NUVOLARI

CONCERIA

NATURE·L®

NATURAL LEATHER TREATMENT

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NATURE·L®

NATURAL LEATHER TREATMENT

· BIODEGRADABLE LEATHER

· HIGHER CUTTING VALUE

· VERSATILE AND HIGH PERFORMING

· ENVIRONMENTAL PROTECTION

· REDUCTION OF WASTE COSTS

· BIODEGRADABLE ISO 14855 ISO 20136

· NON TOXIC, NON POLLUTING

· EXCLUSIVE PATENT

WHO WE ARE

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.

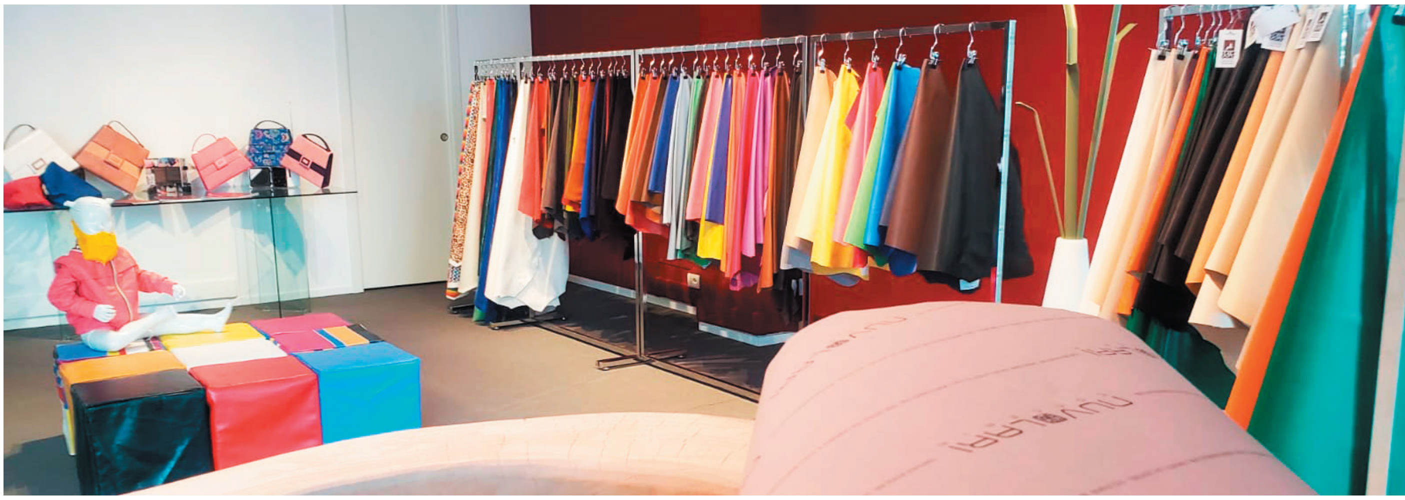
OUR SUSTAINABILITY AWARNESS

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® 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® 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:

1. Higher reduction of water consumptions than the traditional tanning process;

2. Reduced impurities in waste waters from the production process, as no heavy metals are used during tanning

3. Reduced cut-off waste thanks to the increase of the workable leather (less disposal costs, less pollution as cut off are biodegradable

4. Improved leather performances, higher resistant to tears and breakages

5. Improved colour intake and reduced amount of needed dye

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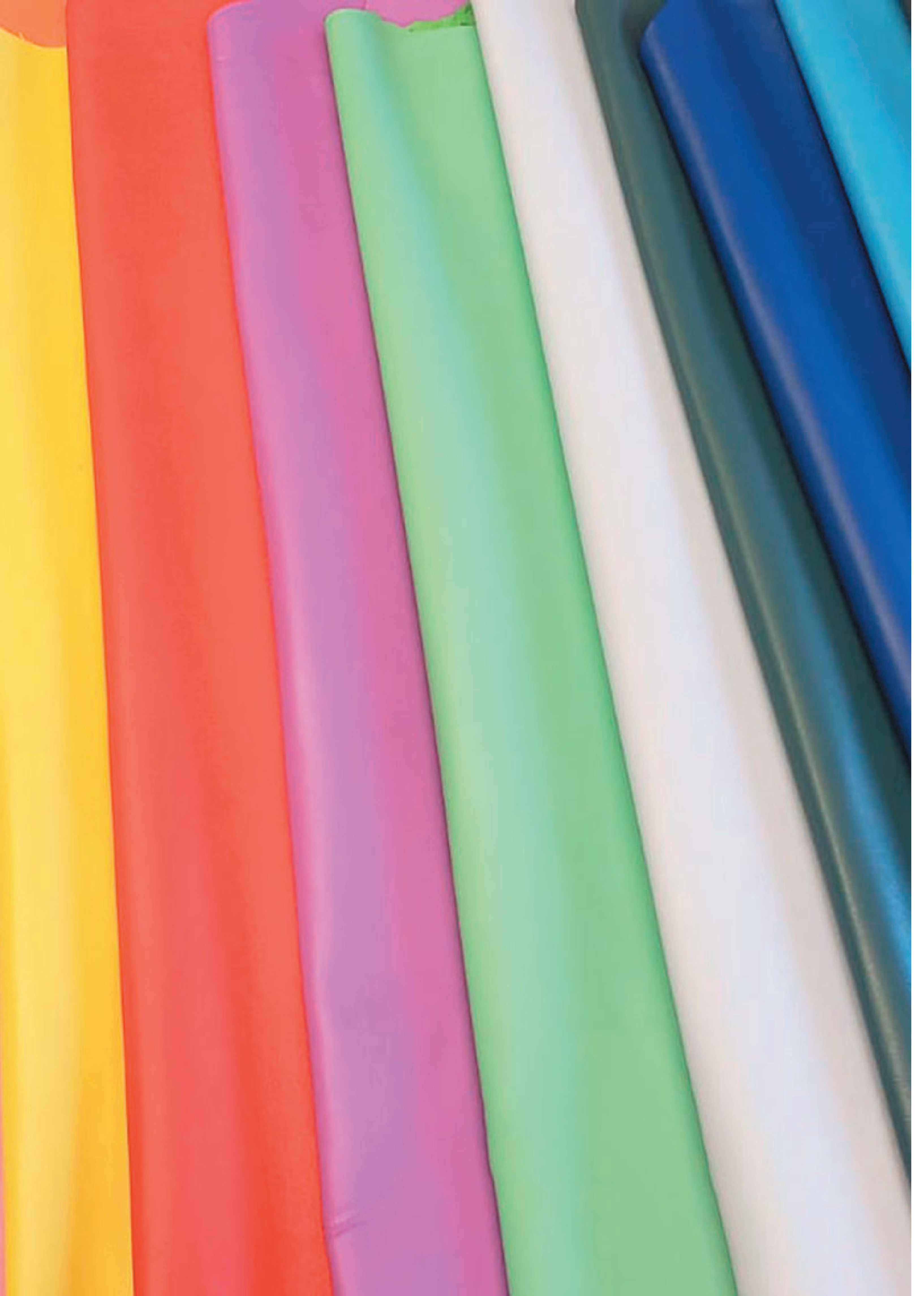
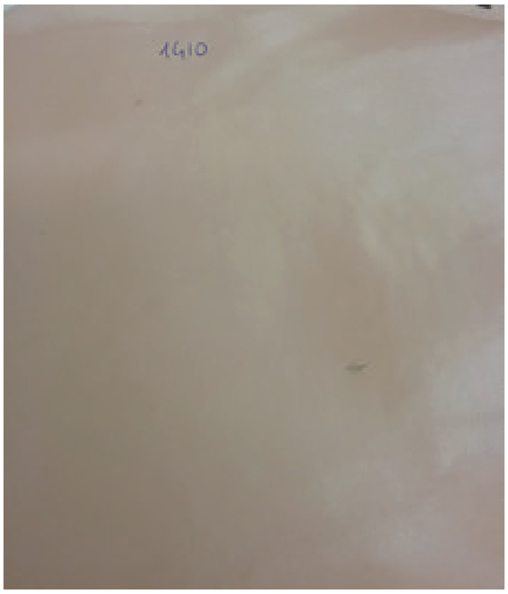


#1 CHARACTERISTICS OF NATURE•L®

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	**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	≥ 3 AFTER 20 RUBS TO DRY (ISRAEL PORTION) ≥ 3 AFTER 50 RUBS TO DRY ≥ 2/3 AFTER 10 RUBS TO WET WITH WATER ≥ 3 AFTER 20 RUBS TO WET WITH WATER (ISRAEL PORTION) ≥ 3 AFTER 50 RUBSTO WET WITH SOLUTION OF SWE

DETERMINATION	METHOD	RESULTS	REQUIREMENTS
COLOUR FASTNESS TO RUBBING	UNI EN ISO 17700:2006 - Method A	**N.50 back and forth movements - Feltre dry on dry specimen** 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 movemen-ts – 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.20 back and forth movemen-ts – 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.*	≥ 3 AFTER 20 RUBS TO DRY (ISRAEL PORTION) ≥ 3 AFTER 50 RUBS TO DRY ≥ 2/3 AFTER 10 RUBS TO WET WITH WATER ≥ 3 AFTER 20 RUBS TO WET WITH WATER (ISRAEL PORTION) ≥ 3 AFTER 50 RUBSTO WET WITH SOLUTION OF SWE

DETERMINATION	METHOD	RESULTS	REQUIREMENTS
COLOUR FASTNESS TO PERSPIRATION	UNI EN ISO 11641:2013	**WITH ACID SWEAT SOLUTION:** Color transfer on acetate: 4/5 of the gray scale Color transfer on cotton: 4/5 of the gray scale Color transfer on nylon: 4/5 of the gray scale Color transfer on polyester: 5 of the gray scale Color transfer on acrylic: 5 of the gray scale Color transfer on wool: 4/5 of the gray scale Sample color degradation: 5 of the gray scale **WITH BASIC SWEAT SOLUTION:** Color transfer on acetate: 4/5 of the gray scale Color transfer on cotton: 4/5 of the gray scale Color transfer on nylon: 4 of the gray scale Color transfer on polyester: 5 of the gray scale Color transfer on acrylic: 4/5 of the gray scale Color transfer on wool: 3/4 of the gray scale Sample color degradation: 5 of the gray scale	≥ 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	METHOD	RESULTS	REQUIREMENTS
DETERMINATION OF TENSILE STRENGTH AND ELONGATION	UNI EN ISO 3376:2012	**DIRECTION: X** Specimen width = 0,8 mm Tensile strength = 15,1 N / mm2 Tensile strength = 126,0 N Elongation = 53,8% **DIRECTION: Y** Specimen width = 0,7 mm Tensile strength = 24,9 N / mm2 Tensile strength = 181,5 N Elongation = 50,6% **NOTE**: *In both directions is observed rupture of finishing before the complete rupture of the specimen.* *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.* *The average value reported is relative to the complete rupture of the specimen.*	≥ 75 N
STRESS RELIEVING AND TENSILE 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	**DIRECTION X:** Specimen thickness = 0,8 mm Tear resistance= 28,2 N **DIRECTION Y:** Specimen thickness = 0,90 mm Tear resistance = 27,4 N	≥20 N (Leather uppers & leather linings)

