Leather as Bio-based material in an EN 16848 standard context

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ABSTRACT

Greenwashing is unfortunately a very diffused practice in many sectors of commerce.
Towards the Green Deal, Europe is setting out a commitment to tackle false environmental claims by ensuring that buyers receive reliable, comparable and verifiable information reducing the risk of 'greenwashing'.
In the document "Proposal for a Directive of the European Parliament and of the Council on substantiation and communication of explicit environmental claims (Green Claims Directive)" [i], we can read that preliminary studies commissioned showed that "a considerable share of environmental claims (53.3%) provide vague, misleading or unfounded information about products' environmental characteristics across the EU and a wide range of product categories", and that "out of the 344 sustainability claims assessed, authorities considered that in over half of the cases (57.5%), the trader did not provide sufficient elements allowing for judgement of the claim's accuracy".
In my past presentations, I have shown the importance of leather's bio-based content in ensuring intrinsic circularity, which is an important parameter to consider in a wider sustainability parameters framework. CEN TC 411 commission is working on new European standards supporting Carbon Neutrality ambition and ensuring clear comparable communication. Among these standards EN 16848[ii] sets the basis for a transparent Business-to-Business communication, supporting producers to develop future articles following eco-design guidelines.
Our paper shows an example of EN 16848 communication of a leather material considering the mandatory information requested by this standard.

Keywords: Bio-based, standards, communication.

1. Introduction

Global warming and natural resources depletion led the United Nations to define the Sustainable Development Goals Statement "blueprint to achieve a better and more sustainable future" and the European Commission to promote the "bioeconomy" concept and to launch the Green Deal Policy. Accordingly, the COP26 conference proposed a drastic reduction of fossil-based fuels and materials, in favour of bio-based materials which should ensure intrinsic carbon neutrality.

If we consider sustainability in a cradle-to-cradle optic, it is fundamental to divide the environmental impact calculation in a series of circular events with the material to be analysed as the main reference. In this context, the intrinsic contribution of an organic material gains importance as support to understand the contribution of renewable/non-renewable carbon sources. Clearly this is not the only parameter to consider. Industrial production of materials involves energy consumption, transport, chemical intermediates, solvents, waste and water treatment, etc., all events which must be precisely measured to understand the overall impact to attribute it.[iii] It is important to clarify that dividing the sustainable / circular process into a series of sustainable/circular events is essential to avoid unwanted impacts compensation, allowing to choose the material with the most virtuous credentials in terms of circularity and end-of life management.

Leather sector is under siege since the past decade by many startups and established materials suppliers proposing new trendy materials claiming sustainability advantages but, as we have demonstrated in many publications, without robust scientific backing, and in most cases pointing to a single slogan distracting the consumer from the essence itself of the "innovation" proposed. The need for transparency in terms of circularity led the European Commission to define a series of policies to promote transparency in sustainability claims and anti-greenwashing tools. The European Commission requested CEN TC 411 to develop the European Standards that will be described in this paper.

2. Linear vs circular models

Since the industrial revolution coal and petrol had an increasingly use in heating, vapour power, internal combustion engines, electricity production and thus transportation, and during the XX Century, with the dawn of petrochemical industry and polymer science evolution, for the production of different plastic materials, from the Bakelite to the state of art resins, and the high stability perfluorinated polymers. From the traditional, circular, and natural materials such as Leather, Cotton, Wool, Hemp, Sisal, etc, the industry moved to the faster and cheaper production of synthetic fibres, coated textiles, elasticised materials, not only in apparel sectors, but for every single consumption good, including packaging.

Leather was also touched by this trend, reducing the months' production of traditional vegetable tanned articles, to the few weeks, thanks not only of Chromium tannage, but also because of the introduction of "replacement" syntans (word used to assert that they could replace vegetable extracts), synthetic resins and fatliquors, binders, dispersants, degreasing agents, beamhouse auxiliaries, acids, solvents, dyes… all products that enhanced a relatively fast production, at the same time supporting leather industry to deliver high fashionable articles. This scalation of the depletion of mineral resources came along not without heavy environmental consequences: Persistent plastics dispersed in the environment creating plastic islands in the oceans as first impressive view but disseminating micro and nano plastics all over the planet, less visible but far more insidious for live beings.

