



SANTORI
P E L L A M I

NATURELLA

NATURAL LEATHER TREATMENT

ecologic system



- BIODEGRADABLE METAL FREE LEATHER
- ENVIRONMENTAL SUSTAINABLE
- HIGH CUTTING VALUE
- VERSATILE AND HIGHLY PERFORMING
- NON TOXIC, NON POLLUTING
- EXCLUSIVE PATENT







WHO WE ARE

Santori Pellami was founded in 1890 by Vincenzo Santori, a forward looking and wise merchant. Santori started selling rabbit skins and increased its trade with cheeses and salami, raw and tanned leathers, calves and bullocks. In 1920 Vincenzo's son, Giuseppe, took over the business. Always looking towards the future, gifted with excellent intuition for business and trade, Giuseppe made the small family business become a real company: the "Santori Giuseppe" company. After 1945, the company became a reference point for all the shoes companies which were then in full expansion in Italy. At the end of the '60s, Giuseppe's sons, Vincenzo and Guerriero, took over the business and the company grew up and expanded, adding leather and linings to the raw hides business. In the '70s the company grew up more and more and in 1978 changed its name to "Santori Pellami srl". A big change came in 1983, when the renowned company became the public limited company Santori Pellami Spa. From 1960 to 1990 the company was managed, throughout all its transformations, by the brothers Vincenzo and Guerriero, who gained a reputation on the market for correctness, reliability and excellent service for the customers. Between 1990 and 1995, Vincenzo e Guerriero's children entered the firm: Giuseppe, Andrea, Carlo and Sara, who are currently managing the company. They all were raised in the atmosphere of the family business, they were nourished by their parents' experience and advice, they have been trained on the field and for these reasons now they run the company with passion, constantly looking for innovation.

Today, Santori Pellami is specialised in the production and sale of leathers. The Santori family's wish is to make their company always more competitive, and to make it a leader in the sector. The goal of the Santori Pellami company is to offer a product that always meets the expectations of every customer. The main elements on which the company is based are: excellent quality-price ratio; prompt delivery; the certainty, for the customer, of always receiving the desired product; continual innovation; respect for the environment.



■ OUR SUSTAINABILITY AWARENESS

The themes of sustainability, circular economy, respect for the environment have today assumed a centrality in the fashion and luxury sector. Since 2015, our company Santori Pellami has been in the search for more sustainable materials, to obtain a leather product that could meet the needs of a transforming market.

Nowadays the path taken has led us to be among the first companies to have experimented a method of tanning with the lowest level of heavy metals, and free from hexavalent Chromium.

This was possible thanks to the uniqueness that since our foundation in 1890, has led our company Santori Pellami to be one of the market leaders in the tanning sector: the attention to the developments of the whole society and the consequent evolution of trends and technologies in leather and high-fashion segments.

Today, on the basis of our experience gained from generation to generation, we are specialized in the production and sale of different leather products from veal, beef, pork, sheep among other. We operate in national and international markets (Belgium, Bulgaria, China, Croatia, Lebanon, Poland, Portugal, Romania, Serbia, Spain, Tunisia, Turkey and Hungary).

Even if we are a small size company, we cover the 0.4 % of the Italian market and 0.2 % in Europe.

In April 2017, after several tests, we have developed an innovative process to obtain a 77% biodegradable leather.

High quality leather hides are tanned using biodegradable, organic ingredients, with low use of heavy metals (Cadmium, Cobalt, Nickel and Lead) and without Chromium.

These leathers have passed the standard requirements for abrasion resistance, colour fastness, grab strength, and dry and wet crocking



for footwear and fashion needs.

More substantial, they have passed the most important test that is the satisfaction of the early customers (fashion industries) who have appreciated the first specimens and are increasing their demand. Today, we have titled and registered the Naturella® trade mark, and we can offer this new leather product in 15-20 colours and in 3 main variety (Sanat, Danubio and Coordinator), with optional plant and flower extract dyeing.

Naturella® hides have been certified compostable in controlled composting conditions according to ISO 14855 and biodegradable according to ISO 20136.

In summary, today Naturella® is an excellent leather for fashion, accessories and footwear, and can guarantee the following positive effects:

- higher reduction of water consumptions than the traditional tanning process;
- waters of the production process are free from heavy metals (toxic and allergenic);
- more surface of the leather is worked, that means less wastes, less disposal costs, less pollution;
- the wastes are biodegradable;
- higher quality of the leather which is more resistant to tears and breakages;
- the leather tanned in this new way absorbs better the colours, reducing their use.

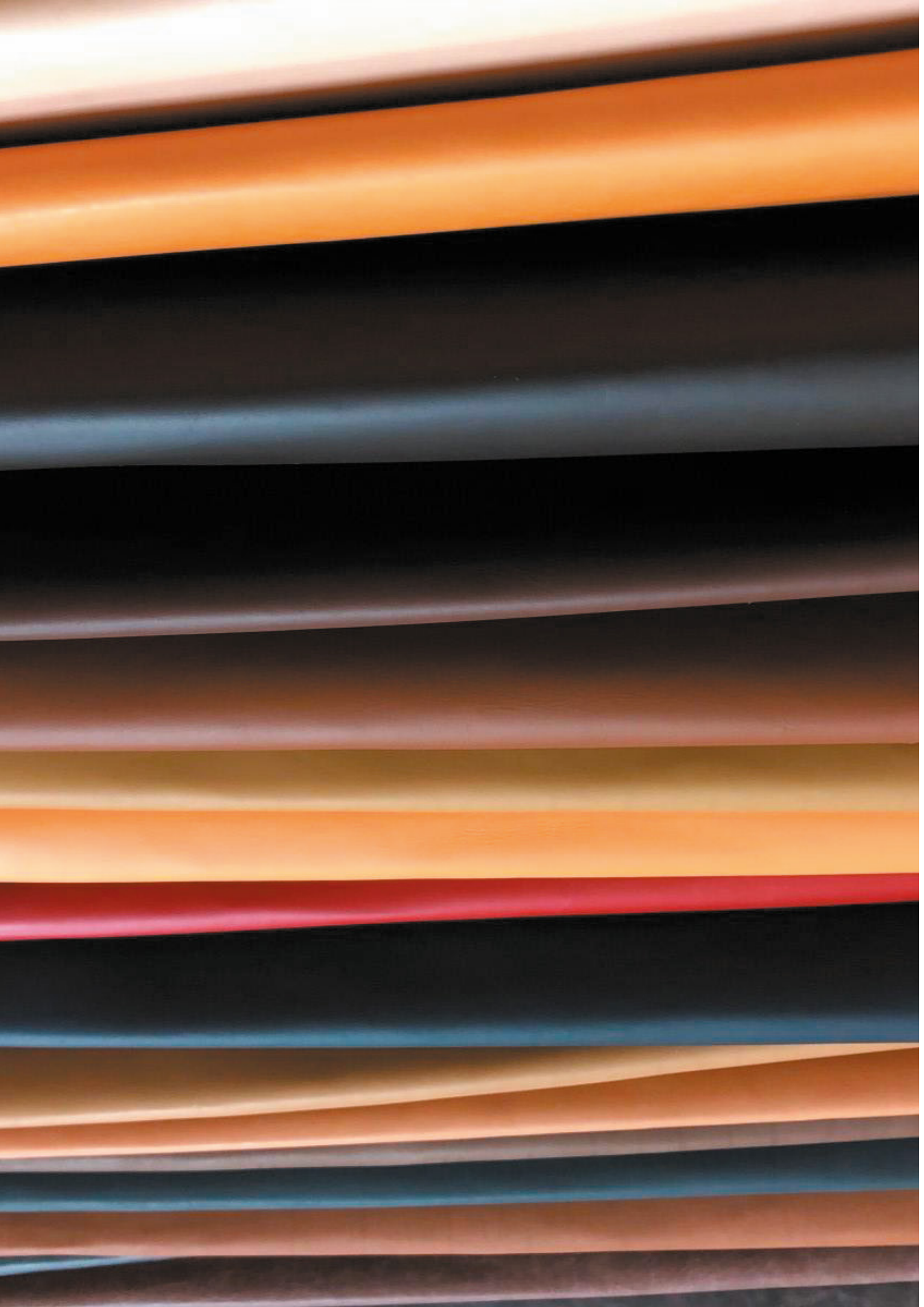
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INNOVATIVE WATER-REPELLENT CERTIFIED AND ECO-FRIENDLY LEATHER