CHARACTERISTICS OF THE LEATHER METAL FREE SHEEP

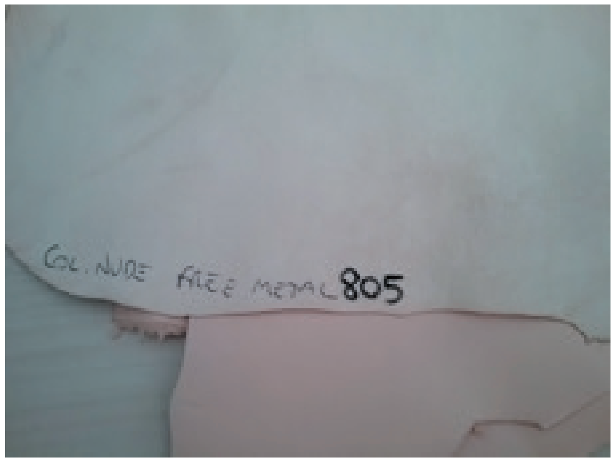
The sample “ART. SHEEP FREEMETAL COL. PINK (DE)” SHEEP has been tested by accredited laboratory Accredia Teknochim, Via Macerata scn, 62015 Monte San Giusto – (MC) – Italy, and the obtained results are indicated below:

DETERMINATION	METHOD	RESULTS	REQUIREMENTS
CHROME	UNI EN ISO 17072-2:2011	26,6 mg/Kg	**Total Metal:** Cr, Al, Ti, Zr, Fe ≤ 0,1 % (1000,0 mg/kg) Leather Metal-free
ALUMINIUM	UNI EN ISO 17072-2:2011	118,4 mg/Kg	
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	

GOAT

CHARACTERISTICS OF THE LEATHER GOAT

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)	≤ 30 mg/Kg	< 30 mg /kg
		3,3'-dimethylbenzidine (CAS 119-93-7)	≤ 30 mg/Kg	
		benzidine (CAS 92-87-5)	≤ 30 mg/Kg	
		4-chloro-o-toluidine (CAS 95-69-2)	≤ 30 mg/Kg	
		5-nitro-o-toluidine (CAS 99-55-8)	≤ 30 mg/Kg	
		p-cresidine (CAS 120-71-8)	≤ 30 mg/Kg	
		2- naphthylamine (CAS 91-59-8)	≤ 30 mg/Kg	
		4,4'-methylene-bis-(2-chloro-aniline) (CAS 101-14-4)	≤ 30 mg/Kg	
		o-aminoazotoluene (CAS 97-56-3)	≤ 30 mg/Kg	
		4,4' –oxydianiline (CAS 101-80-4)	≤ 30 mg/Kg	
		4-methoxy-m-phenylenediamine (CAS 615-05-4)	≤ 30 mg/Kg	
		4,4'-thiodianiline (CAS 139-65-1)	≤ 30 mg/Kg	
		4-chloroaniline (CAS 106-47-8)	≤ 30 mg/Kg	
		o-toluidine (CAS 95-53-4)	≤ 30 mg/Kg	
		o-dianisidine (CAS 119-90-4)	≤ 30 mg/Kg	
		4,4'-methylenedi-o-toluidine (CAS 838-88-0)	≤ 30 mg/Kg	
		4,4' methylenedianiline (CAS 101-77-9)	≤ 30 mg/Kg	
		2,4,5 trimethylaniline (CAS 137-17-7)	≤ 30 mg/Kg	
		3,3'-dichlorobenzidine (CAS 91-94-1)	≤ 30 mg/Kg	
		4-aminoazobenzene (CAS 60-09-3)	≤ 30 mg/Kg	
		4-methyl-m-phenylenediamine (CAS 95-80-7)	≤ 30 mg/Kg	
		o-anisidine (CAS 90-04-0)	≤ 30 mg/Kg	
		2,4-xylidine (CAS 95-68-1)	≤ 30 mg/Kg	
		2,6-xylidine (CAS 87-62-7)	≤ 30 mg/Kg	

DETERMINATION	METHOD	RESULTS		
CARCINOGENIC DYES (§) (*)	Extration in Methanol – 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 Violet 49 (CAS 1694-09-3) Solvent Yellow 1 (CAS 60-09-3) Direct Blue 218 (CAS 28407-37-6) Direct Brown 95 (CAS 16071-86-6) Direct Black 3 (CAS 6227-04-9) Direct Yellow 1 (CAS 6472-91-9) Pigment Yellow 34 (CAS 1344-37-2) Basic Violet 3 (CAS 548-62-9/603-48-5/14426-25-6	Not Detectable Not Detectable	Sum < 50 mg/kg
DETERMINATION OF TOTAL PB CONTENT	UNI EN ISO 17072-2:2011	< 0,25 mg/Kg		< 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	METHOD	RESULTS		
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 LEATHER (*)	METHOD A2 - 24H, 80 °C, 10 % U.R. - ISO 10195:2018	/		
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
PENTACHLOROPHENOL (CAS 87-86-5) (§) (*)	UNI EN ISO 17070:2015	< 0,1 mg/kg		< 0,5 mg/kg
2,3,4,5-TETRAHCLOROPHENOL (CAS 4901-51-3)(§) (*)	UNI EN ISO 17070:2015	< 0,1 mg/kg		< 0,5 mg/kg

DETERMINATION	METHOD	RESULTS		
2,3,4,6- TETRACHLOROPHE-NOL (CAS 58-90-2)(§) (*)	UNI EN ISO 17070:2015	< 0,1 mg/kg		< 0,5 mg/kg
2,3,5,6- TETRACHLOROPHE-NOL (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 COMPOUNDS	UNI CEN ISO/TS 16179:2012	Mono-n-butilstagno (MBT) (CAS 1118-46-3)	< 100 µg/Kg	DBT < 2 mg/kg TBT < 1 mg/kg TPhT < 1 mg/kg Others < 1 mg/kg
		Di-n-butilstagno (DBT) (CAS 683-18-1)	< 100 µg/Kg	
		Tri-n-butilstagno (TBT) (CAS 1461-22-9)	< 100 µg/Kg	
		Mono-n-octilstagno (MOT) (CAS 3091-25-6)	< 100 µg/Kg	
		Tetra-n-butilstagno (TeBT) (CAS 1461-25-2)	< 100 µg/Kg	
		Di-n-octilstagno (DOT) (CAS 3542-36-7)	< 100 µg/Kg	
		Trifenilstagno (TPhT) (CAS 639-58-7)	< 100 µg/Kg	
		Tri-cicloesilstagno (TcyT) (CAS 3091-32-5)	< 100 µg/Kg	
		Tri-n-octilstagno (TOT) (CAS 2587-76-0)	< 100 µg/Kg	
TOLUENE AND BENZENE - CHLORORGANIC CARRIERS (*) (§)	DIN 54232:2010 Extraction with solvent (Diclhoromethan) in ultrasounds (20') EPA 3550C:2000	Sum		Sum < 500 mg/kg
		1,2 - Dichlorobenzene (CAS 95-50-1)	< 1,00 mg/kg	
		1,3 - Diclhorobenzene (CAS 541-73-1)	< 0,05 mg/kg	
		1,4 - Diclhorobenzene (CAS 106-46-7)	< 0,05 mg/kg	
		1,2,3 - Trichlorobenzene (CAS 87-61-6)	< 0,05 mg/kg	
		1,2,4 - Trichlorobenzene (CAS 120-82-1)	< 0,05 mg/kg	
		1,3,5 - Trichlorobenzene (CAS 108-70-3)	< 0,05 mg/kg	
		1,2,4,5 - Tetrachlorobenzene (CAS 95-94-3)	< 0,05 mg/kg	
		1,2,3,5 - Tetrachlorobenzene (CAS 634-90-2)	< 0,05 mg/kg	
		1,2,3,4 - Tetrachlorobenzene (CAS 634-66-2)	< 0,05 mg/kg	

DETERMINATION	METHOD	RESULTS		
		Pentachlorobenzene (CAS 608-93-5)	< 0,05 mg/kg	Sum < 500 mg/kg
		Esachlorobenzene (CAS 118-74-1)	< 0,05 mg/kg	
		2- Chlorotoluene (CAS 95-49-8)	< 0,05 mg/kg	
		3- Chlorotoluene (CAS 108-41-8)	< 0,05 mg/kg	
		4- Chlorotoluene (CAS 106-43-4)	< 0,05 mg/kg	
		2,3- Dichlorotoluene (CAS 32768-54-0)	< 0,05 mg/kg	
		2,4- Dichlorotoluene (CAS 95-73-8)	< 0,05 mg/kg	
		2,5- Dichlorotoluene (CAS 19398-61-9)	< 0,05 mg/kg	
		2,6- Dichlorotoluene (CAS 118-69-4)	< 0,05 mg/kg	
		3,4- Dichlorotoluene (CAS 95-75-0)	< 0,05 mg/kg	
		2,3,6- Trichlorotoluene (CAS 2077-46-5)	< 0,05 mg/kg	
		2,4,5- Trichlorotoluene (CAS 6639-30-1)	< 0,05 mg/kg	
		Alfa, alfa, alfa - Trichlorotoluene (CAS 98-07-07)	< 0,05 mg/kg	
		Alfa, 2,4 - Trichlorotoluene (CAS 94-99-5)	< 0,05 mg/kg	
		Alfa, 2,6 - Trichlorotoluene (CAS 2014-83-7)	< 0,05 mg/kg	
		Alfa, 3,4 - Trichlorotoluene (CAS 102-47-6)	< 0,05 mg/kg	
		Alfa, alfa, 2,6 - Tetrachlorotoluene (CAS 81-19-6)	< 0,05 mg/kg	
		Alfa, alfa, alfa,2 - Tetrachlorotoluene (CAS 2136-89-2)	< 0,05 mg/kg	
		Alfa, alfa, alfa,4 - Tetrachlorotoluene (CAS 5216-25-1)	< 0,05 mg/kg	
		Pentachlorotoluene (CAS 877-11-2)	< 0,05 mg/kg	
PH (*)	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
DIMETHYLFUMARATE (*)(§)	ISO/TS 16186:2012	< 0,05 mg/kg		< 0,1 mg/kg

DETERMINATION	METHOD	RESULTS	
FORMAMIDE (*)(§)	EPA5021A	< 1,0 mg/kg	< 200 mg/kg
N,N-DIMETHTLACETAMIDE (DMAC) (*) (§)	EPA 5021A + EPA 8260	< 5,0 mg/kg	< 1000 mg/kg
DIMETHYLFORMAMIDE (CAS 68-12-2) (*) (§)	CEN ISO/TS 16189:2013	< 5,0 mg/kg	< 1000 mg/kg
1-METHYL-2-PYRROLIDONE (CAS 872-50-4) (*) (§)	EN ISO 19070:2014	< 1,0 mg/kg	< 1000 mg/kg

