



Cutting CO2 with natural fibers

Climate smart plastics — helping reduce your Scope 3 carbon footprint by at least 40%, often up to 90%



Show your fibers

How do you show consumers fields, climates, oceans, and ecosystems when they make a purchase? With as much as 35% of its content from the natural fibers of plants like hemp and trees, Trifilon's unique look and feel can communicate why it's a more sustainable choice.

Organic look

Trifilon's biocomposites look different than compounds filled with mineral powders or short fibers from wood. Designers like the variety and speckling of our visible bast fibers, some of which are as long as three millimeters. That look also signals the technology behind it, which allows the fibers to add strength and stiffness. Our own treatment technology means the fibers have a more uniform, brighter color than other darker, dirtier biocomposites. Because it looks original, many designers like our biocomposites undressed.

Surface Finish

Trifilon's materials accommodate high polishes even for grades with the most bio-content. They hold a number of patterns and textures such as those achieved with EDM.



Coloring & Fiber Visibility

Our materials achieve most colors you can think of and work with standard master-batch pigments. In darker tones though, our larger bast fibers will become less visible. All our standard grades are delivered uncolored giving brand owners the freedom to color as they wish.

Optics

Our materials can be opaque when colored. They can be translucent at thickness below one millimeter. They achieve a slight gloss on a highly polished surface even with higher fiber content.



Garden chairs by Very Good & Proper

Haptics

Our plant fibers make slightly stiffer and stronger materials than pure plastics. But biocomposites feel warmer because of improved insulation properties and feel less oily or slippery and more like paper or wood.

Odor

Our biocomposites have negligible smell and odors at room temperature and smell less than conventional wood-based biocomposites.

Processing

Trifilon delivers its biocomposites to manufacturers in 20 kg sacks and 1.000 kg big bags of granulates that can be used in standard injection molding machines.



Axkid Envirobaby infant car seat

Meet our three material families

Trifilon's materials are unique and have different design characteristics. The look and feel of a final product is affected by the source of the base resins – polypropylene, starch-derived, or recycled plastics. It's also affected by the fiber used for reinforcement in the biocomposite. We currently use industrial hemp bast fiber and specially refined cellulose from European forests in proprietary blends to maximize performance and sustainability. Our fiber treatment means our materials achieve much lighter colors than other biocomposites, which gives designers greater freedom to color their products.

EPIC Travelgear

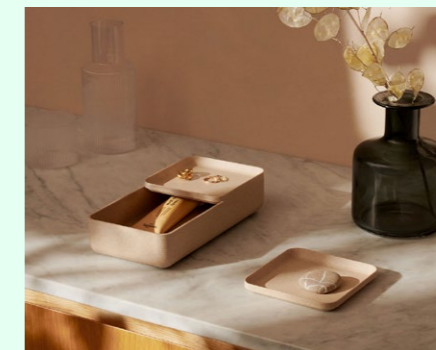
EPIC Travelgear used Trifilon BioLite to form the Phantom BIO suitcase. Some models featured solid darker colors, while others showed off the natural fibers using lighter tones. The suitcase shell surface incorporated a number of finishes and patterns, from blank, highly polished sections, to rougher, more coarse patterns.



Lyft snus containers



orga.nicer



Silwa Headlamp



Trifilon BioLite

Mixes food safe polypropylene with up to 35% natural fibers from sustainable European farms and forests to improve mechanical properties and enables a lower CO2 footprint. Trifilon's BioLite grades are highly versatile and suited for food contact and child safe products. Specialty packaging, thin-wall goods and products that demand relatively high impact work well with BioLite. From a sustainability perspective, the natural fibers in BioLite enable a CO2 footprint reduction of up to 60% compared to conventional polypropylene.

By integrating BioLite in their product, brand owners can make an immediate impact on the CO2 related to their product. Designers appreciate Trifilon's fiber processing technology as it allows for greater coloring freedom, including lighter colors, compared to early generations of wood filled plastics. BioLite can be colored using standard masterbatches and it achieves a number of surface finishes, matte or polished.

Products and Application Areas:

Food packaging, tobacco canisters, cups, cosmetic jars, toys, child seats, suitcases.

Trifilon Switch

Trifilon Switch® offers designers a sustainable choice that works just like regular plastic for a variety of applications. It makes for an easy choice for those eco-minded visionaries who want to integrate more bio-based materials into their products. Because of the strength of the natural fibers and Trifilon's fiber processing technology, Switch has excellent mechanical qualities and can replace pure-fossil plastics.