| COMPONENTE | PARAMETRO | LIMITI DI RIFERIMENTO (BASATA SU TR: UNI CEN ISO/TR 20879:2007 - TOMAIO, REQUISITI PRESTAZIONALI PER COMPONENTI PER CALZATURE) | VALUTAZIONE (\$) |
|------------|---|--|----------------------|
| TOMAIO | Determinazione dell'impermeabilità dinamica | Resistente all'acqua: tempo di penetrazione \geq 60 minuti e assorbimento dopo 60 minuti \leq 20%; Altamente resistente all'acqua: tempo di penetrazione \geq 180 minuti e assorbimento dopo 180 minuti \leq 25%; | RESISTENTE ALL'ACQUA |

| DETERMINAZIONE | METODO | RISULTATI |
|------------------------------------|-----------------------|--|
| DETERMINAZIONE DELL'IMPERMEABILITÀ | EN 13518:2001/A1-2005 | DIREZIONE X: Tempo di penetrazione > 24 ore Assorbimento dopo 60 minuti = 5,05% Assorbimento dopo 180 minuti = 7,77% DIREZIONE Y: Tempo di penetrazione > 24 ore Assorbimento dopo 60 minuti = 5,42% Assorbimento dopo 180 minuti = 8,21% |



#1 CHARACTERISTICS OF NATURELLA®

PANORAMA CERTIFICAZIONE ECOPELLE

UNI 11427

CUOIO ECOLOGICO, ECOPELLE



ART. NATURELLA



| CARATTERISTICHE DEL CUOIO | METODI DI PROVA | REQUISITI | ART. SANA 1 | ART. DANUBIO | ART. COORDINATOR |
|---|--|--|--------------|--------------|------------------|
| COLORANTI AZOICI | UNI EN ISO 17234-1 e UNI EN ISO 17234-2 | ≤ 30 mg/kg ¹ | / | / | / |
| CROMO ESAVALENTE | UNI EN ISO 17075 | ≤ 3 mg/kg ² | / | / | / |
| FORMALDEIDE LIBERA | UNI EN ISO 17226-1 | ≤ 150 mg/kg articoli per bambino ≤ 75 mg/kg | 33,7 mg/kg | < 1,0 mg/kg | 9 mg/kg |
| PENTAFLOROFENOLO | UNI EN ISO 17070 | ≤ 1 mg/kg | < 0,1 mg/kg | < 0,1 mg/kg | < 0,1 mg/kg |
| TETRAFLOROFENOLI | UNI EN ISO 17070 | ≤ 1 mg/kg | < 0,1 mg/kg | < 0,1 mg/kg | < 0,1 mg/kg |
| METALLI ESTRAIBILI CON SUDORE ARTIFICIALE | UNI EN ISO 17072-1 | | | | |
| Ni - nichel | | ≤ 4 mg/kg | < 0,75 mg/kg | < 0,75 mg/kg | < 0,75 mg/kg |
| Cd - cadmio | | ≤ 1 mg/kg | 0,052 mg/kg | 0,052 mg/kg | 0,052 mg/kg |
| Co - cobalto | | ≤ 4 mg/kg | < 0,25 mg/kg | < 0,25 mg/kg | < 0,25 mg/kg |
| Pb - piombo | | ≤ 3 mg/kg | < 0,75 mg/kg | < 0,75 mg/kg | < 0,75 mg/kg |

¹ Il limite indicato equivale al limite di rivelabilità del metodo

² Il requisito relativo al contenuto di Cromo esavalente è convenzionalmente espresso come "non rivelabile" quando il contenuto è ≤ 3 mg/kg

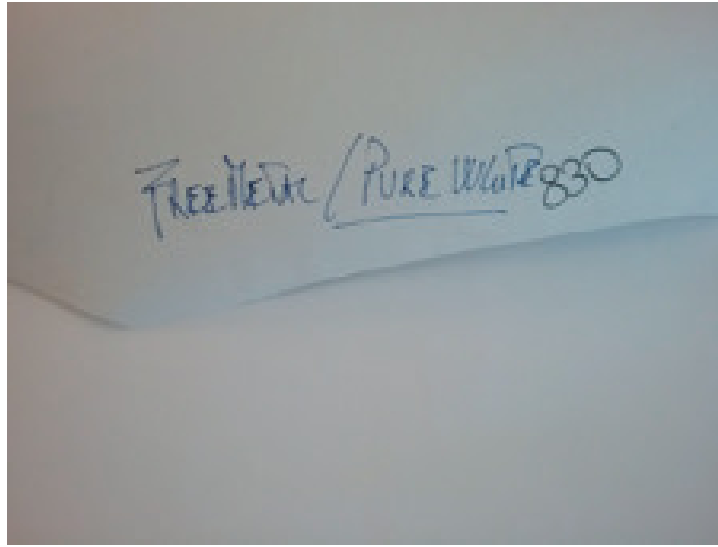


ART. VITELLO FREE METAL NERO.