CHARACTERISTICS OF THE LEATHER METAL FREE GOAT

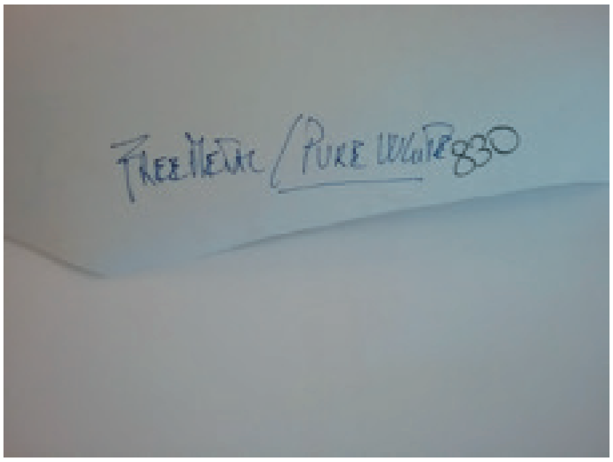
The sample ART. PINK CAPRA CRUST" – GOAT has been tested by accredited laboratory Accredia Teknochim, Via Macerata scn, 62015 Monte San Giusto – (MC) – Italy, and the obtained results are indicated below:

DETERMINATION	METHOD	RESULTS	REQUIREMENTS
CHROME	UNI EN ISO 17072-2:2011	32,87 mg/Kg	**Total Metal:** Cr, Al, Ti, Zr, Fe ≤ 0,1 % (1000,0 mg/kg) Leather Metal-free
ALUMINIUM	UNI EN ISO 17072-2:2011	101,5 mg/Kg	
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	

COW

CHARACTERISTICS OF THE LEATHER METAL FREE COW

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:



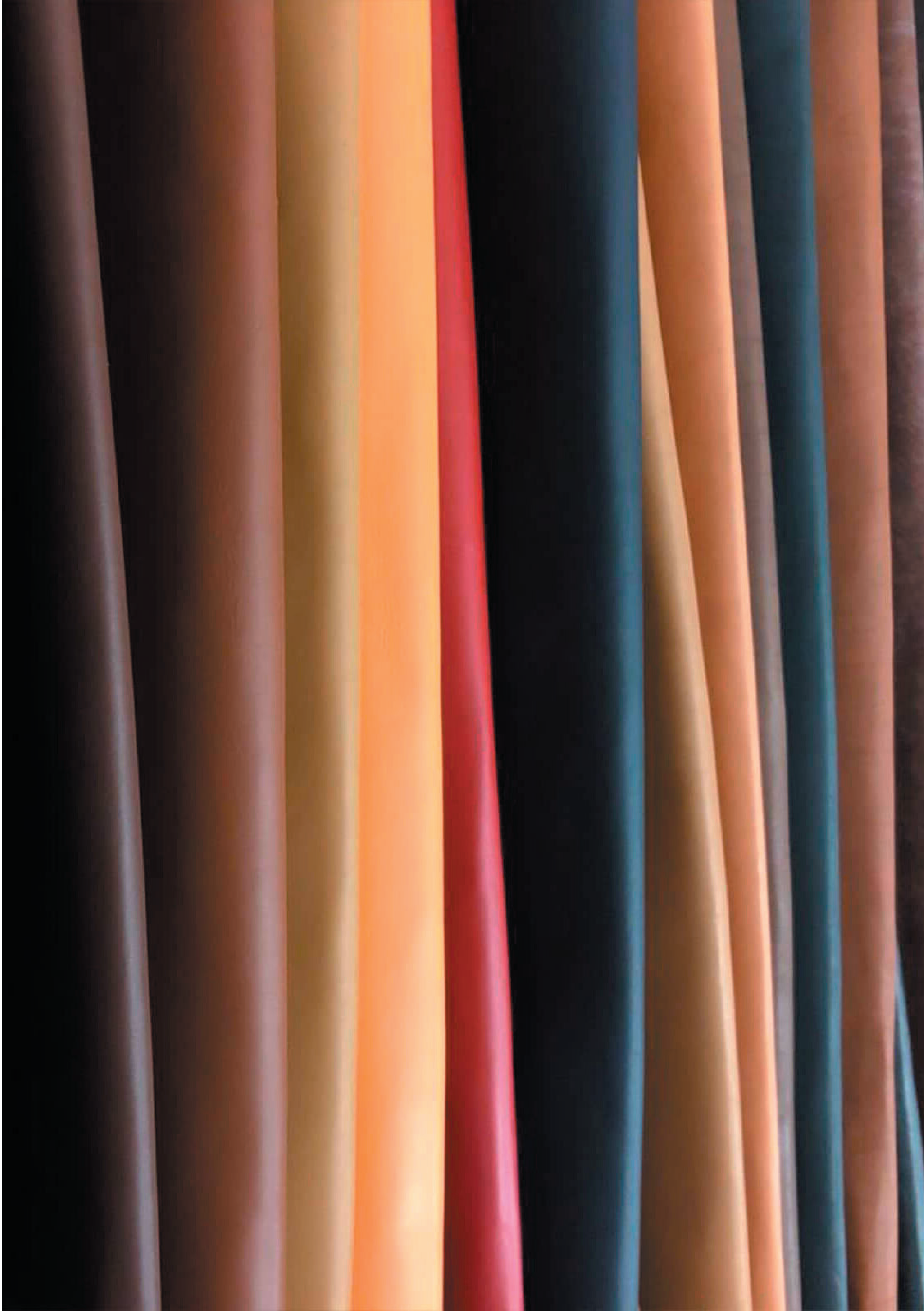
DETERMINATION	METHOD	RESULTS	REQUIREMENTS
CHROME	UNI EN ISO 17072-2:2011	5,1 mg/Kg	**Total Metal:** Cr, Al, Ti, Zr, Fe ≤ 0,1 % (1000,0 mg/kg) Leather Metal-free
ALUMINIUM	UNI EN ISO 17072-2:2011	59,1 mg/Kg	
TITANIUM	UNI EN ISO 17072-2:2011	20,2 mg/Kg	
IRON	UNI EN ISO 17072-2:2011	39,4 mg/Kg	
ZIRCONIUM	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: 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	≥ 3 AFTER 20 RUBS TO DRY (ISRAEL PORTION) ≥ 3 AFTER 50 RUBS TO DRY ≥ 2/3 AFTER 10 RUBS TO WET WITH WATER ≥ 3 AFTER 20 RUBS TO WET WITH WATER (ISRAEL PORTION)

DETERMINATION	METHOD	RESULTS	REQUIREMENTS
		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	



#2 DURABILITY

INNOVHUB
STAZIONI SPERIMENTALI PER L'INDUSTRIA
innovazione e ricerca
SSCCP
STAZIONE SPERIMENTALE CARTA, CARTONI, E PASTE PER CARTA
SEDE OPERATIVA:
Via Giuseppe Colombo, 83
20133 Milano
Tel +39 02 8515.3610
sales.innovhub@mi.camcom.it
www.innovhub-ssi.it

OBJECTIVE OF THE STUDY:

Effect of microorganisms and weathering aging treatments on two leather samples, comparison of two different tanning treatments. Tests detailed in the Test Reports: RPT-SSCCP-181240, RPT-SSCCP-181444 and RPT-SSCCP-190164.

LEATHER SAMPLES NAMED:

- ARTICLE NATURE-L GOAT;
- CLASSIC GOAT.

TEST CONDITIONS

The antimicrobial and soil burial resistances were determined according to AATCC TM30 "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-SSCCP-181240, RPT-SSC-CP-181444 and RPT-SSCCP-190164.

RESULTS: AATCC 30. TEST II

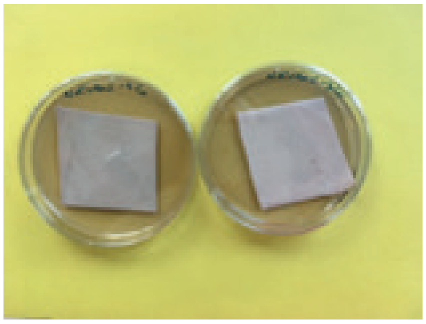
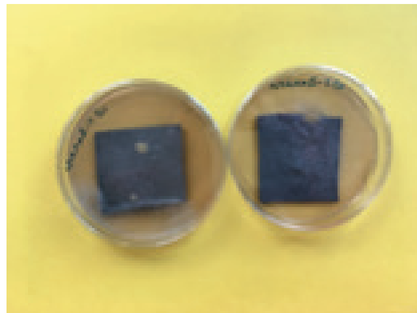
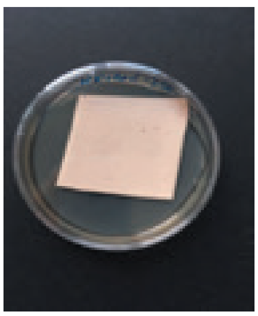
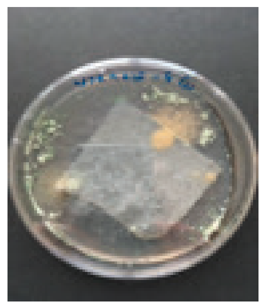
	Chaetomium globosum	
	INCUBATION TIME: 7 DAYS	**INCUBATION TIME: 14 DAYS**
Cotton reference 100%	++	++
ARTICLE NATURE•L GOAT	-*	-*
CLASSIC GOAT	-*	++*

(++) : Growth on the entire specimen surface.
(+) : Growth on part of the specimen.
(-) : Growth not present.
*Growth of microorganisms different from the inoculated ones.

–

The results only refer to the samples subjected to the test performed.
Residues of the samples are stored for three months since the issue of the Test Report.
Partial reproduction of this test report is allowed only after written approval by the laboratory.

PICTURES:
SAMPLES TREATED WITH *Chaetomium globosum* FUNGI (AATCC 30 TEST II)

ARTICLE NATURE•L GOAT	CLASSIC GOAT
AFTER 7 DAYS	AFTER 7 DAYS
	
AFTER 14 DAYS	AFTER 14 DAYS
	

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. TEST III

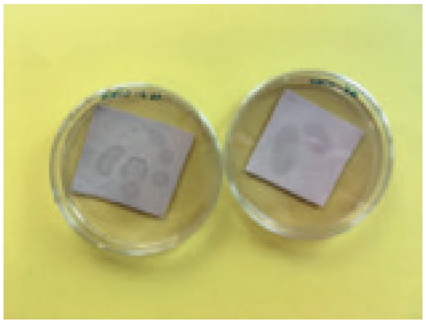
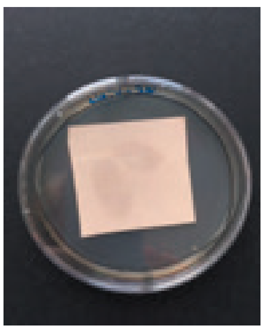
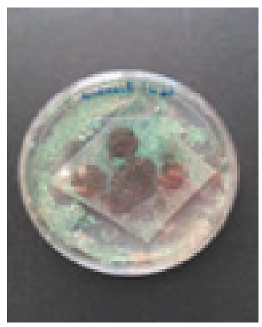
	Aspergillus niger	
	INCUBATION TIME: 7 DAYS	**INCUBATION TIME: 14 DAYS**
Cotton reference 100%	++	++
ARTICLE NATURE•L GOAT	-	-
CLASSIC GOAT	++*	++*

(++) : Growth on the entire specimen surface.
(+) : Growth on part of the specimen.
(-) : Growth not present.
*Growth of microorganisms different from the inoculated ones.

