of the PEF-compliant characterization step

The climate change category presented in this study indicates the GWP – Global Warming Potential of the analysed process in terms of fossil, biogenic and land use/transformation contributions. It is expressed in kg CO2 eq and it's a good measure of the Carbon Footprint of Nature-L<sup>®</sup>, indicating the quantity of GHG – Green House Gases emitted during the production.

Non-cancer and cancer human health effects belong to toxicity categories, expressed in the study in Comparative Toxic Unit for human (CTUh). This unit indicates the estimated increase in morbidity in the total human population per unit mass of the chemicals emitted.

Ecotoxicity freshwater indicates the impact of the studied production process in terms of toxicity in the environmental matrix of freshwaters. It's expressed in Comparative Toxic Unit for human (CTUh). Land use is expressed in dimensionless points. This impact category is related to the soil quality index. Water scarcity is a measure of the user deprivation potential in terms of relative available blue water remaining. It is expressed therefore as cubic meters of water deprived by the studied processes.







Wheat bread, 250 g 0,21 kgCO<sub>2eq</sub> Beef fillet, 150 g 6,72 kgCO<sub>2eq</sub>

Nature-L<sup>®</sup>, 1 m<sup>2</sup> 41,5 kgCO<sub>2eq</sub>

Figure 2- Climate change impact comparison LCA Food Database. Bread; Meat. http://lcafood.dk/

Normalization and weighting are optional Impact Assessment steps; both have been performed using PEFcompliant factors.

Normalization is the calculation of the magnitude of each category indicator with respect to the global impact per person considering the world's population.

Weighting is used to create a single score value by correlating every impact assessment result with a set of factors that reflect the perceived relative importance of the impact categories.





Figure 3 - Results of the PEF-compliant normalization step

After normalization, the most relevant impact categories are the toxicity ones, represented by "Non-cancer human health effects", "Cancer human health effects", "Eutrophication terrestrial" and "Ecotoxicity freshwater". The most relevant impact categories included in the PEF Category Rules document (as acidification, climate change, terrestrial eutrophication, particulate matter, resource use – fossils and water use) present little normalized contribution for the production of Nature-L<sup>®</sup>.

	Upstream %	Core %
Weighting single score	91.60	8.40

The process has been divided into the PEF-compliant sections of upstream and core.

Farming, slaughtering and preservation are upstream processes and contribute to the majority of the impacts. Thanks to the specific recipe used in the production process of Nature-L<sup>®</sup> leather, the core tanning process presents lower impact than the upstream one.

	Upstream %	Core %
Climate change	89.01	10.99
Non-cancer human health effects	97.34	2.66
Cancer human health effects	91.12	8.88
Ecotoxicity freshwater	92.87	7.13
Land use	95.45	4.55
Water scarcity	71.11	28.89

Table 2 - Relative contribution of the characterization and single score weighting results for core and upstream processes

From the data obtained, farming, slaughtering and preservation phases in the production of raw hides and skins have a higher environmental impact than the core tanning process for the production of Nature-L<sup>®</sup>:

91.6% of the impacts for Nature-L® come from the upstream processes, while tanning activities occurring in Italy accounts for 8.4% of the total environmental burden.

Conceria Nuvolari through its metals-free biodegradable leather products contributes actively to support Sustainable Development Goals (SDG): 12 (Responsible consumption and production), 13 (Climate action), and 15 (Life on Land).



Figure 4 - Results of the PEF-compliant contribution analysis



Figure 5 - Results of the PEF-compliant: impacts on core and upstream



## NATURE-L CAPRINE LEATHER

#### **OBJECTIVE OF THE STUDY**

Conceria Nuvolari has evaluated the environmental profile of its metal-free biodegradable leather Nature-L<sup>®</sup> (caprine) following the Product Environmental Footprint (PEF) method. The project has been performed by Prof. Giovanni Dotelli, Full Professor of Materials Science and Technology at Politecnico di Milano.

#### WHAT IS PEF?

It is a well-standardized methodology to perform LCA (Life Cycle Assessment) studies of a product on condition that specific category rules are available. Category rules help perform an LCA study in a way that guarantees reproducibility and comparability.