Considering materials in a cradle-to-grave perspective and their environmental fate, we must ponder two possible scenarios; either fossil carbon can be naturally degraded or eventually incinerated to its minimal form (CO_2), thus altering the natural abundance in the atmosphere, or if this is not feasible, then persisting as macro, micro and nanoplastics, or as POPs (Persistent Organic Products), the so called "forever chemicals". In synthesis the clue is to step back from the fossil-based chemicals, "replacing the replacement" products with natural origin ones. Petroleum was natural carbon millions of years ago so it belongs to a past natural equilibrium.

The alternative is to move from linear to circular models aiming to the goal of the carbon neutrality and considering case by case the best end-of-life options allowing to avoid any recalcitrant or persistent chemicals or materials residues.

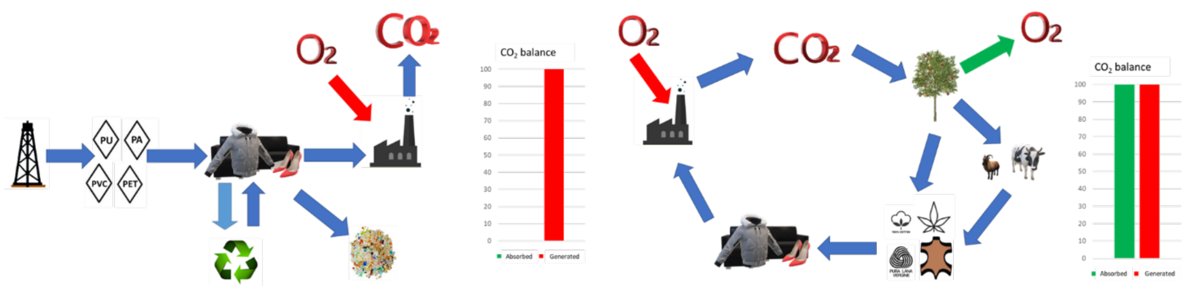

Figure 1 – Linear vs circular model of materials production.

Figure 1 describes a 100% linear versus a 100% circular model (which is utopic in common materials). Apart of the typical fossil based polymeric materials which carbon which we can define as totally fossil, the state-of-art materials, including leather are hybrids, with a crescent bio-based carbon content, depending on the process applied. For this reason, the quantification on bio-based carbon content thru radiocarbon gained relevance as mean to understand the fossil/renewable carbon content in any organic material.

A complete description of the quantification method towards radiocarbon analysis and the bio-based content of the most popular so called "leather alternatives" is described in the paper "Material Circularity: A Novel Method for Biobased Carbon Quantification of Leather, Artificial Leather, and Trendy Alternatives" (Carcione, Bartalini, Defeo, et al 2023). In the tests performed so far, leather has the highest bio-based content, especially if produced with traditional tannages and light finishes.

Considering this fact and that sustainable circular materials should ideally leave no traces upon end-of-life management, is that leather and leather waste should be a resource to achieve useful byproducts, achieving the most virtuous results. And once we have achieved this scope being able to communicate it clearly.

3. European standards supporting green claims transparency.

CEN/TC 411 is the Technical Committee on Bio-based products under the European Committee for Standardization (CEN), created in May 2011 in response to mandates from the European Commission with the scope to support the development of a sustainable bioeconomy.

The primary purpose of Technical Committee CEN/TC 411 is to develop standards for bio-based products covering horizontal aspects, including terminology, sampling, bio-based and biomass content, sustainability criteria, and transparency in communication of sustainability characteristics.

The adoption of CEN TC 411 standards allows to manage a complete set of information regarding the sustainability and circularity in a prospective of the transparent communication of the sustainability and circularity claims, and even more, allowing to compare the performances of varied materials.