–

The results only refer to the samples subjected to the test performed.
Residues of the samples are stored for three months since the issue of the Test Report.
Partial reproduction of this test report is allowed only after written approval by the laboratory.

PICTURES:
SAMPLES TREATED WITH *Aspergillus niger* FUNGI (TEST AATCC 30 III)

ARTICLE NATURE•L GOAT	CLASSIC GOAT
AFTER 7 DAYS	AFTER 7 DAYS
	
AFTER 14 DAYS	AFTER 14 DAYS
	

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

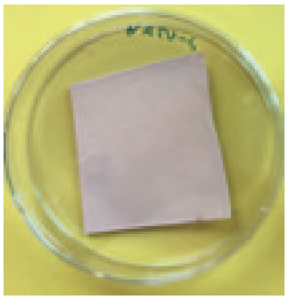
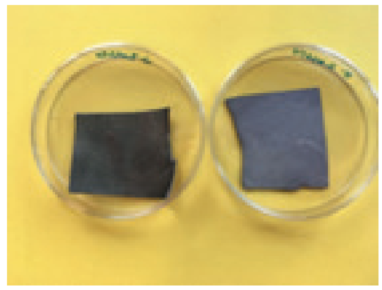
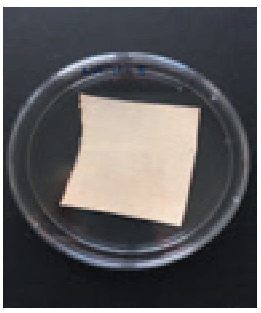
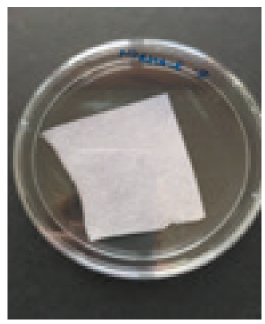
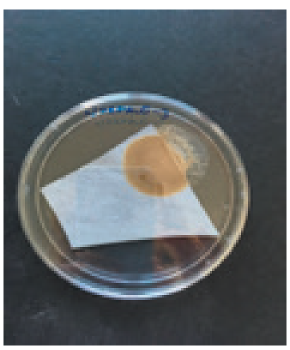
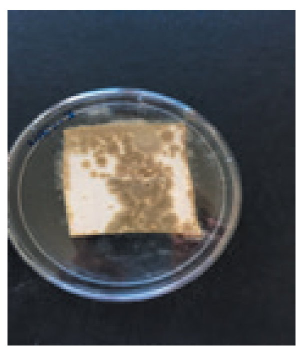
	Aspergillus niger* + *Penicillium chrysogenium* + *Trichoderma viride
	INCUBATION TIME: 28 DAYS
COTTON REFERENCE 100%	++
ARTICLE NATURE•L GOAT	-*
CLASSIC GOAT	-*

(++) : Growth on the entire specimen surface.
(+) : Growth on part of the specimen.
(-) : Growth not present.
*Growth of microorganisms different from the inoculated ones.

–

The results only refer to the samples subjected to the test performed.
Residues of the samples are stored for three months since the issue of the Test Report.
Partial reproduction of this test report is allowed only after written approval by the laboratory.

PICTURES:
SAMPLES TREATED WITH A MIXTURE OF FUNGI (AATCC TEST 30 IV)

ARTICLE NATURE•L GOAT	CLASSIC GOAT
AFTER 7 DAYS	AFTER 7 DAYS
	
AFTER 14 DAYS	AFTER 14 DAYS
	
AFTER 28 DAYS	AFTER 28 DAYS
	

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.

–

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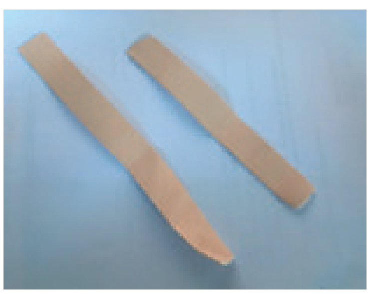
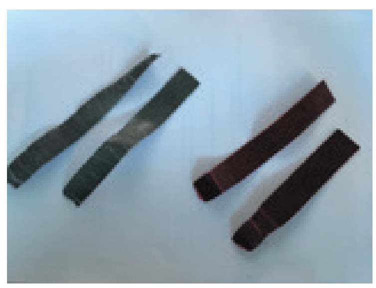
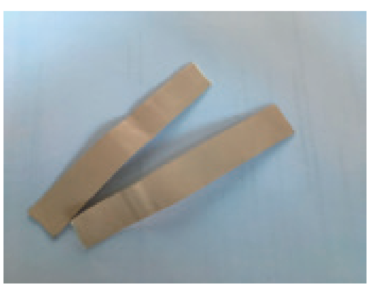
Partial reproduction of this test report is allowed only after written approval by the laboratory.

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 TREATED SAMPLES	Average	254,89	36,76	36,76	318,73	52,04	52,04
	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 LIGHT FASTNESS AGING TREATMENT	Average	292,97	37,14	37,14	301,44	45,43	45,43
	SD	47,57	3,58	3,58	83,00	15,55	15,55
	cv%	16,24	9,63	9,63	27,53	34,23	34,23
AFTER HEAT AGING TREATMENT	Average	215,25	34,02	34,02	270,45	46,00	46,00
	SD	35,88	3,59	3,59	61,24	11,08	11,08
	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.

ARTICLE NATURE•L® GOAT	CLASSIC GOAT
AFTER LIGHT FASTNESS AGING	AFTER LIGHT FASTNESS AGING
	
AFTER HEAT AGING	AFTER HEAT AGING
	

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SOIL BURIAL TEST

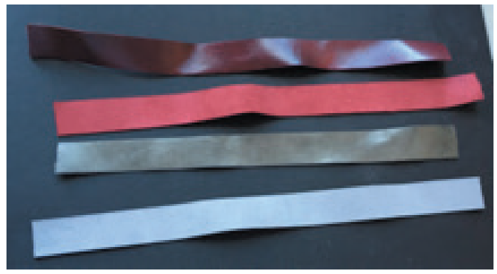
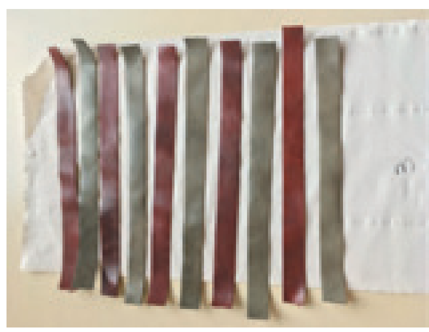
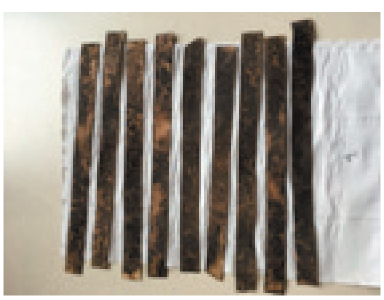
		ARTICLE NATURE•L® GOAT			CLASSIC GOAT		
		Max Force (N)	Elongation Max (mm)	Elongation % Max (%)	Max Force (N)	Elongation Max (mm)	Elongation % Max (%)
NOT TREATED SAMPLES	Average	254,89	36,76	36,76	318,73	52,04	52,04
	SD	34,20	5,16	5,16	72,32	19,02	19,02
	cv%	13,42	14,04	14,04	22,70	36,55	36,55
AFTER 4 WEEKS SOIL BURIAL TREATMENT	Average	201,66	37,66	37,66	286,00	41,89	41,89
	SD	28,54	7,58	7,58	75,48	13,13	13,13
	cv%	14,15	20,12	20,12	26,39	31,35	31,35
AFTER 16 WEEKS SOIL BURIAL TREATMENT	Average	209,10	40,72	40,72	296,58	39,58	39,58
	SD	21,16	9,39	9,39	37,52	7,97	7,97
	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® 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® Goat shows significant presence of stains due to microbial growth, while the sample Classic Goat only shows few stains as consequence of microbial growth.

–

The results only refer to the samples subjected to the test performed.
Residues of the samples are stored for three months since the issue of the Test Report.

ARTICLE NATURE•L® GOAT	CLASSIC GOAT
NOT TREATED	NOT TREATED
	
AFTER SOIL BURIAL	AFTER SOIL BURIAL
	
AFTER 4 WEEKS UPPER SIDE	AFTER 4 WEEKS UPPER SIDE
	
AFTER 4 WEEKS LOWER SIDE	AFTER 4 WEEKS LOWER SIDE
	

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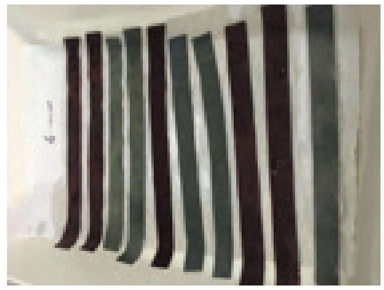
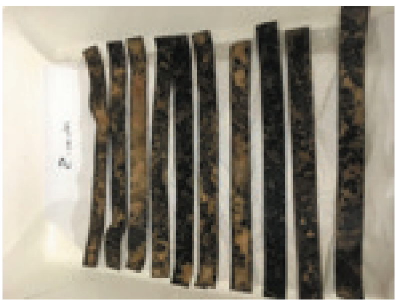
Residues of the samples are stored for three months since the issue of the Test Report.
Partial reproduction of this test report is allowed only after written approval by the laboratory.

ARTICLE NATURE•L® GOAT	CLASSIC GOAT
AFTER 16 WEEKS UPPER SIDE	AFTER 16 WEEKS UPPER SIDE
	
AFTER 16 WEEKS LOWER SIDE	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

–

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Residues of the samples are stored for three months since the issue of the Test Report.
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#3 BIODEGRADABILITY

METHOD: ISO 14855

DIPARTIMENTO DI SCIENZE E TECNOLOGIE
AGRO-ALIMENTARI

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 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 AND TEST PARAMETERS

MATERIALS

Sample A-2018 and sample B-2018: powder

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

BIODEGRADABILITY (%)

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	BIODEGRADATION (%) (MEAN)
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 PARAMETERS:

Biodegradation (%) of the reference material after 45 days of incubation > 70% ☑ YES ☐ NO

Differences of biodegradability (%) among replicates (reference material) < 20% ☑ YES ☐ NO

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

DIPARTIMENTO DI SCIENZE E TECNOLOGIE
AGRO-ALIMENTARI

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 AND TEST PARAMETERS

MATERIALS
Sample B-2019-Conceria Nuvolari: powder

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

BIODEGRADABILITY (%)

$$D_t = \frac{(CO_2)_T - (CO_2)_B}{ThCO_2} \times 100\ \%$$

WHERE:
(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	BIODEGRADATION (%) (MEAN)
Cellulose	96.3	97.5	98.0	**97.3**
B-2019-Conceria Nuvolari	8.1	8.9	7.3	**7.8**

VALIDITY PARAMETERS:

Biodegradation (%) of the reference material after 45 days of incubation > 70% ☑ YES ☐ NO

Differences of biodegradability (%) among replicates (reference material) < 20% ☑ YES ☐ NO

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

BIODEGRADABILITY

METHOD: ISO 20136

COW

ITALIAN LEATHER RESEARCH INSTITUTE
STAZIONE SPERIMENTALE PER L'INDUSTRIA DELLE PELLI E DELLE MATERIE CONCIANTI
Organismo di Ricerca Nazionale delle Camere di Commercio di Napoli, Pisa e Vicenza

REPORT OF BIODEGRADABILITY TESTS ON A SAMPLE OF NATURE - I COW - NS. ORDER CONFIRMATION PROT. N. 531 OF 21/10/2020

• NATURE - I COW (MARKED AS RP 390/20)

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 ± 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.