### WHAT IS THE ENVIRONMENTAL FOOTPRINT (EF) OF A PRODUCT?

EF is a complete picture of the environmental performance of a product including all life stages. In the case of leather products, being intermediate products (i.e. business-to-business), the LCA analysis is cradle-to-gate.

### WHY CHOOSING THE PEF METHODOLOGY TO PERFORM AN LCA?

The PEF methodology has been created by the European Commission (EC) to calculate all the relevant environmental information of products and enable feasible, relevant and appropriate comparisons among products belonging to the same category. This method could be the support of future green policies by EC.

### WHY PERFORMING A PEF STUDY OF LEATHER?

This is one of the few sectors that have completed the first pilot phase, therefore PEFCR are available. Indeed, the Leather Pilot Technical Secretariat has produced the PEF Category Rules for the leather (PEFCR), which are valid until 31 December 2020. Following these rules is now possible to realize Life Cycle Assessment (LCA) studies fully compliant with the PEF methodology.

#### IS THIS NEW ROUTE OF INTEREST FOR THE FASHION INDUSTRY SECTOR?

Yes, it is, the Sustainable Apparel Coalition is leading the new PEFCR project "Apparel", which includes accessories, dresses, hosiery, underwear, leggings/ tights, baselayer, jacket, jersey, pants, shirts, skirt, socks, sweater and cardigans, swimwear, tshirt, boots, cleats, court, dress shoes/ heel, other athletic shoes, sandals and sneakers.

## MATERIALS AND METHODS

Every step of the LCA study has been performed as much in accordance to the PEFCR – Product Environmental Footprint Category Rules for the production of leather, published in April 2018 on behalf of the European Commission's Joint Research Centre.

Nature-L<sup>®</sup> is modelled as caprine, ovine leather belonging to the Representative Product categories RP2 for footwear and leather goods and RP3 for garments and gloves.

A cradle-to-gate approach is followed in the study: upstream (farming, slaughtering and preservation) and core (tanning) processes have been identified within the system boundary. The core process has been divided into five unit processes where the main production phases of Nature-L<sup>®</sup> are performed.

For every unit process, data about the required material, energetic and logistic input and output flows have been collected and modelled using the PEF-compliant datasets included in the Environmental Footprint EF2.0 database.

The obtained information has been processed using the PEF-compliant Environmental Footprint EF2.0 Impact Assessment methods.

The evaluation of the environmental impacts has been mainly based on company-specific data collected from the industrial realities where the leather tanning process for Nature-L<sup>®</sup> is performed.



FIGURE 1 - SYSTEM BOUNDARY FOR THE PRODUCTION OF NATURE-L® WITH THE MAIN UNIT PROCES-SES

## RESULTS

Following the PEF guidelines, the environmental impact of 1 square metre of Nature-L<sup>®</sup> is quantified through characterization for every PEF-compliant impact category. However, the PEF Category Rules for leather don't allow the evaluation of the environmental benefit guaranteed by the biodegradability of the product. It is so since leather is an intermediate product and the PEF-compliant cradle-to-gate approach implies a system boundary ending with the production of leather in the industrial facilities, thus not considering downstream processes as B2B distribution, further manufacturing into finished consumer products, distribution to customers, use phase and end-of-life treatment of used products.

IMPACT CATEGORY	UNIT OF MEASURE	CAPRINE
Climate change	kg CO2 eq	2.02E+01
fossil		9.7E+00
biogenic		9.9E+00
land use and transformation		6E-01
Ozone depletion	kg CFC11 eq	1.69E-07
Ionising radiation, HH	kBq U-235 eq	4.94E-01
Photochemical ozone formation, HH	kg NMVOC eq	2.79E-02
Respiratory inorganics	disease incidence	2.41E-06
Non-cancer human health effects	CTUh	2.21E-05
Cancer human health effects	CTUh	3.68E-07
Acidification terrestrial and freshwater	mol H+ eq	3.41E-01
Eutrophication freshwater	kg P eq	9.44E-04
Eutrophication marine	kg N eq	5.89E-02
Eutrophication terrestrial	mol N eq	1.45E+00
Ecotoxicity freshwater	CTUe	3.77E+01
Land use	Pt	2.43E+03
Water scarcity	m3 deprived	5.75E+00
Resource use, energy carriers	MJ	1.01E+02
Resource use, mineral and metals	kg Sb eq	2.42E-05

Table 1 - Results of the PEF-compliant characterization step

The climate change category presented in this study indicates the GWP – Global Warming Potential of the analysed process in terms of fossil, biogenic and land use/transformation contributions. It is expressed in kg CO2 eq and it's a good measure of the Carbon Footprint of Nature-L<sup>®</sup>, indicating the quantity of GHG – Green House Gases emitted during the production.