The most relevant standards useful for apparel sector and related industries are the following:

- EN 16575 - Bio-based products — Vocabulary
- EN 16640 – Bio-based products — Determination of the bio-based carbon content of products using the radiocarbon method.
- EN 16785-1 - Bio-based products — Bio-based content — Part 1: Determination of the bio-based content using the radiocarbon analysis and elemental analysis.
- EN 16785-2 - Bio-based products — Bio-based content — Part 2: Determination of the bio-based content using the material balance method.
- EN 16751 - Bio-based products — Sustainability criteria (This standard sets horizontal sustainability basis applicable to all bio-based products excluding food. It considers environmental, social, and economic criteria for bio-based products)
- EN 16848 – Requirements for Business-to-Business communication of characteristics using a Data Sheet
- EN 16935 – Requirements for Business-to-Consumer communication and claims

4. Information required in EN 16848 for sustainable performance communication.

In this section I will describe the minimum information required by EN 16848 for sustainable performance communication and claims.

Biomass type - The first requirement is to define the origin of the biomass, stating its origin from animals, plants, trees, algae, marine organisms, microorganisms, or others.

Biomass origin: This information regards the geographic origin of the biomass and linked to the traceability of the material.

Bio-based content – Requested to analyse the minimum verifiable bio-based carbon in relation to the total carbon (EN 16640), and the minimum verifiable biomass in relation to the total mass of the product (EN 16785-1/2) The first regards the proportion of circular carbon, the second the biomass content considering the biogenesis elements (C H N O S).

Biomass sustainability – Regards the sustainability criteria as per EN 16751. This point considers the land usage, water resources consumption for the relevant components of the biomass, for example if the biomass is a product or a byproduct, land and water use, socio-economic impact of its production.

End-of-life options – Regarding the waste management of the material upon end of life, we should consider the individual impact that each waste generates.

Additional information – Other environmental certificates and eventually LCA, remain at the end of the declaration. The reason is not casual, but to prioritise the use of biomaterials, to ensure the choice of those with virtuous end-of-life management and finally calculating its Carbon footprint.

5. Example of a EN 16848 datasheet

The first part of the "Data Sheet for Business to Business declaration for bio-based products according to EN 16848" contains the Bio-based product identification, with information of the name of the product or article, producer or supplier of the material with address and other relevant contacts, the intended use for the material, and the type of biomass. Following the minimum content of the biomass (in the case of study, which is a Veg tanned leather, we must consider the minimum content of the significant biomasses involved in the production of the material.

Considering the example where three distinct biomass sources are combined in percentage level we may define them as Animal origin: Bovine hides farmed and slaughtered in Normandie, France / Vegetable extract Quebracho (Schinopsis balancae) from Chaco region, Argentina and Chestnut (Castanea sativa) from Piemonte, Italy.

Following the minimum verifiable bio-based carbon in relation to the total carbon expressed in percentage (analysed with EN 16640), and the Bio-based content (analysed with EN

Data Sheet for Business to Business declaration for bio-based products according to EN 16848		
BIO-BASED PRODUCT IDENTIFICATION		
Product name (s)	Vacchetta X	
Supplier name and contact for further information	XY Tannery Address / contacts	
Intended use	Apparel material	
Biomass type (s) -	Bovine hides Vegetable tanned	
Biomass origin (s) -	> 55% Bovine hides farmed and slaughthered in Normandie, France	
	>27 % Extract from Quebracho tree - *Schinopsis balancae* from Chaco region, Argentina	
	> 8% Extract of Chestnut tree - *Castanea sativa* from Piemonte, Italy	
BIO-BASED CARBON CONTENT		
Minimum verifiable bio-based carbon in relation to the total carbon (%)	> 92%	EN 16640
BIO-BASED CONTENT		
Minimum verifiable biomass in relation to the total mass of the product	> 95%	EN16785-1
BIOMASS SUSTAINABILITY		
Information on aspects of biomass sustainability	Biomass fraction:	> 55 % Bovine hides from regenerative farming, byproduct of beef industry
	Standard / certification system:	EN 16751
	Biomass fraction:	> 27 % Quebracho extract produced with sustainable practises
	Standard / certification system:	EN 16751
	Biomass fraction:	> 8 % Chestnut extract produced with sustainable practises
	Standard / certification system:	PEFC
END OF LIFE OPTIONS		
Material recycling	Not relevant	
Organic Recycling - Industrial compostability	Environment	Microrganisms in aerobic conditions
	Compostability	100%
	Standard:	ISO 20200
	Test duration:	32 days
	Phytotoxicity test:	Pass
	Ecotoxicity tests	OECD 208:2006
	Verify local regulations and authorised Composting facilities.	
Organic Recycling - fertilizer Reg.(EU) 2019/1009)	Test result:	Pass
	Verify feasibility with authorised local fertilisers producers	
Energy recovery	Calorific value - ISO 17225-1	22,3 Mj/kg
	Renewable energy -	> 95 %
		1757,8 g CO_2/kg
		264 g NO_2/kg
Biodegradability characteristics for products used in nature	Environment	Microrganisms in aerobic conditions
	Biodegradation	> 70%
	Standard:	ISO 20136:2017
	Test duration:	6 months
Managed disposal	Disposal charcteristics	To be defined
Additional information	Ecoleather standard - UNI 11427	Certified
	LCA	To be defined
	ISSUED BY:.......................................IN COMPLIANCE WITH EN 16848.	
	DATE:...	