RESULTS

TIME	NATURE-L COW
Day	**% Biodegradability**
0	0,0
7	17,7
14	30,5
21	51,9
28	60,9
35	68,4
42	72,9

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

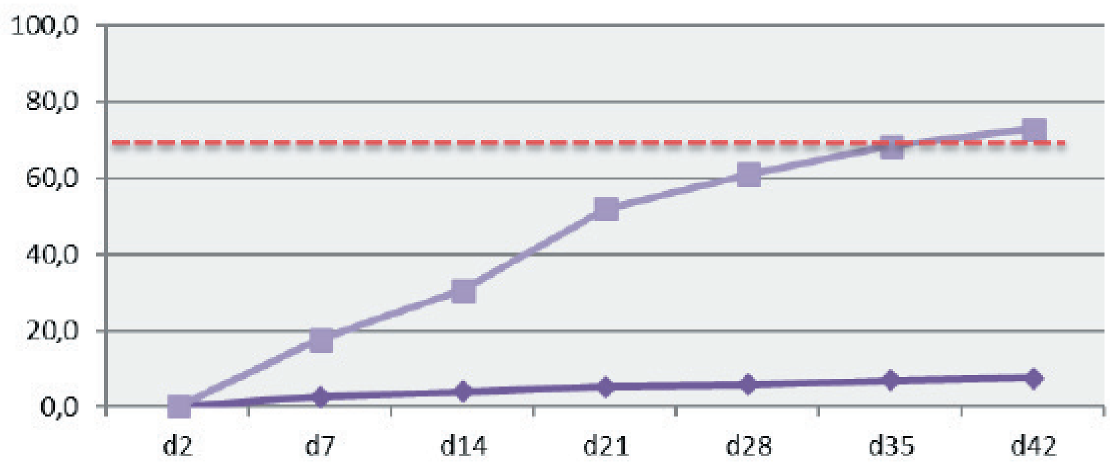


Figure 1. Graph of the Biodegradability of the NATURE - I COW sample and of the Negative Sample

For the sample under examination, the graph highlights the achievement of a plateau phase on day 42, corresponding to a biodegradability percentage of 72,9%.

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	%	72,9
Relative Biodegradability	ISO 20136:2017	%	85,4

Based on the above data, the sample called NATURE - I COW has a relative biodegradability of 85,4% after 42 days and therefore can be considered as BIODEGRADABLE UNDER AEROBIC CONDITIONS according to the ISO 20136: 2017 method.

Labs Manager

Dott. G. Calvanese

BIODEGRADABILITY

METHOD: ISO 20136

GOAT

ITALIAN LEATHER RESEARCH INSTITUTE
STAZIONE SPERIMENTALE PER L'INDUSTRIA DELLE PELLI E DELLE MATERIE CONCIANTI
Organismo di Ricerca Nazionale delle Camere di Commercio di Napoli, Pisa e Vicenza

REPORT OF BIODEGRADABILITY TESTS ON A SAMPLE OF NATURE - I GOAT - NS. ORDER CONFIRMATION PROT. N. 531 OF 21/10/2020

• NATURE - I 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 ± 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.

RESULTS

TIME	NATURE - I GOAT
Day	**% Biodegradability**
0	0,0
7	18,7
14	37,8
21	46,7
28	56,5
35	66,7
42	71,3

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

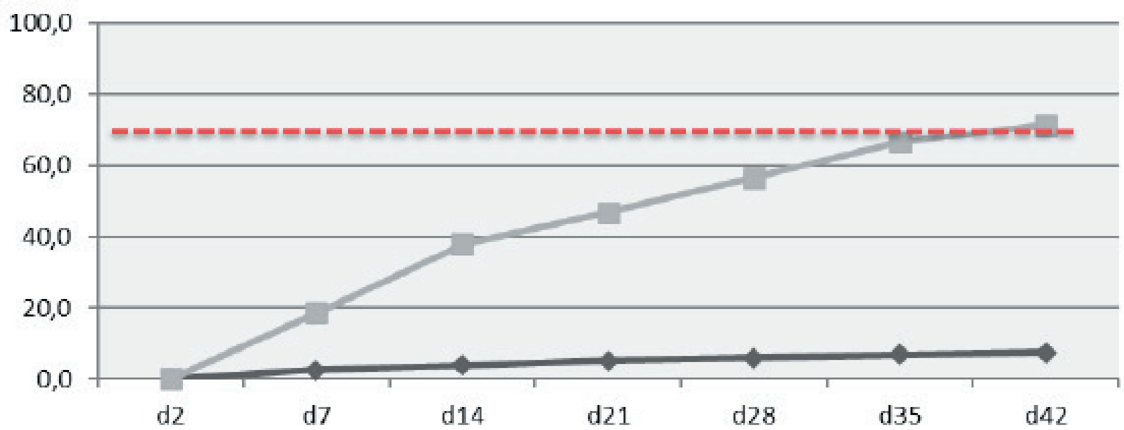


Figure 1. Graph of the Biodegradability of the NATURE - I GOAT sample and of the Negative Sample

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

Dott. G. Calvanese

BIODEGRADABILITY

METHOD: ISO 20136

SHEEP

ITALIAN LEATHER RESEARCH INSTITUTE
STAZIONE SPERIMENTALE PER L'INDUSTRIA DELLE PELLI E DELLE MATERIE CONCIANTI
Organismo di Ricerca Nazionale delle Camere di Commercio di Napoli, Pisa e Vicenza

REPORT OF BIODEGRADABILITY TESTS ON A SAMPLE OF NATURE - I SHEEP - NS. ORDER CONFIRMATION PROT. N. 531 OF 21/10/2020

• NATURE - I 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 ± 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.

RESULTS

TIME	NATURE - I SHEEP
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.

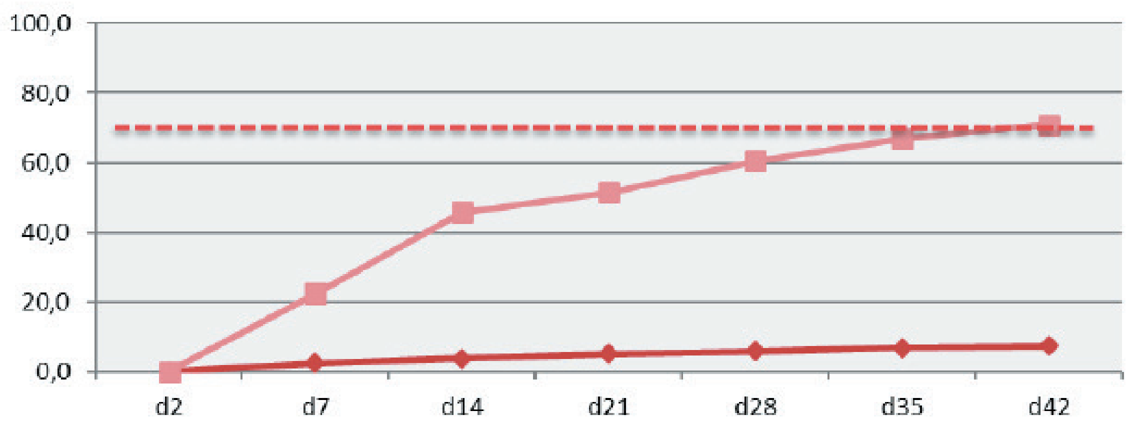


Figure 1. Graph of the Biodegradability of the NATURE - I SHEEP sample and of the Negative Sample

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%.

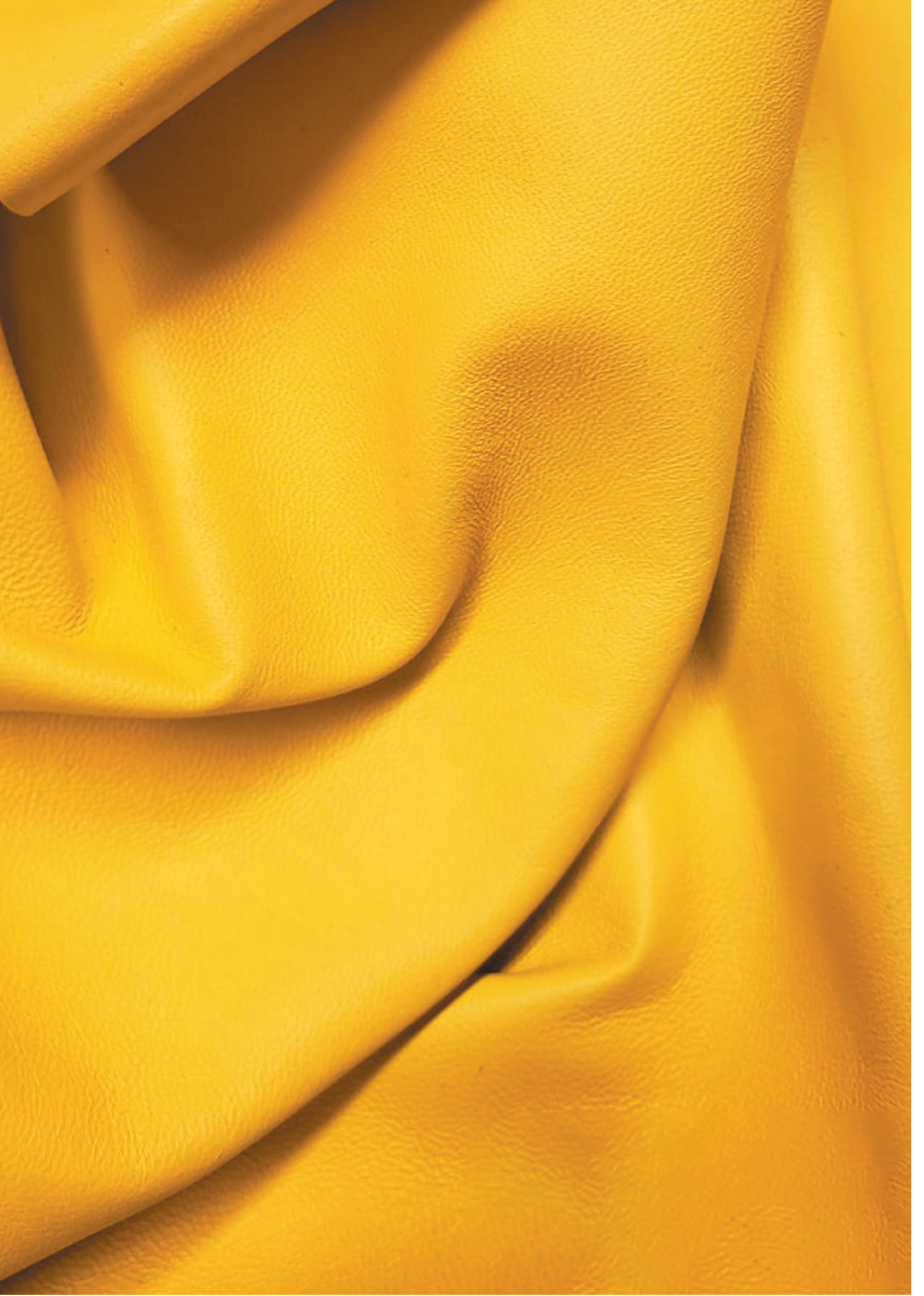
For the purpose of determining the Biodegradability value in accordance with ISO 20136, we underline that the sample and the positive control (collagen) showed a biodegradability content higher than 70% after 42 days of testing. Therefore the results of the determinations were the following:

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

Dott. G. Calvanese



#4
ENVIRONMENTAL FOOTPRINT PROFILE

POLITECNICO
MILANO 1863

CMIC
dipartimento di chimica,
materiali e ingegneria chimica
"Giulio Natta"

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® 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.