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

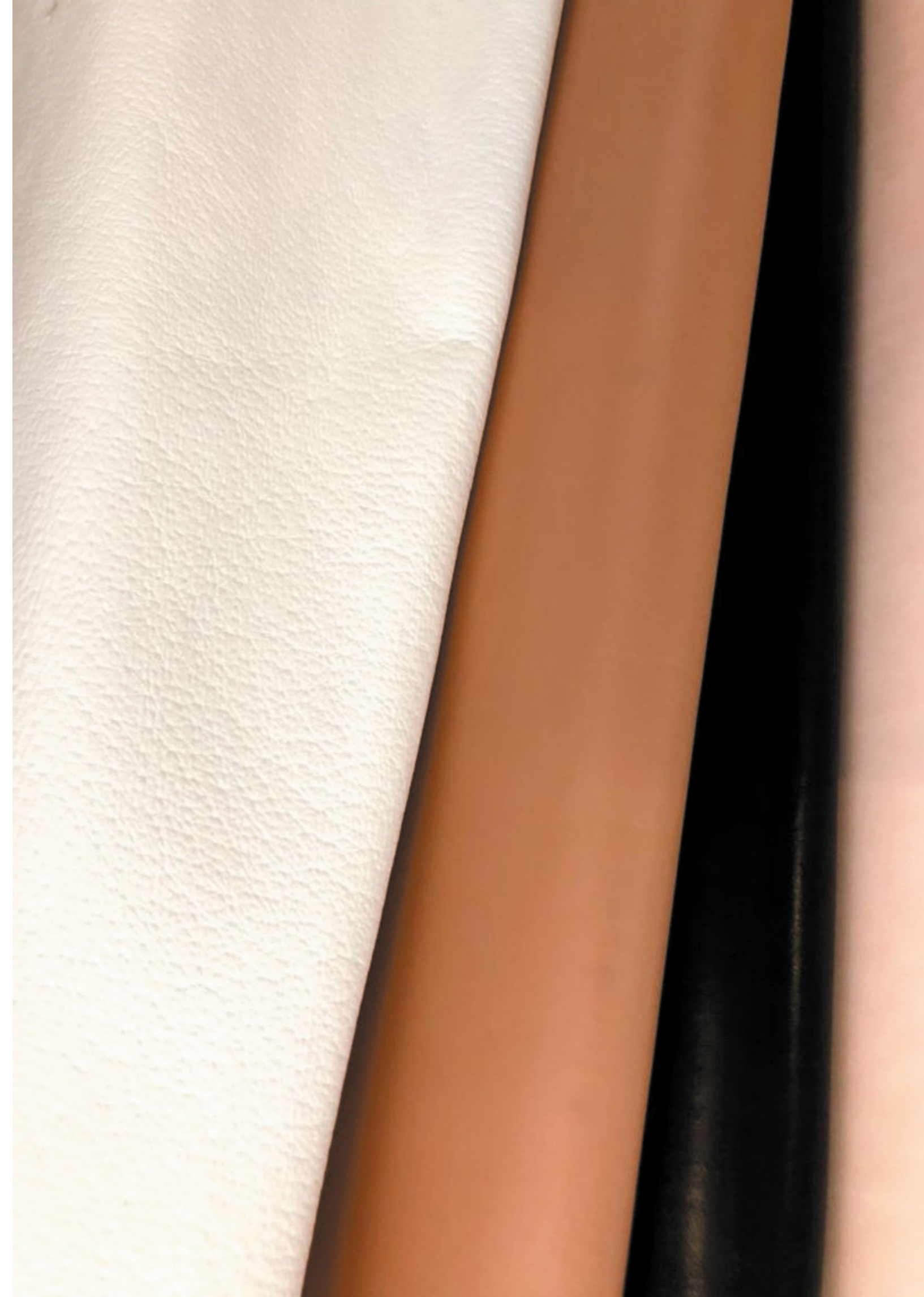
| DETERMINATION | METHOD | RESULTS | REQUIREMENTS (based on: H&M QUALITY STANDARDS & REQUIREMENTS) |
|-----------------------------------|-----------------------|--|---|
| Colour fastness to rubbing | UNI EN ISO 11640:2013 | <p>GRAIN SIDE</p> <p>N.20 back and forth movements - Dry felt pad on dry specimen</p> <p>Color transfer on the felt pad: 5 degree of the grey scale Sample color variation: 5 degree of the grey scale</p> <p>N.50 back and forth movements - Dry felt pad on dry specimen</p> <p>Color transfer on the felt pad: 5 degree of the grey scale Sample color variation: 4/5 degree of the grey scale</p> | <p>≥ 3 AFTER 20 RUBS TO DRY (ISRAEL PORTION)</p> <p>≥ 3 AFTER 50 RUBS TO DRY</p> <p>≥ 2/3 AFTER 10 RUBS TO WET WITH WATER</p> <p>≥ 3 AFTER 20 RUBS TO WET WITH WATER (ISRAEL PORTION)</p> |

| DETERMINATION | METHOD | RESULTS | REQUIREMENTS (based on: H&M QUALITY STANDARDS & REQUIREMENTS) |
|--|------------------------------|---|---|
| <p>Colour fastness to rubbing</p> | <p>UNI EN ISO 11640:2013</p> | <p>GRAIN SIDE</p> <p>N.10 back and forth movements – Damp felt pad with water on dry specimen</p> <p>Color transfer on the felt pad: 4/5 degree of the grey scale Sample color variation: 5 degree of the grey scale</p> <p>N.20 back and forth movements – Damp felt pad with water on dry specimen</p> <p>Color transfer on the felt pad: 4/5 degree of the grey scale Sample color variation: 4/5 degree of the grey scale</p> <p>FLESH SIDE <i>Note: Weight on felt 500 g</i></p> <p>N.20 back and forth movements - Dry felt pad on dry specimen</p> <p>Color transfer on the felt pad: 4 degree of the grey scale Sample color variation: 4 degree of the grey scale</p> <p>N.10 back and forth movements – Damp felt pad with water on dry specimen</p> <p>Color transfer on the felt pad: 4/5 degree of the grey scale Sample color variation: 4 degree of the grey scale</p> <p>N.20 back and forth movements – Damp felt pad with water on dry specimen</p> <p>Color transfer on the felt pad: 4/5 degree of the grey scale Sample color variation: 3/4 degree of the grey scale</p> | <p>≥ 3 AFTER 20 RUBS TO DRY (ISRAEL PORTION) ≥ 3 AFTER 50 RUBS TO DRY</p> <p>≥ 2/3 AFTER 10 RUBS TO WET WITH WATER ≥ 3 AFTER 20 RUBS TO WET WITH WATER (ISRAEL PORTION)</p> |

ART. FREE METAL / PURE WHITE.