Figure 2 - EN 16848 datasheet

16784-1 or EN 16785-2), in the example: 92% bio-based carbon (EN 16640) / 95% biomass content (EN16785-1).

Later, the Biomass sustainability (according to EN 16751) is based in the verification of the socio-economic impact of the production of the biomasses declared. In the case the Leather, is always a byproduct from beef industry, produced under certified good farming practises. Quebracho extract produced in Chaco province, Argentina following good forest management practises, and Chestnut extract from Piemonte, Italy with a PEFC certification.

The end-of-life options allows to communicate the best way to manage the production scrap, trimmings, splits residues from the production, as well as propaedeutic for eco-design. At this point, the higher variety of end-of-life options the more versatile the material will be in an eco-design context.

We should verify which end-of life options we can apply and declare them in the data sheet:

Material recycling: few possibilities allow to recycle leather apart of bonded leathers which are objectionable at the point of considering their end-of life options.

Organic recycling: Several end-of life options can be included in this category, such as compost, fertilizers, biostimulants, biochar and biogas production.

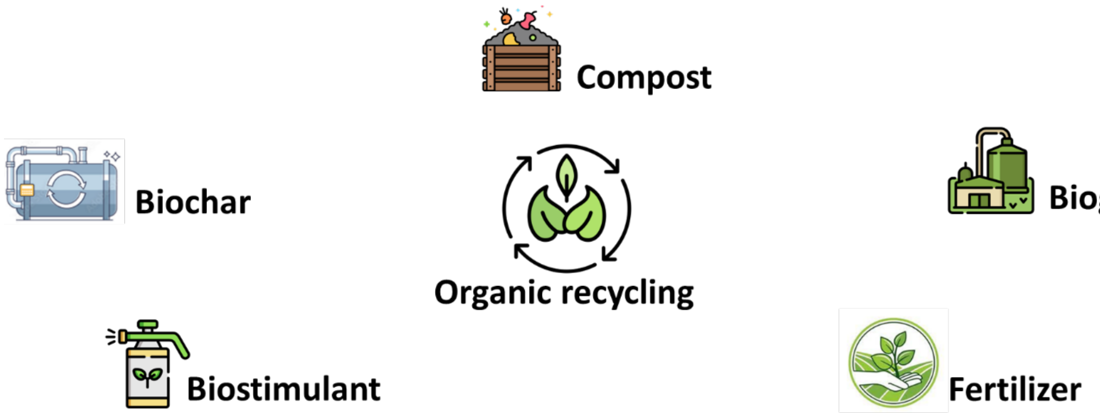

Figure 3 – Organic recycling-related end-of-life options

Each of these options are linked to a series of analysis related to the use scenario after conversion. For example, to transform leather into fertilizer we must ensure that analytically the leather waste complies with the Reg. (EU) 2019/1009)[iv], while for compost after verifying its compostability with EN 20200[v] the resulting compost should pass the OECD 208:2006[vi] test or equivalent.

When the finishing is thick the methods described may be not viable, due to the potential microplastics release, in which case the option is to verify is the transformation into biochar by pyrolysis or eventual incineration.

For incineration (and energy recovery) we should quote the calorific value of the material (in MJ/Kg) the % of renewable energy (based in the biomass proportion), and clearly the Greenhouse gasses (GHG) emissions that this process will produce.