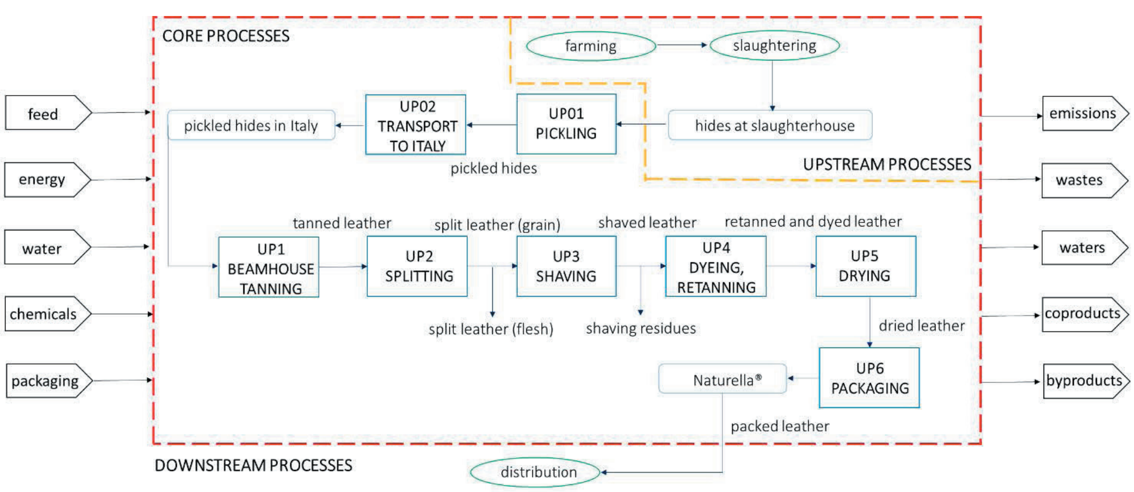


Figure 1 - System boundary for the production of Nature-L® with the main unit processes

RESULTS

Following the PEF guidelines, the environmental impact of 1 square metre of Nature-L® 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®, 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.

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.

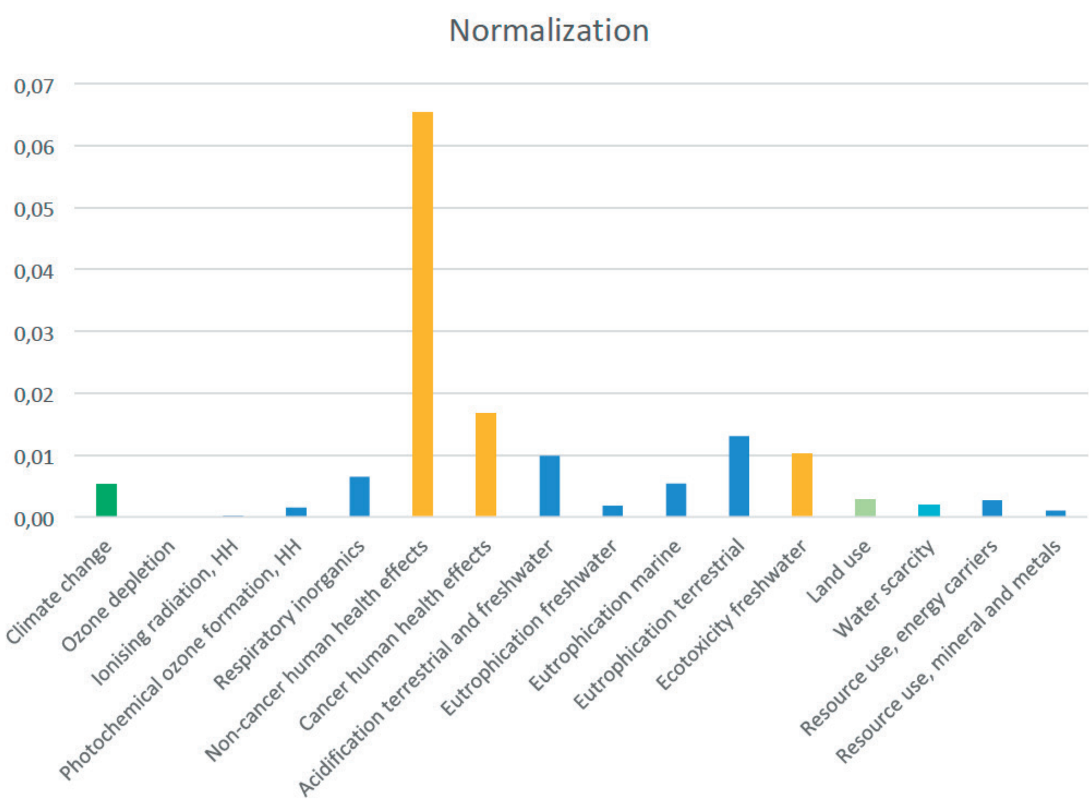


Figure 3 - Results of the PEF-compliant normalization step

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®.

	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® 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®:
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).

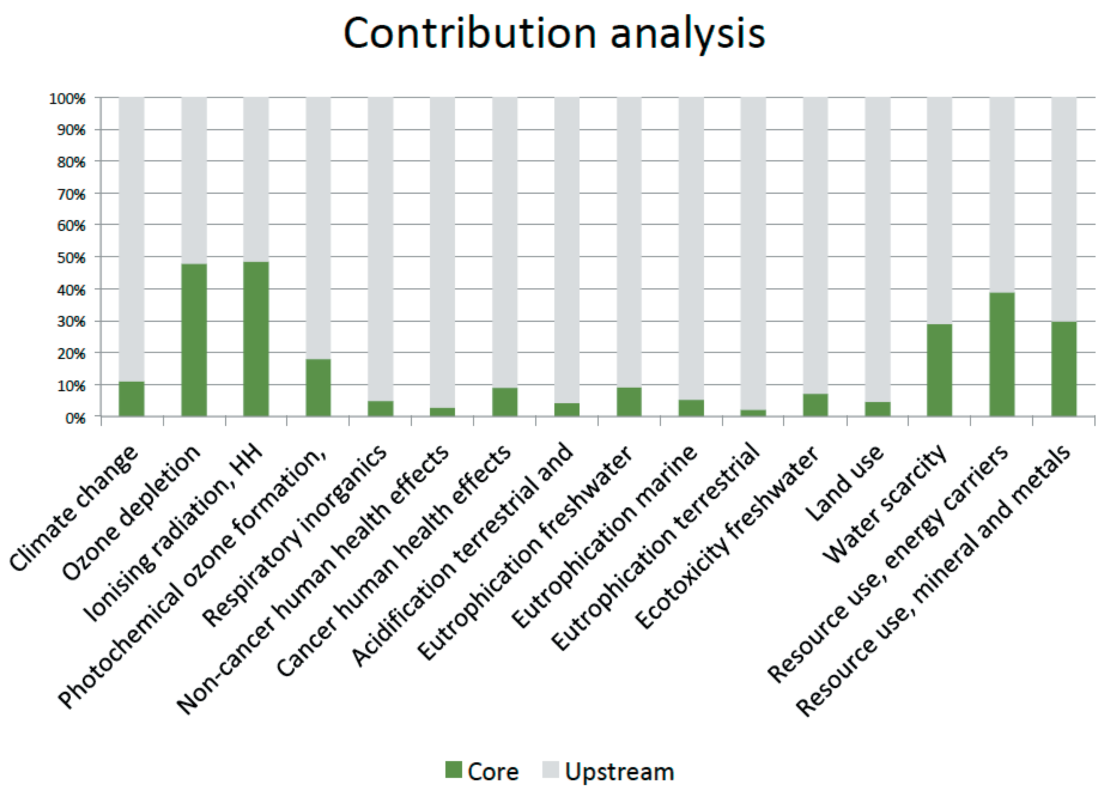


Figure 4 - Results of the PEF-compliant contribution analysis

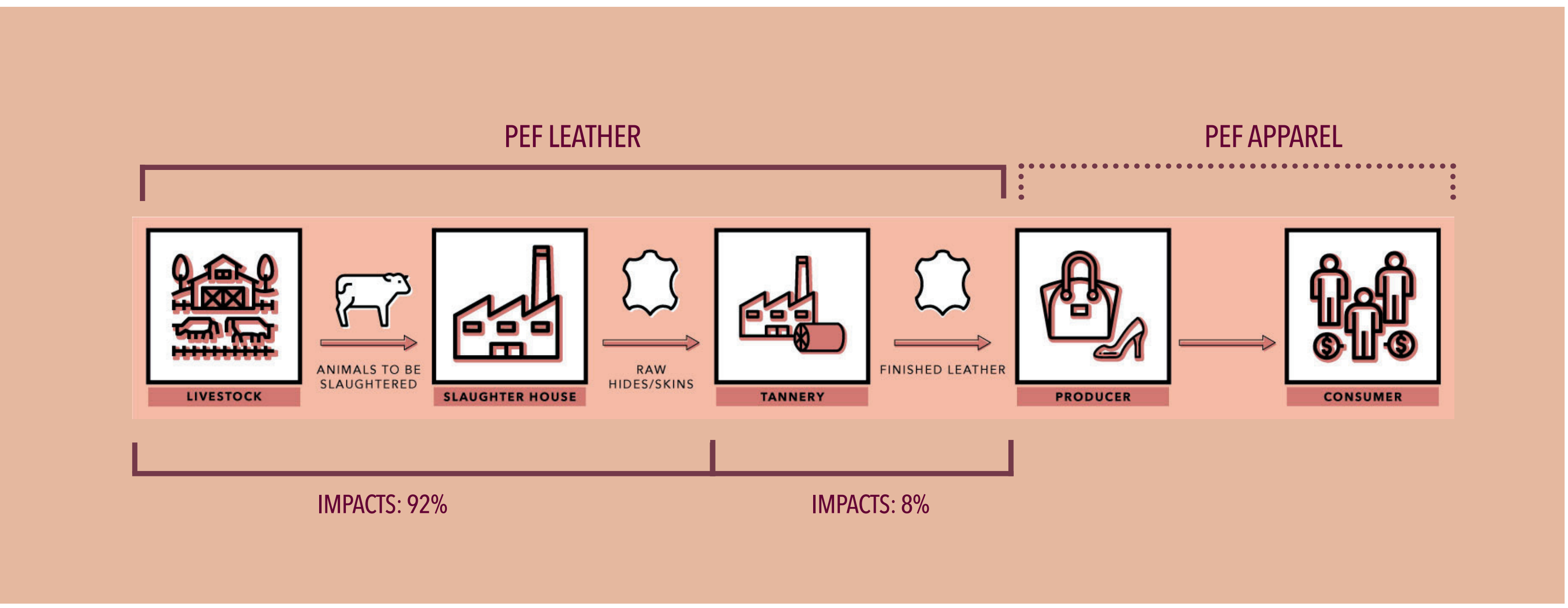


Figure 5 - Results of the PEF-compliant: impacts on core and upstream

NATURE-L® CAPRINE LEATHER

OBJECTIVE OF THE STUDY

Conceria Nuvolari has evaluated the environmental profile of its metal-free biodegradable leather Nature-L® (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® 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® 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.