The sample Art. FREE METAL / PURE WHITE 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 | Reference (Based on: UNI EN 15987:2015- Leather - Terminology - Key definitions for the leather trade) |
|----------------------|----------------------------|----------------|--|
| Chrome | UNI EN ISO 17072-2:2011 | 5,1 mg/Kg | ≤ 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 | |



#2 DURABILITY



INNOVHUB
STAZIONI SPERIMENTALI
PER L'INDUSTRIA

innovazione e ricerca



STAZIONE SPERIMENTALE
CARTA, CARTONI, E PASTE PER CARTA
SEDE OPERATIVA:
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20133 Milano
Tel +39 02 8515.3610
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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-181238, RPT-SSCCP-181443 and RPT-SSCCP-190163.

LEATHER SAMPLES NAMED:

- ARTICLE NATURELLA®
- CLASSIC CALF

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-181238, RPT-SSCCP-181443 e RPT-SSCCP-190163.

RESULTS: AATCC 30. TEST II

| | <i>Chaetomium globosum</i> | |
|-----------------------|----------------------------|-----------------------------|
| | INCUBATION TIME: 7 DAYS | INCUBATION TIME: 14 DAYS |
| Cotton reference 100% | ++ | ++ |
| ARTICLE NATURELLA® | - | - |
| CLASSIC CALF | ++* | ++* |

(++) : Growth on the entire specimen surface.

(+) : Growth on part of the specimen.

(-) : Growth not present.

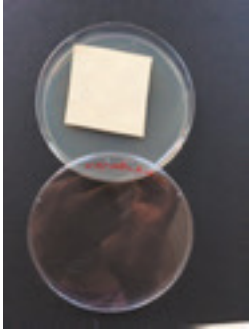

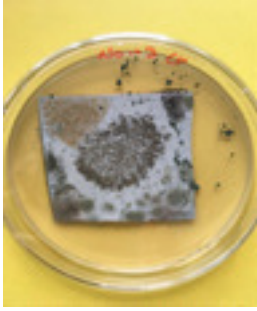
*Growth of microorganisms different from the inoculated ones.

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 NATURELLA® | CLASSIC CALF |
|---|--|
| AFTER 7 DAYS | AFTER 7 DAYS |
|  |  |
| AFTER 14 DAYS | AFTER 14 DAYS |
|  |  |

As reported in the table and in the pictures, the sample Classic Calf after 14 days of contact shows a significant growth of the inoculated fungi, while no fungal growth is detected on sample Naturella®, the sample Classic Calf shows a significant growth of fungi different from the inoculated ones.

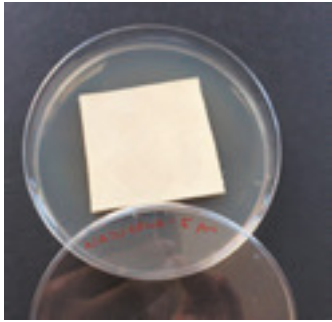
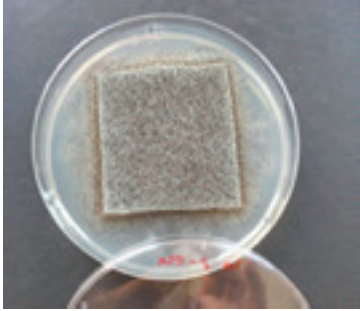

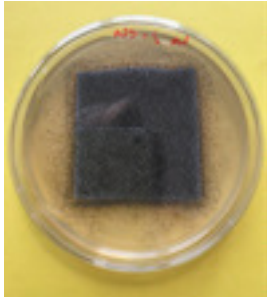
RESULTS: AATCC 30. TEST II

| | INCUBATION TIME: 7 DAYS | INCUBATION TIME: 14 DAYS |
|-----------------------|----------------------------|-----------------------------|
| Cotton reference 100% | ++ | ++ |
| ARTICLE NATURELLA® | - | - |
| CLASSIC CALF | ++ | ++ |

- (++) : Growth on the entire specimen surface.
- (+) : Growth on part of the specimen.
- (-) : Growth not present.

—
 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 NATURELLA® | CLASSIC CALF |
|--|---|
| AFTER 7 DAYS | AFTER 7 DAYS |
|  |  |
| AFTER 14 DAYS | AFTER 14 DAYS |
|  |  |

As reported in the table and in the pictures, the sample Classic Calf after 14 days of contact shows a significant growth of the inoculated fungi, while no fungal growth is detected on sample Naturella®, the sample Classic Calf shows a significant growth of fungi different from the inoculated ones.

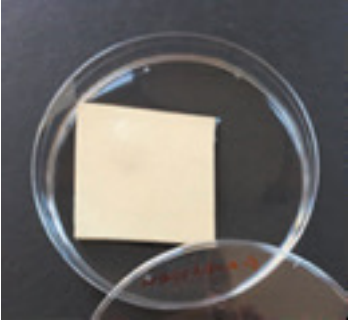

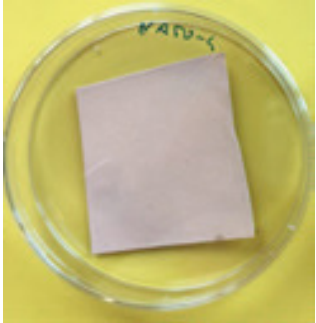
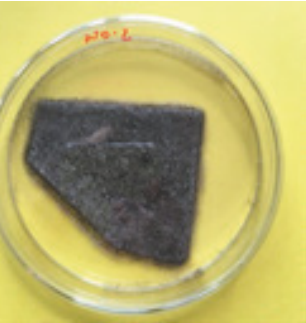
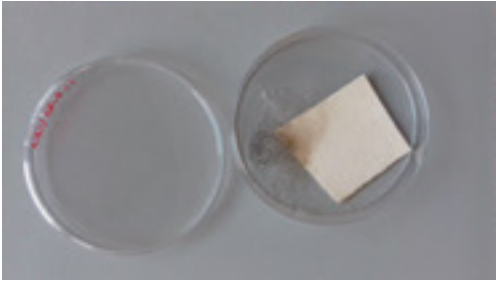
RESULTS: AATCC 30. TEST IV

| | <i>Aspergillus niger</i> + <i>Penicillium chrysogenum</i> + <i>Trichoderma viride</i> |
|-----------------------|--|
| | INCUBATION TIME: 28 DAYS |
| COTTON REFERENCE 100% | ++ |
| ARTICLE NATURELLA® | + |
| CLASSIC CALF | ++ |

- (++) : Growth on the entire specimen surface.
 (+) : Growth on part of the specimen.
 (-) : Growth not present.