We should also consider biodegradability characteristics upon eventual dispersion in the environment, and finally managed disposal options according to FprCEN/TR 16957.[vii]

6. EN16848 in an eco-design context

The current trend is pointing to mono-material as eco-design with the hope of recycling upon end-of-life, without considering that this practise is limited to the quality and cleanliness of the materials to treat, and that micro and nano plastics proportions emitted by recycled materials increase with recycling cycles.

Conceptually the eco-designer has two options: either searching materials and auxiliaries sharing the same end-of-life, in which case the composite obtained will inherit the end-of-life options of the startup materials or applying a design to disassembly concept into fractions with end-of-life options in common, considering the eventual disassembly option, and after this defining with the sustainability team the EN 16935 (Requirements for Business-to-Consumer communication and claims) data sheet for the products' end-of-life options for the good's datasheet.

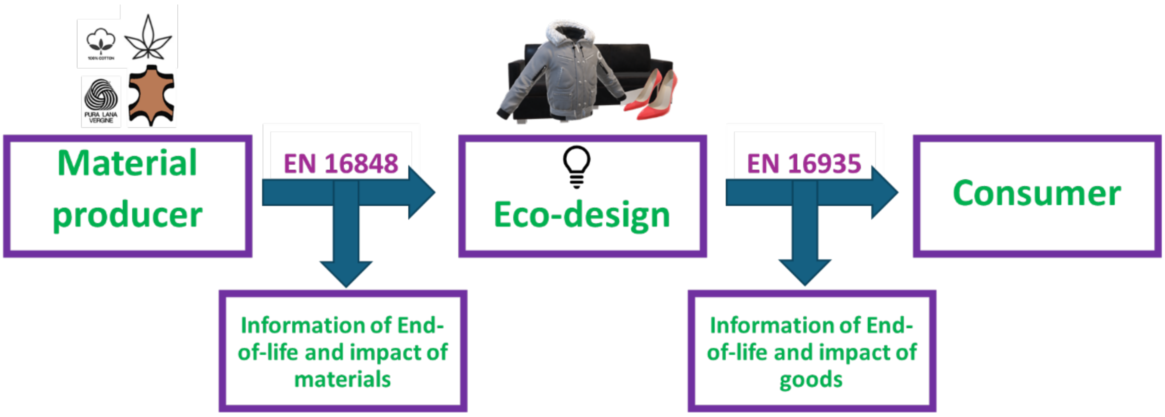

Figure 4 – Applying EN 16848 as basic information in an Eco-design context and as vital information for EN 16935 application

7. Conclusion

EN16848 data sheet is a useful tool to manage the relevant information of sustainability that we can use for claims and communication. With a set of mandatory information, the data to communicate is specific, scientifically backed limiting the possibility of green washing. The fixed set of information allows to compare easily the significant data supporting the eco-design in the study of lower impact goods. The end-of-life information allows to study goods which should leave no traces after waste management.

8. References

[i] European Commission - Proposal for a Directive of the European Parliament and of the Council on substantiation and communication of explicit environmental claims (Green Claims Directive) – CELEX:52023PC0166 (2023)

[ii] CEN TC 411 – EN 16848:2017 - Bio-based products – Requirements for Business to Business communication of characteristics using a Data Sheet – 2017

[iii] Carcione,F. et Al. - Material Circularity: A Novel Method for Biobased Carbon Quantification of Leather, Artificial Leather, and Trendy Alternatives. Coatings 2023, 13(5), 892

[iv] Regulation (EU) 2019/1009 of the European Parliament and of the Council of 5 June 2019 laying down rules on the making available on the market of EU fertilising products and amending Regulations (EC) No 1069/2009 and (EC) No 1107/2009 and repealing Regulation (EC) No 2003/2003 – 2019

[v] ISO Standard ISO 20200:2023 - Plastics — Determination of the degree of disintegration of plastic materials under composting conditions in a laboratory-scale test - 2023

[vi] OECD Test No. 208: Terrestrial Plant Test: Seedling Emergence and Seedling Growth Test – 2006.

[vii] CEN Standard: PD CEN/TR 16957:2016 - Bio-based products. Guidelines for Life Cycle Inventory (LCI) for the End-of-life phase