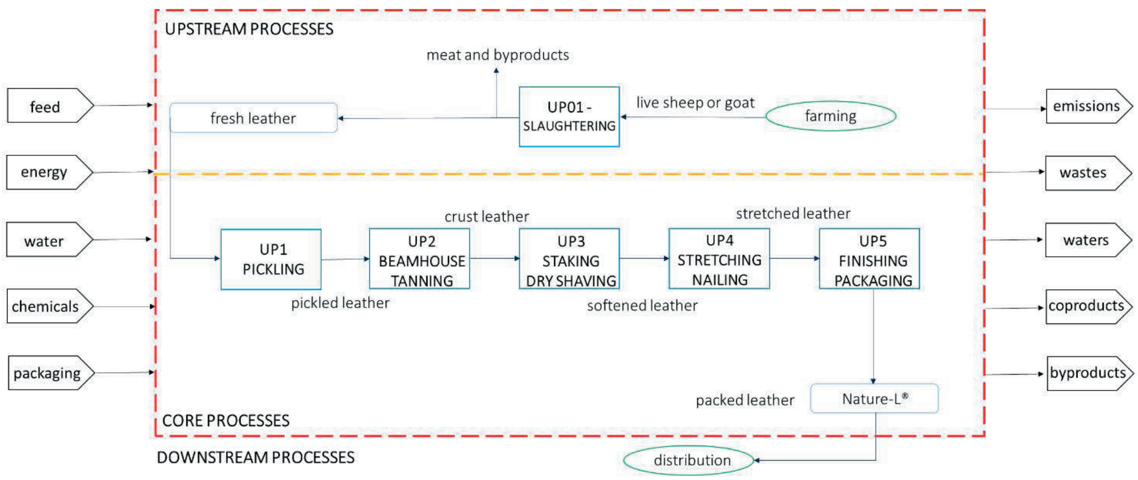


Figure 1 - System boundary for the production of Nature-L® with the main unit processes

RESULTS

Following the PEF guidelines, the environmental impact of 1 square metre of Nature-L® 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®, 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.

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.

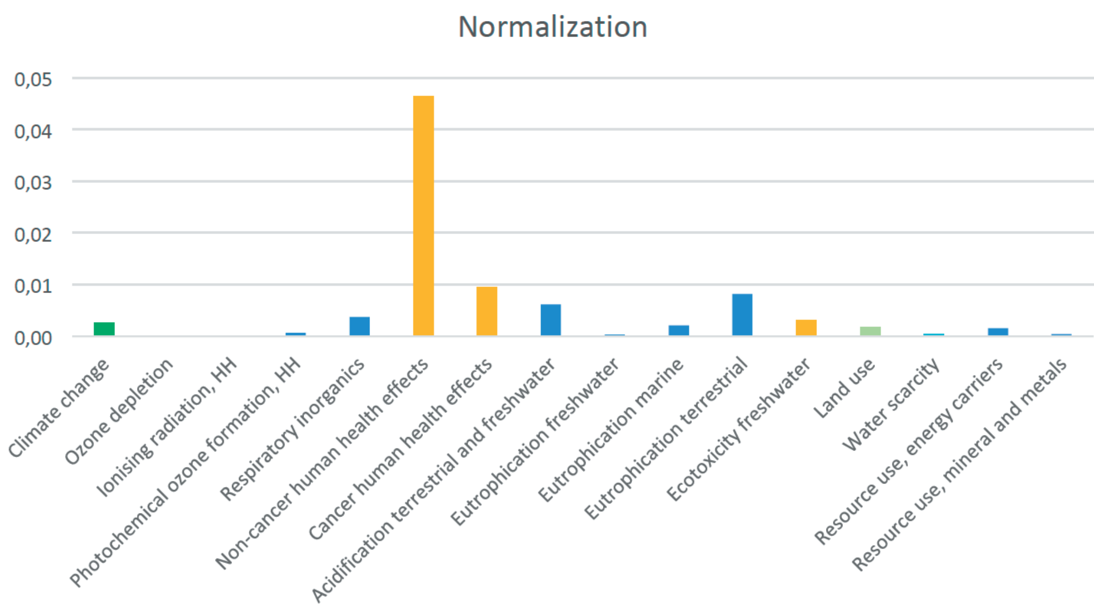


Figure 3 - Results of the PEF-compliant normalization step

After normalization, the most relevant impact categories are the toxicity ones, represented by "Non-cancer human health effects" 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®.

	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® 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®: 81.73% of the impacts for Nature-L® 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).

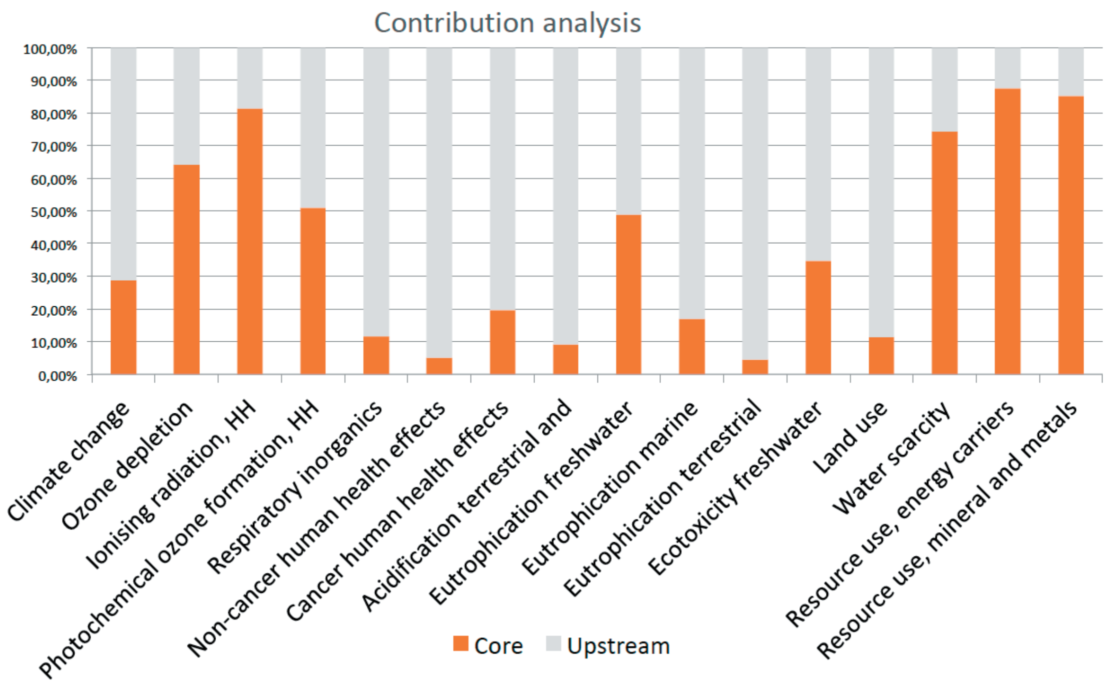


Figure 4 - Results of the PEF-compliant contribution analysis

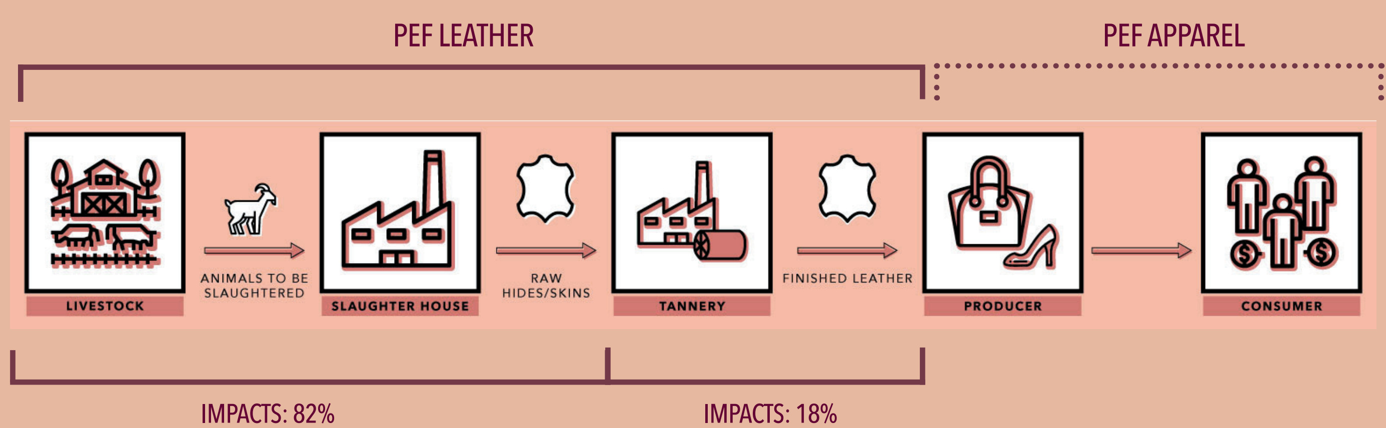


Figure 5- Results of the PEF-compliant: impacts on core and upstream

NATURE-L® OVINE LEATHER

OBJECTIVE OF THE STUDY

Conceria Nuvolari has evaluated the environmental profile of its metal-free biodegradable leather Nature-L® (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® 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® 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.