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

| ARTICLE NATURELLA® | CLASSIC CALF |
|---|---|
| AFTER 7 DAYS | AFTER 7 DAYS |
|  |  |
| AFTER 14 DAYS | AFTER 14 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 Naturella® sample after 28 days of contact with moulds under testing conditions only present a partial growth of the inoculated fungi.

—
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CLIMATIC CHAMBER TREATMENTS

| | | ARTICLE NATURELLA® | | | CLASSIC CALF | | |
|---|----------------|--------------------|---------------------|----------------------|---------------|---------------------|----------------------|
| | | Max Force (N) | Elongation Max (mm) | Elongation % Max (%) | Max Force (N) | Elongation Max (mm) | Elongation % Max (%) |
| NOT TREATED SAMPLES | Average | 247,37 | 36,85 | 36,85 | 220,41 | 34,24 | 34,24 |
| | SD | 36,75 | 5,73 | 5,73 | 39,45 | 7,84 | 7,84 |
| | cv% | 14,86 | 15,55 | 15,55 | 17,90 | 22,89 | 22,90 |
| AFTER LIGHT FASTNESS AGING TREATMENT | Average | 297,51 | 39,37 | 39,37 | 227,91 | 36,01 | 36,01 |
| | SD | 68,28 | 3,53 | 3,53 | 51,66 | 3,94 | 3,94 |
| | cv% | 22,95 | 8,97 | 8,97 | 22,67 | 10,94 | 10,94 |
| AFTER HEAT AGING TREATMENT | Average | 240,51 | 42,18 | 42,18 | 223,01 | 45,01 | 45,01 |
| | SD | 63,79 | 4,54 | 4,54 | 29,88 | 14,75 | 14,75 |
| | cv% | 26,52 | 10,75 | 10,75 | 13,40 | 32,77 | 32,77 |

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 in climatic chamber.

| ARTICLE NATURELLA® | CLASSIC CALF |
|---|--|
| AFTER LIGHT FASTNESS AGING | AFTER LIGHT FASTNESS AGING |
|  |  |
| AFTER HEAT AGING | AFTER HEAT AGING |
|  |  |

The results only refer to the samples subjected to the test performed.
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SOIL BURIAL TEST

| | | ARTICLE NATURELLA® | | | CLASSIC CALF | | |
|--------------------------------------|---------|--------------------|---------------------|----------------------|---------------|---------------------|----------------------|
| | | Max Force (N) | Elongation Max (mm) | Elongation % Max (%) | Max Force (N) | Elongation Max (mm) | Elongation % Max (%) |
| NOT TREATED SAMPLES | Average | 247,37 | 36,85 | 36,85 | 220,41 | 34,24 | 34,24 |
| | SD | 36,75 | 5,73 | 5,73 | 39,45 | 7,84 | 7,84 |
| | cv% | 14,86 | 15,55 | 15,55 | 17,90 | 22,89 | 22,90 |
| AFTER LIGHT FASTNESS AGING TREATMENT | Average | 245,98 | 38,78 | 38,78 | 227,17 | 33,45 | 33,45 |
| | SD | 93,97 | 6,01 | 6,01 | 36,48 | 6,24 | 6,24 |
| | cv% | 38,20 | 15,50 | 15,50 | 16,06 | 18,66 | 18,66 |
| AFTER HEAT AGING TREATMENT | Average | 204,04 | 34,40 | 34,40 | 202,80 | 35,06 | 35,06 |
| | SD | 29,88 | 1,75 | 1,75 | 38,23 | 4,68 | 4,68 |
| | cv% | 14,64 | 5,09 | 5,09 | 18,85 | 13,36 | 13,36 |

After 4 weeks of soil burial treatment differences in the tensile properties are not detected for both samples. After 16 weeks this result is confirmed. 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, no evidence of microbial growth was detected. After 16 weeks both samples show few stains as consequence of microbial growth.

| ARTICLE NATURELLA® | CLASSIC CALF |
|---|--|
| 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 |
|  |  |

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.
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| ARTICLE NATURELLA® | CLASSIC CALF |
|--|---|
| AFTER LIGHT FASTNESS AGING | AFTER LIGHT FASTNESS AGING |
|  |  |
| AFTER HEAT AGING | AFTER HEAT AGING |
|  |  |

CONCLUSIONS

The results of fungal resistance tests evidence that CLASSIC CALF sample is more sensible to surface fungal growth, while sample ARTICLE NATURELLA® only shows 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 CLASSIC CALF after soil burial treatments. The different tanning 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.
Partial reproduction of this test report is allowed only after written approval by the laboratory.



#3 BIODEGRADABILITY

METHOD: ISO 14855



DIPARTIMENTO DI SCIENZE AGRARIE

TEST REPORT: BIODEGRADABILITY OF NATURELLA®

REQUESTING COMPANY:

SANTORI PELLAMI s.p.a. VIA FRANCIA 1/A 63811 MONTE URANO (FM)

PRINCIPAL INVESTIGATOR:

Cesare Accinelli, Laboratory A60 - Dipartimento Scienze Agrarie (Alma Mater Studiorum - Università di Bologna) - Department of Agricultural Sciences (Alma Mater Studiorum - University of Bologna)

SAMPLE ID: Leather Sample 1 (Sample A)

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

Leather Sample 1 (Sample A): powder

Leather Sample 1 (Sample A): disks (8.5-cm diameter)

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:

$$D_t = \frac{(\text{CO}_2)_T - (\text{CO}_2)_B}{\text{ThCO}_2} \times 100 \%$$

(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 | 96.3 | 97.4 | 99.1 | 97.6 |
| Sample A | 78.3 | 75.4 | 77.9 | 77.2 |
| Sample B | 75.3 | 76.1 | 77.0 | 76.1 |

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 showed a biodegradability of 77.2. Similar values were also observed by incubating disks of the same leather samples, with an average value of 76.1%. On the basis of these results, the two leather samples can be considered as biodegradable.