Non-cancer and cancer human health effects belong to toxicity categories, expressed in the study in Comparative Toxic Unit for human (CTUh). This unit indicates the estimated increase in morbidity in the total human population per unit mass of the chemicals emitted.

Ecotoxicity freshwater indicates the impact of the studied production process in terms of toxicity in the environmental matrix of freshwaters. It's expressed in Comparative Toxic Unit for human (CTUh). Land use is expressed in dimensionless points. This impact category is related to the soil quality index. Water scarcity is a measure of the user deprivation potential in terms of relative available blue water remaining. It is expressed therefore as cubic meters of water deprived by the studied processes.







Wheat bread, 250 g 0,21 kgCO<sub>2eq</sub> Beef fillet, 150 g 6,72 kgCO<sub>2eq</sub> Nature-L<sup>®</sup>, 1 m<sup>2</sup> 20,2 kgCO<sub>2eq</sub>

## FIGURE 2- CLIMATE CHANGE IMPACT COMPARISON LCA FOOD DATABASE. BREAD; MEAT. HTTP://LCA-FOOD.DK/

Normalization and weighting are optional Impact Assessment steps; both have been performed using PEFcompliant factors.

Normalization is the calculation of the magnitude of each category indicator with respect to the global impact per person considering the world's population.

Weighting is used to create a single score value by correlating every impact assessment result with a set of factors that reflect the perceived relative importance of the impact categories.



Normalization

Figure 3 - Results of the PEF-compliant normalization step

After normalization, the most relevant impact categories are the toxicity ones, represented by "Non-cancer human health effects" and "Ecotoxicity freshwater" "Cancer human health effects". The most relevant impact categories included in the PEF Category Rules document (as acidification, climate change, terrestrial eutrophication, particulate matter, resource use – fossils and water use) present little normalized contribution for the production of Nature-L<sup>®</sup>.

	Upstream %	Core %
Weighting single score	81.73	18.27

The process has been divided into the PEF-compliant sections of upstream and core.

Farming, slaughtering and preservation are upstream processes and contribute to the majority of the impacts. Thanks to the specific recipe used in the production process of Nature-L<sup>®</sup> leather, the core tanning process presents lower impact than the upstream one.

	Upstream %	Core %
Climate change	71.18	28.82
Non-cancer human health effects	94.84	5.16
Cancer human health effects	80.45	19.55
Ecotoxicity freshwater	65.29	34.71
Land use	88.66	11.34
Water scarcity	25.62	74.38

Table 2 - Relative contribution of the characterization and single score weighting results for core and upstream processes

From the data obtained, farming, slaughtering and preservation phases in the production of raw hides and skins have a higher environmental impact than the core tanning process for the production of Nature-L<sup>®</sup>: 81.73% of the impacts for Nature-L<sup>®</sup> come from the upstream processes, while tanning activities occurring in Italy accounts for 18.27% of the total environmental burden.

Conceria Nuvolari through its metals-free biodegradable leather products contributes actively to support Sustainable Development Goals (SDG): 12 (Responsible consumption and production), 13 (Climate action), and 15 (Life on Land).



Figure 4 - Results of the PEF-compliant contribution analysis



Figure 5- Results of the PEF-compliant: impacts on core and upstream



## NATURE-L OVINE LEATHER

### **OBJECTIVE OF THE STUDY**

Conceria Nuvolari has evaluated the environmental profile of its metal-free biodegradable leather Nature-L<sup>®</sup> (ovine) following the Product Environmental Footprint (PEF) method. The project has been performed by Prof. Giovanni Dotelli, Full Professor of Materials Science and Technology at Politecnico di Milano.