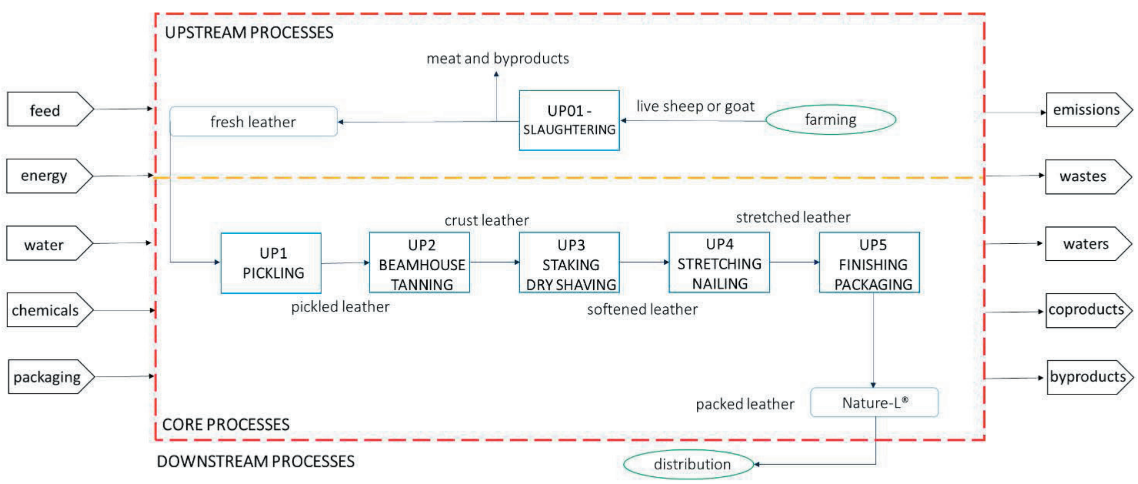


Figure 1 - System boundary for the production of Nature-L® with the main unit processes

RESULTS

Following the PEF guidelines, the environmental impact of 1 square metre of Nature-L® 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®, 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.

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.

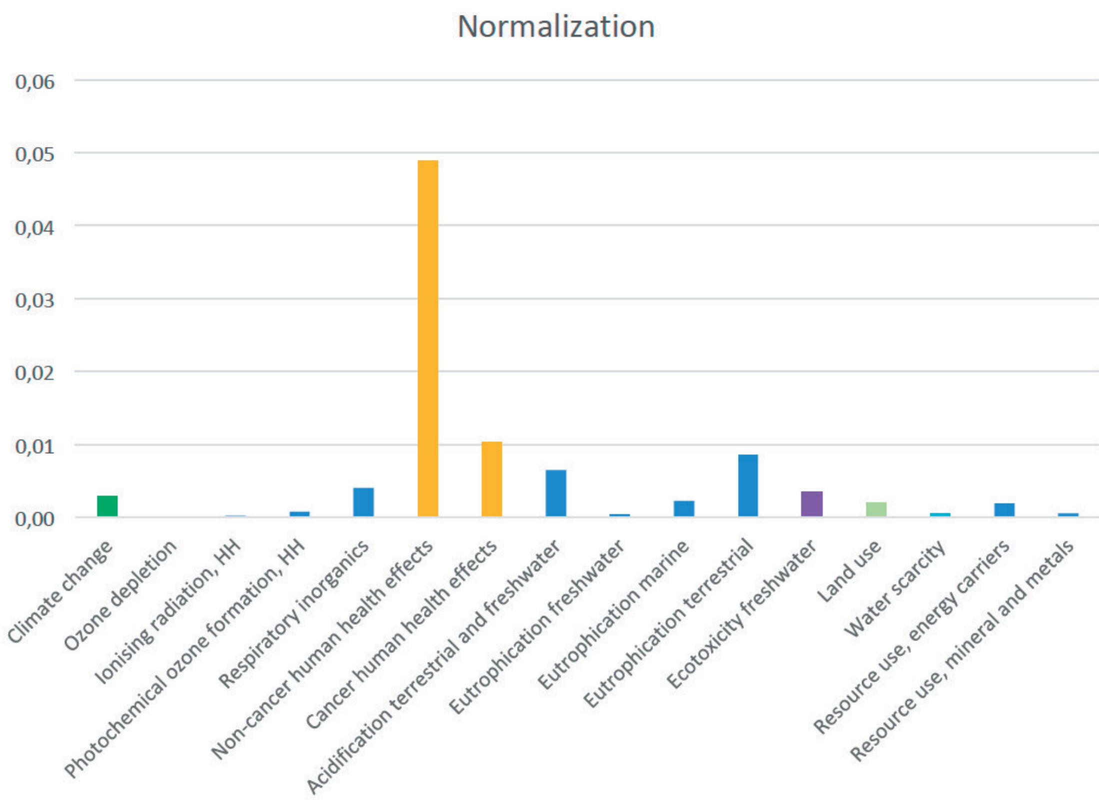


Figure 3 - Results of the PEF-compliant normalization step

After normalization, the most relevant impact categories are the toxicity ones, represented by "Non-cancer human health effects" 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®.

	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® 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®: 79.2% of the impacts for Nature-L® 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).

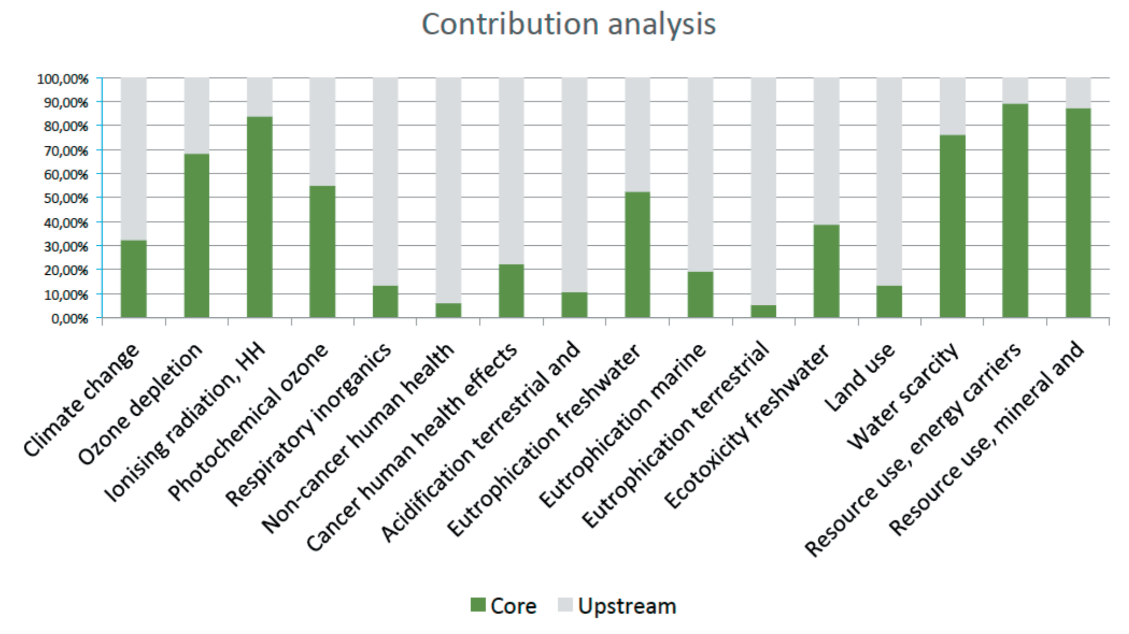


Figure 4 - Results of the PEF-compliant contribution analysis

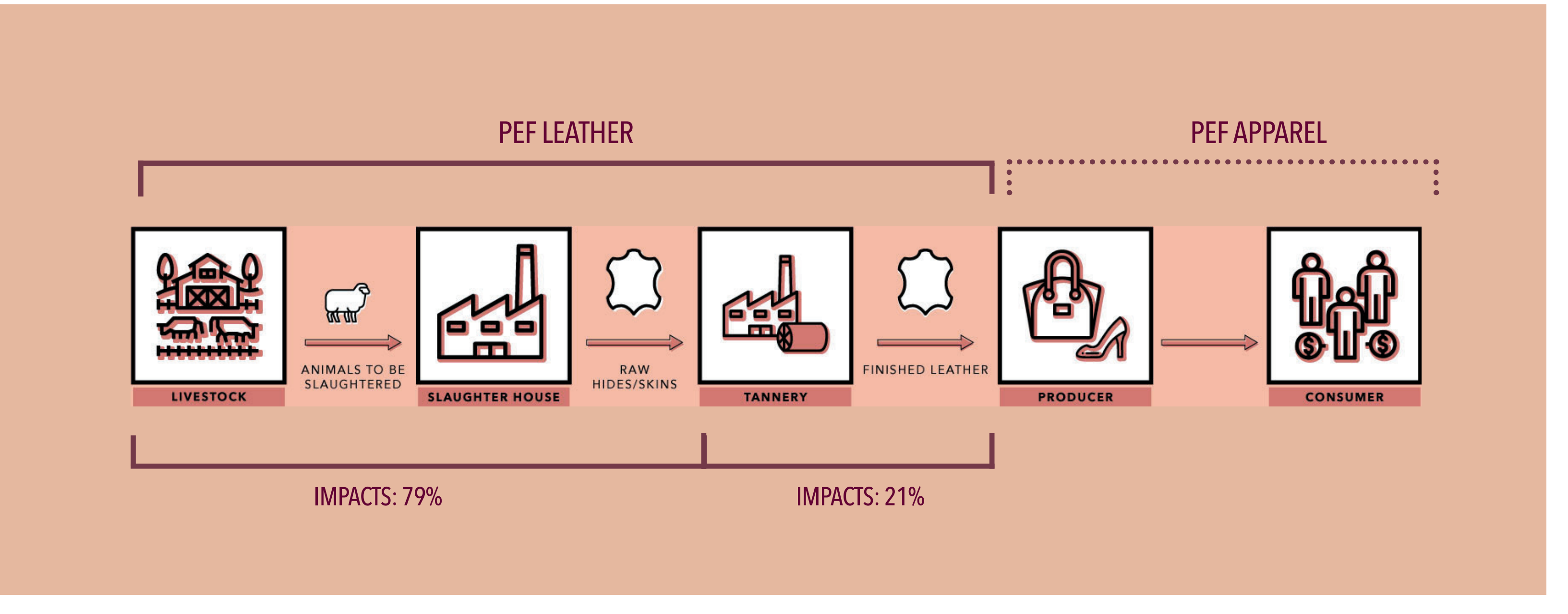


Figure 5- Results of the PEF-compliant: impacts on core and upstream

#5
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:

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.

ATTESTATO

Conceria Nuvolari

ha neutralizzato le emissioni di gas serra connesse con

produzione linea Nature-L Biodegradabili metal free

mediante sostegno al Progetto UNFCCC IN_9625 (installazione di impianti eolici in India) e IN_5016 (forestazione in India)

offset di 650 t CO_2eq

codice attestato: **1370120S05B** data attestato: **dicembre 2020**

offset promosso nell'ambito del Percorso CO_2 emission zero

www.reteclima.it

LWG CERTIFICATION

Leather Working Group is the international organization that manages the largest global projec on leather sustainability.

LWG aims to improve the environmental impact of the tanning industry by certifying and classifying tanneries on the basis of their commitment to sustainability.

LWG aims to improve the environmental impact of the leather industry by assessing and certifying leather manufacturers. Additionally, its purpose is also to engage with members of the leather supply chain and give them the knowledge to be able to make informed, sustainable choices in their businesses.

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CONCERIA

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