Bologna, September 26th 2017
Dr Cesare Accinelli, PhD





DIPARTIMENTO DI SCIENZE AGRARIE

TEST REPORT: BIODEGRADABILITY OF CLASSIC LEATHER

REQUESTING COMPANY:

SANTORI PELLAMI s.p.a. VIA FRANCIA 1/A 63811 MONTE URANO (FM)

PRINCIPAL INVESTIGATOR:

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

SAMPLE ID: Sample A-2019-Santori

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-2019-Santori: 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 (%)

$$D_t = \frac{(\text{CO}_2)_T - (\text{CO}_2)_B}{\text{ThCO}_2} \times 100 \%$$

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 | 97.1 | 98.3 | 94.8 | 96.1 |
| A-2019-Santori | 10.2 | 7.4 | 8.9 | 8.8 |

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 A-2019-Santori showed a biodegradability of 13.3%.

Bologna, September 13th, 2019

Prof. Cesare Accinelli



#3 BIODEGRADABILITY

METHOD: ISO 20136



TEST REPORT: BIODEGRADABILITY TESTS ON A SAMPLE OF NATURELLA® COW

NATURELLA COW

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.

| TIME | NATURELLA COW |
|------|----------------------|
| DAY | BIODEGRADABILITY (%) |
| 0 | 0,0 |
| 7 | 12,0 |
| 14 | 33,6 |
| 21 | 43,8 |
| 28 | 52,7 |
| 35 | 69,6 |
| 42 | 72,8 |

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

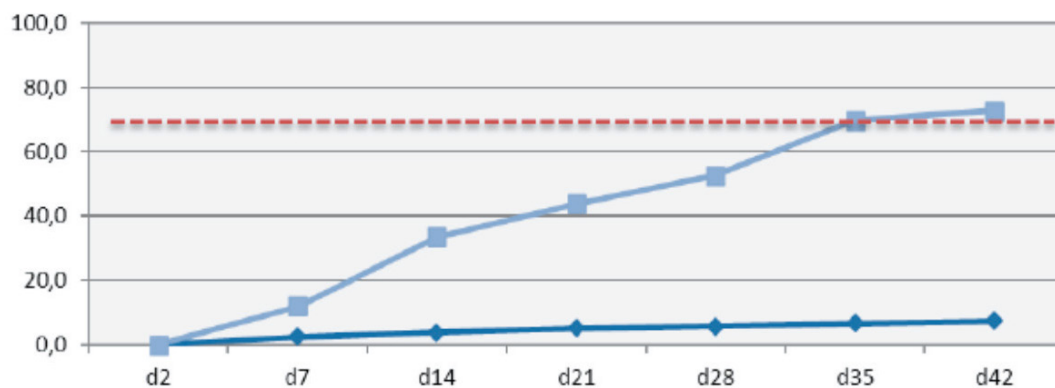


Figure 1. Graph of the Biodegradability of the NATURELLA COW sample and of the Negative Sample

For the sample under examination, the graph highlights the achievement of a plateau phase on day 42, corresponding to a biodegradability percentage of 72,8%.

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 | % | 72,8 |
| Relative Biodegradability | ISO 20136:2017 | % | 85,3 |

Based on the above data, the sample called NATURELLA COW has a relative biodegradability of 85,3% after 42 days and therefore can be considered as BIODEGRADABLE UNDER AEROBIC CONDITIONS according to the ISO 20136: 2017 method.

#4 ENVIRONMENTAL FOOTPRINT PROFILE



POLITECNICO
MILANO 1863



CMIC

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

OBJECTIVE OF THE STUDY

Santori Pellami has evaluated the environmental profile of its metal-free biodegradable leather Naturella® (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.

Naturella® 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 Naturella® 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 Naturella® is performed.

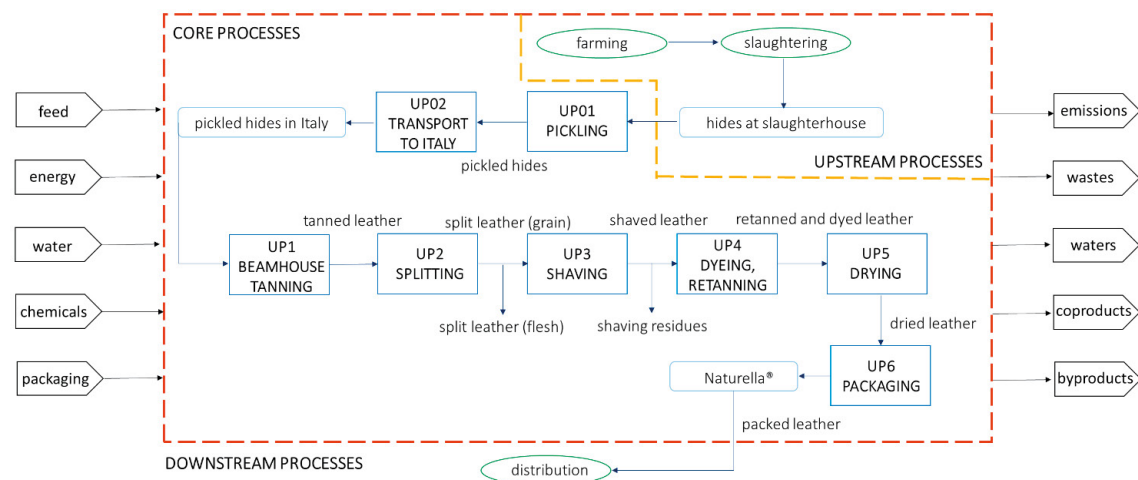


Figure 1 - System boundary for the production of Naturella® with the main unit processes

RESULTS

Following the PEF guidelines, the environmental impact of 1 square metre of Naturella® 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 Naturella®, 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.