#### WHAT IS PEF?

It is a well-standardized methodology to perform LCA (Life Cycle Assessment) studies of a product on condition that specific category rules are available. Category rules help perform an LCA study ina way that guarantees reproducibility and comparability.

### WHAT IS THE ENVIRONMENTAL FOOTPRINT (EF) OF A PRODUCT?

EF is a complete picture of the environmental performance of a product including all life stages. In the case of leather products, being intermediate products (i.e. business-to-business), the LCA analysis is cradle-to-gate.

## WHY CHOOSING THE PEF METHODOLOGY TO PERFORM AN LCA?

The PEF methodology has been created by the European Commission (EC) to calculate all the relevant environmental information of products and enable feasible, relevant and appropriate comparisons among products belonging to the same category. This method could be the support of future green policies by EC.

### **WHY PERFORMING A PEF STUDY OF LEATHER?**

This is one of the few sectors that have completed the first pilot phase, therefore PEFCR are available. Indeed, the Leather Pilot Technical Secretariat has produced the PEF Category Rules for the leather (PEFCR), which are valid until 31 December 2020. Following these rules is now possible to realize Life Cycle Assessment (LCA) studies fully compliant with the PEF methodology.

#### IS THIS NEW ROUTE OF INTEREST FOR THE FASHION INDUSTRY SECTOR?

Yes, it is, the Sustainable Apparel Coalition is leading the new PEFCR project "Apparel", which includes accessories, dresses, hosiery, underwear, leggings/ tights, baselayer, jacket, jersey, pants, shirts, skirt, socks, sweater and cardigans, swimwear, tshirt, boots, cleats, court, dress shoes/ heel, other athletic shoes, sandals and sneakers.

## MATERIALS AND METHODS

Every step of the LCA study has been performed as much in accordance to the PEFCR – Product Environmental Footprint Category Rules for the production of leather, published in April 2018 on behalf of the European Commission's Joint Research Centre.

Nature-L<sup>®</sup> is modelled as caprine, ovine leather belonging to the Representative Product categories RP2 for footwear and leather goods and RP3 for garments and gloves.

A cradle-to-gate approach is followed in the study: upstream (farming, slaughtering and preservation) and core (tanning) processes have been identified within the system boundary. The core process has been divided into five unit processes where the main production phases of Nature-L<sup>®</sup> are performed.

For every unit process, data about the required material, energetic and logistic input and output flows have been collected and modelled using the PEF-compliant datasets included in the Environmental Footprint EF2.0 database.

The obtained information has been processed using the PEF-compliant Environmental Footprint EF2.0 Impact Assessment methods.

The evaluation of the environmental impacts has been mainly based on company-specific data collected from the industrial realities where the leather tanning process for Nature-L<sup>®</sup> is performed.



Figure 1 - System boundary for the production of Nature-L® with the main unit processes

## RESULTS

Following the PEF guidelines, the environmental impact of 1 square metre of Nature-L<sup>®</sup> is quantified through characterization for every PEF-compliant impact category. However, the PEF Category Rules for leather don't allow the evaluation of the environmental benefit guaranteed by the biodegradability of the product. It is so since leather is an intermediate product and the PEF-compliant cradle-to-gate approach implies a system boundary ending with the production of leather in the industrial facilities, thus not considering downstream processes as B2B distribution, further manufacturing into finished consumer products, distribution to customers, use phase and end-of-life treatment of used products.

IMPACT CATEGORY	UNIT OF MEASURE	OVINE
Climate change	kg CO2 eq	2.21E+01
fossil		1.11E+01
biogenic		1.03E+01
land use and transformation		7.06E-01
Ozone depletion	kg CFC11 eq	1.98E-07
Ionising radiation, HH	kBq U-235 eq	5.89E-01
Photochemical ozone formation, HH	kg NMVOC eq	3.15E-02
Respiratory inorganics	disease incidence	2.56E-06
Non-cancer human health effects	CTUh	2.32E-05
Cancer human health effects	CTUh	3.96E-07
Acidification terrestrial and freshwater	mol H+ eq	3.61E-01
Eutrophication freshwater	kg P eq	1.05E-03
Eutrophication marine	kg N eq	6.32E-02
Eutrophication terrestrial	mol N eq	1.52E+00
Ecotoxicity freshwater	CTUe	4.17E+01
Land use	Pt	2.58E+03
Water scarcity	m3 deprived	6.39E+00
Resource use, energy carriers	MJ	1.22E+02
Resource use, mineral and metals	kg Sb eq	2.94E-05