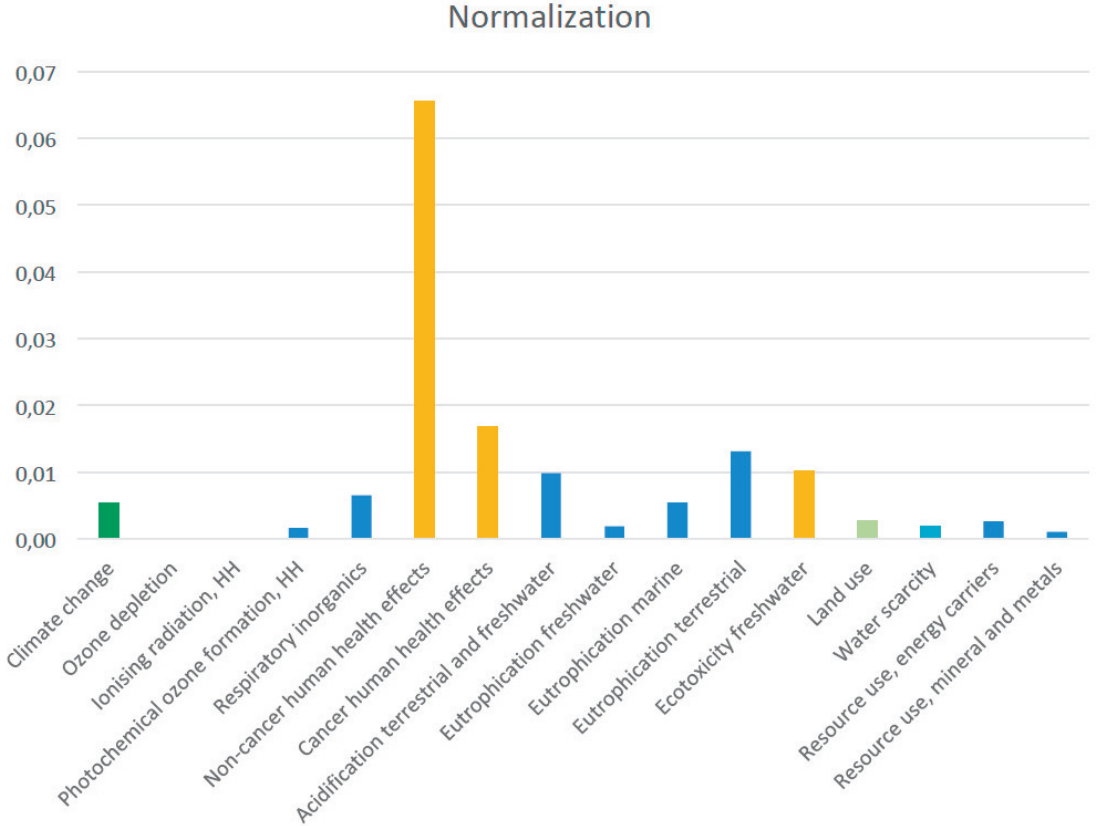


Figure 3 - Results of the PEF-compliant normalization step

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 Naturella®.

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

Santori Pellami 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).