Table 1 - Results of the PEF-compliant characterization step

The climate change category presented in this study indicates the GWP – Global Warming Potential of the analysed process in terms of fossil, biogenic and land use/transformation contributions. It is expressed in kg CO2 eq and it's a good measure of the Carbon Footprint of Nature-L<sup>®</sup>, indicating the quantity of GHG – Green House Gases emitted during the production.

Non-cancer and cancer human health effects belong to toxicity categories, expressed in the study in Comparative Toxic Unit for human (CTUh). This unit indicates the estimated increase in morbidity in the total human population per unit mass of the chemicals emitted.

Ecotoxicity freshwater indicates the impact of the studied production process in terms of toxicity in the environmental matrix of freshwaters. It's expressed in Comparative Toxic Unit for human (CTUh). Land use is expressed in dimensionless points. This impact category is related to the soil quality index. Water scarcity is a measure of the user deprivation potential in terms of relative available blue water remaining. It is expressed therefore as cubic meters of water deprived by the studied processes.







Wheat bread, 250 g 0,21 kgCO<sub>2eq</sub> Beef fillet, 150 g 6,72 kgCO<sub>2eq</sub>

Nature-L<sup>®</sup>, 1 m<sup>2</sup> 22,1 kgCO<sub>2ea</sub>

Figure 2- Climate change impact comparison LCA Food Database. Bread; Meat. http://lcafood.dk/

Normalization and weighting are optional Impact Assessment steps; both have been performed using PEFcompliant factors.

Normalization is the calculation of the magnitude of each category indicator with respect to the global impact per person considering the world's population.

Weighting is used to create a single score value by correlating every impact assessment result with a set of factors that reflect the perceived relative importance of the impact categories.



Normalization

Figure 3 - Results of the PEF-compliant normalization step

After normalization, the most relevant impact categories are the toxicity ones, represented by "Non-cancer human health effects" and "Ecotoxicity freshwater" "Cancer human health effects". The most relevant

impact categories included in the PEF Category Rules document (as acidification, climate change, terrestrial eutrophication, particulate matter, resource use – fossils and water use) present little normalized contribution for the production of Nature-L<sup>®</sup>.

	Upstream %	Core %
Weighting single score	79.20	20.80

The process has been divided into the PEF-compliant sections of upstream and core.

Farming, slaughtering and preservation are upstream processes and contribute to the majority of the impacts. Thanks to the specific recipe used in the production process of Nature-L<sup>®</sup> leather, the core tanning process presents lower impact than the upstream one.

	Upstream %	Core %
Climate change	67.73	32.27
Non-cancer human health effects	93.91	6.09
Cancer human health effects	77.76	22.24
Ecotoxicity freshwater	61.40	38.60
Land use	86.65	13.35
Water scarcity	23.98	76.02

Table 2 - Relative contribution of the characterization and single score weighting results for core and upstream processes

From the data obtained, farming, slaughtering and preservation phases in the production of raw hides and skins have a higher environmental impact than the core tanning process for the production of Nature-L<sup>®</sup>: 79.2% of the impacts for Nature-L<sup>®</sup> come from the upstream processes, while tanning activities occurring in Italy accounts for 20.8% of the total environmental burden.

Conceria Nuvolari through its metals-free biodegradable leather products contributes actively to support Sustainable Development Goals (SDG): 12 (Responsible consumption and production), 13 (Climate action), and 15 (Life on Land).


Figure 4 - Results of the PEF-compliant contribution analysis



Figure 5- Results of the PEF-compliant: impacts on core and upstream







Carbon neutrality is the result of the balancing between the greenhouse gas emissions generated during the production processes and the reabsorbed emissions. It is the final result of a process of quantification, reduction and compensation of CO2 and the generated greenhouse gas emissions.

Today, carbon neutrality is a fundamental climate performance objective of the Organizations which choose to make their activities carbon free and is a Corporate Social Responsibility (CSR) strategy chosen to face the global warming.