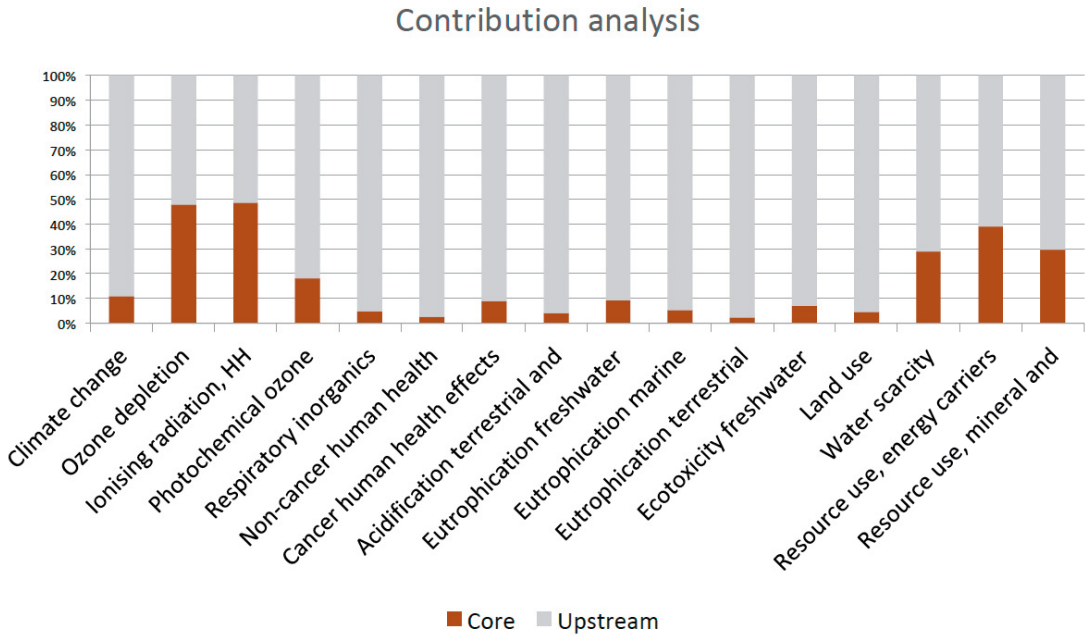


Figure 4 - Results of the PEF-compliant contribution analysis

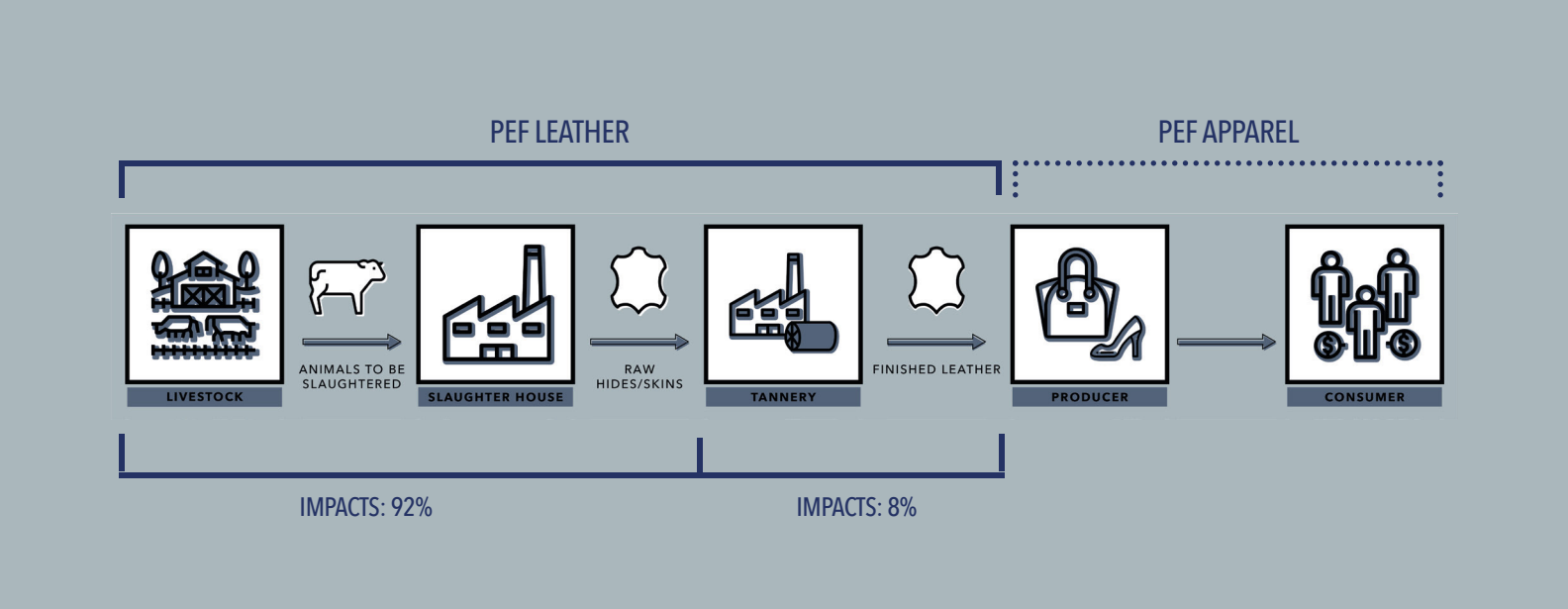


Figure 5- Results of the PEF-compliant: impacts on core and upstream

#5

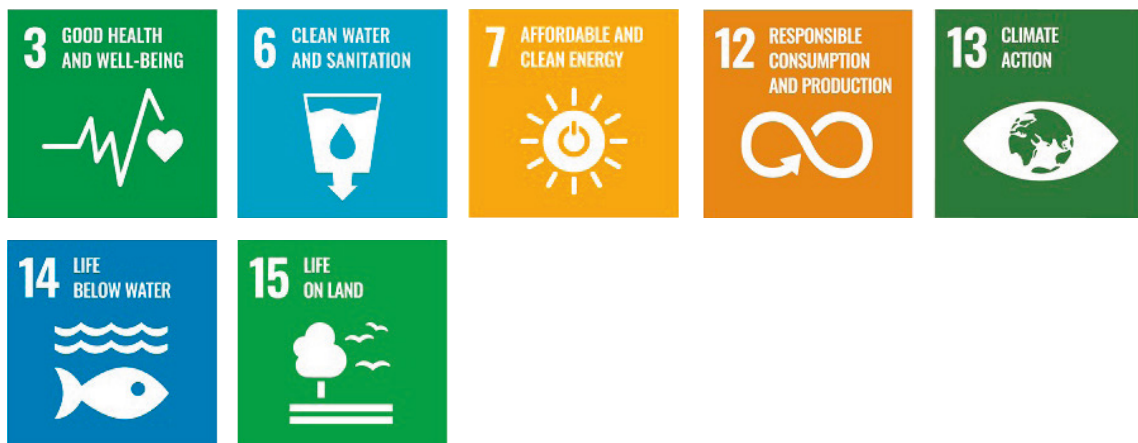
OUR SUSTAINABLE DEVELOPMENT GOALS

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.

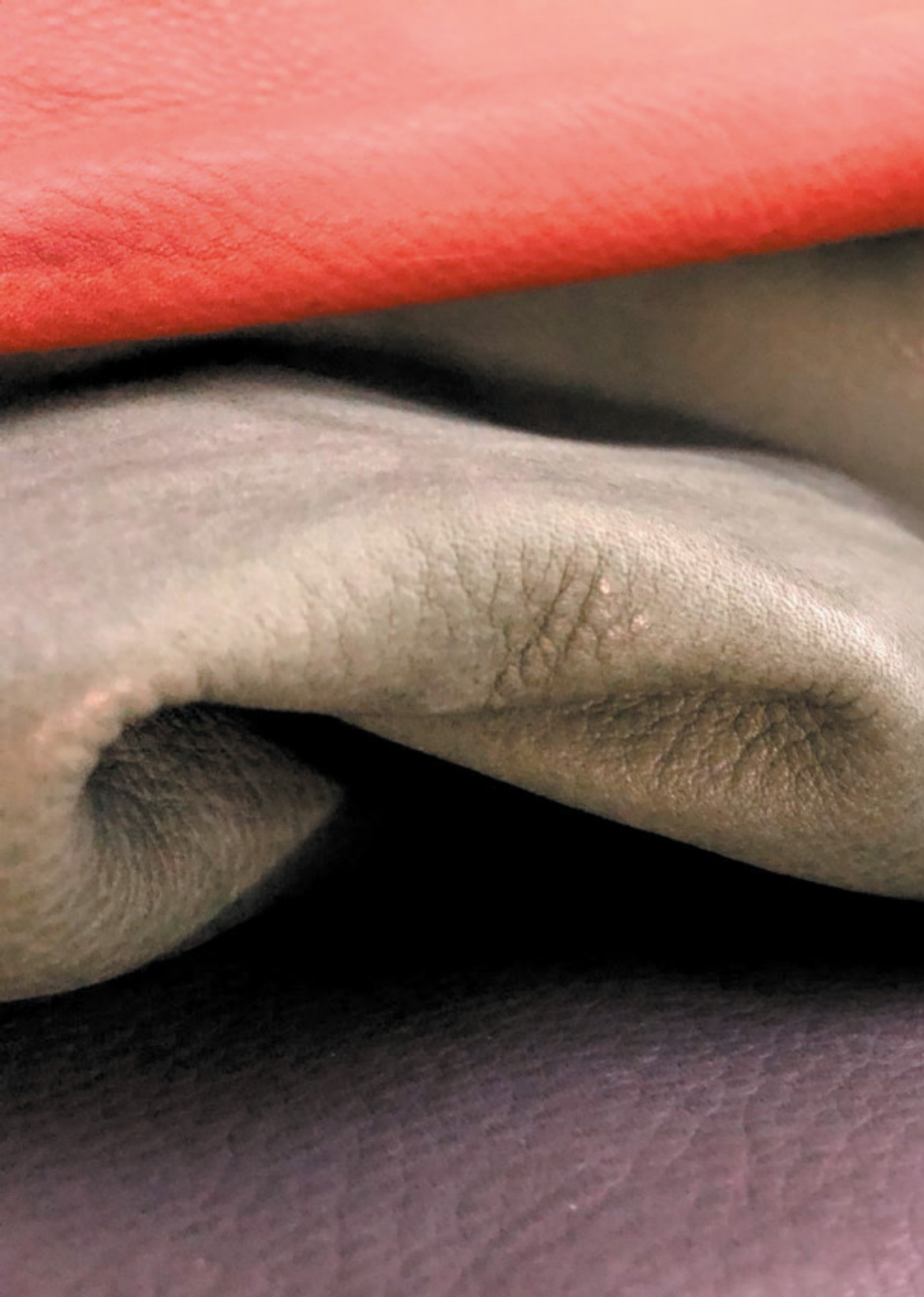
The Sustainable Development Goals are vital for a recovery that leads to greener, more inclusive economies, and stronger, more resilient societies.



We are committed to achieve the following Sustainable Development Goals:











SANTORI
P E L L A M I

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