Carbon neutrality is an action in line with the decarbonisation objectives defined by the international climate agreements in order to limit the temperature increase to 1.5°C above pre-industrial levels by 2100.



# 4 ENVIRONMENTAL PROTECTION PROJECTS SUSTAINED

- 4.000 SQM REFORESTATION
- 2 COUNTRIES INVOLVED

Conceria Nuvolari managed to neutralize the carbon footprint of its metalfree and biodegradable Nature-L articles produced during the year 2020:

650.000 kgCO2eq have been neutralized thanks to our cooperation with Rete Clima in a joint effort to support an international carbon offset project aimed at promoting the construction of a wind farm in India, in Satara District with an overall energy capacity of 7.2 MW.

This project, focused on the generation of clean electricity, provides an alternative scenario to the model of "Business As Usual" based on energy production from fossil fuels. A clean and renewable energy alternative is offered with advantage of guaranteeing the local energy supply and allowing the carbon offset of greenhouse gas emissions. It also contributes to the to the achievement of SDGs 7, 8, 13.



ete clima

#### **A T T E S T A T O**

#### Conceria Nuvolari

ha neutralizzato le emissioni di gas serra connesse con

#### produzione linea Nature-L Biodegradabili metal free

mediante sostegno al Progetto CDM KR\_222 (impianti eolici in Corea del Sud) e CDM IN\_9347 (impianti eolici in India)

#### offset di 900 t CO<sub>2</sub>eq

codice attestato: 1400121S05B

data attestato: dicembre 2021



## 06

# HIGHLIGHTS

#### **ECOMONDO**

The abstract "Sustainable leathers for sustainable fashion" has been accepted in the Call for Papers 2021 and has been published in the poster session during the Technical Session of the XXIII National Conference on Composting and Anaerobic Digestion, organized by the Technical Scientific Committee Ecomondo and Consorzio Italiano Compostatori at Ecomondo Fair (Rimini, 26-29 October 2021)

The paper has been published in the international peer-reviewed scientific journal "Procedia Environmental Science, Engineering and Management".







### GREEN ITALY 2021

In the last 5 years, 441.000 Italian companies have invested in green economy and sustainability.

Conceria Nuvolari is among them and is present in the GreenItaly 2021 Report realized by Symbola Foundation and Unioncamere.



### 100 ITALIAN CIRCULAR ECONOMY STORIES

Conceria Nuvolari has been selected among the "100 Italian Circular Economy Stories" Report by Symbola Foundation. The Report has been presented by Ermete Realacci (President of Symbola Foundation) and Francesco Starace (CEO of Enel Group) and provides a description of the 100 most significant cases of circularity in Italy.







## I VOLTI DELLA Sostenibilità

On the occasion of the sustainability exhibition "Salone della CSR e dell'innovazione sociale" (Milan 2021), Conceria Nuvolari has been selected because of its contribution to sustainable fashion.



SMAU



Italian excellence, example of innovation for companies and public administrations

### UAL: UNIVERSITY OF THE ARTS LONDON

Conceria Nuvolari participated to the "Split Jacket" project, carried out by the University of the Arts London.

Jackets and coats are complex products which generally prevent any of their parts from being recycled and condemning the whole product to landfill or incineration. The Split Jacket suggests a way in which it is possible to combine different materials to get the aesthetic and functional qualities expected from the garments while still allowing the components to return to their optimal recycling stream.

The Split Jacket jacket combines a Conceria Nuvolari bio-degradabe Nature-L® leather outer layer with a polyester lining to get the best of two worlds. These materials come together in a light way for the duration of the jacket's life cycle using design for disassembly techniques. At the end of the product's useful life, the connections can be undone for each component to be recovered. Following the materials inherent qualities and recyclability, route leads to a new aesthetic which respects their nature and place in a circular economy.

The Split Jacket has been exhibited at the Design Museum of London as part of the Waste Age exhibition (October 2021-February 2022). The exhibition aims to promote living without waste and tries to imagine a more resourceful world for generations to come.





## CONCERIA OUV ULARI SOCIETÀ BENEFIT

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GRAPHENE LEATHER® HIGH RESISTANCE ANTIBACTERIAL LEATHER