Unlike other bio-fiber reinforced materials, Switch is relatively easy to injection mold, even in thin-walled goods. As all of Switch's main ingredients are derived from renewable feedstocks, it enables a CO2 footprint reduction of up to 70% compared to conventional plastics like ABS. By integrating Switch in their product, brand owners can most often achieve both a reduction in their overall CO2 footprint and promote the use of more renewable, non-fossil based plastics.

Products and Application Areas:

Storage boxes, phone cases, garden pegs, secondary packaging, umbrella parts.

Trifilon Revo

Combining recycled polypropylene with plant fibers, Trifilon Revo is our lowest CO2 footprint material family. We understand that consistent quality is important to brand owners and their injection molding partners, so that's why we only source our recycled polymers from Europe, ensuring that they meet stringent EU regulatory requirements. And because both hemp and wood cellulose sequester carbon (takes carbon from the air to form its cells during growth), the total carbon calculations when using Trifilon Revo are even better than typical recycled plastic.

Unlike most other recycled plastics, Revo doesn't just come in black or dark grey, but can be colored using standard masterbatches and it even achieves lighter colors and tones.

Products and Application Areas:

Chairs & stools, outdoor gear, headlamps, suitcases, trays, storage boxes.

Life cycle

Trifilon evaluates the footprint of 1 kg of its materials using a number of impact categories to give you a solid basis for evaluating its sustainability merits in your application. Read here about why we think our biocomposites represent the best sustainable option for many products on the market.

Production Phase

Buying organic material from responsibly managed farms and forests in Northern Europe means Trifilon achieves drastic and immediate CO2 savings for many production processes. Trifilon strives to develop new feedstocks closer to home in the Nordics and to develop relationships and technologies for using recycled plastic streams.



Axkid Envirobaby infant car seat

Our mission to create lower CO2 plastics wouldn't be possible without natural fibers like hemp and wood cellulose. Grown and harvested in a sustainable manner, both of these types of natural fibers enable the replacement of conventional plastics with a renewable form of carbon. Unlike many other agricultural feedstock crops, the hemp fibers we incorporate are grown as a rotational crop and do not compete with food. And the cellulose we incorporate into our materials comes from northern European forests that support and encourage the preservation of diverse natural biomes.

Use Phase

Quality – Our fiber treatment technology makes some of the best biocomposites on the market. They produce higher-quality products whose durability lowers consumer impact. It also means quality-oriented brands can consider greener options immediately.

Toxicity – Switching to a lower CO2 material shouldn't have toxic trade-offs. From the initial engineering of our formulations, we always ensure that no persistent chemicals or hormone disrupting molecules are used in our biocomposites. All our materials are compliant with the latest EU health regulations and where applicable, are child and even food contact safe.



End-of-life Phase

Landfill/incineration – Where our biocomposites would be discarded in a landfill or incinerated for energy capture, the bio-content represents an improvement over pure fossil-derived plastics.

Recycling – While biocomposite materials like Trifilon's can be re-extruded and re-granulated under the right conditions, there are no recycling schemes in place today to handle our materials. This is mainly due to a lack of sorting technology and a secondary market for recycled biocomposites. Today nearly all bioplastics/biocomposites instead go to landfill or are burned in waste-to-power facilities.



Phone cases made with Trifilon Switch



Chair by Very Good & Proper



Future possibilities

Both chemical and mechanical recycling of biocomposites are possible in the future, but it is unclear if large-scale systems will be fully deployed in 3 years or 10 years. With this uncertainty in mind, we always recommend product designers to reduce the amount of material and focus on the long-term durability of products. Better yet, design for disassembly and reuse in a closed-loop and consider if a take-back scheme could be possible. For the moment, recycling is not a legal requirement in most countries. Some economies though, like the EU, are pushing hard toward ambitious targets. For instance in the EU, 55% of all plastic should be recycled by 2030.

Our materials

- ✓ Help mitigate climate change
- ✓ Utilize CO2 sequestering natural fibers
- ✓ Don't compete with food production
- ✓ No hazardous or toxic substances
- ✓ Promote biodiversity, sustainable farming and silviculture

Cake Anti-Poaching Motorbike



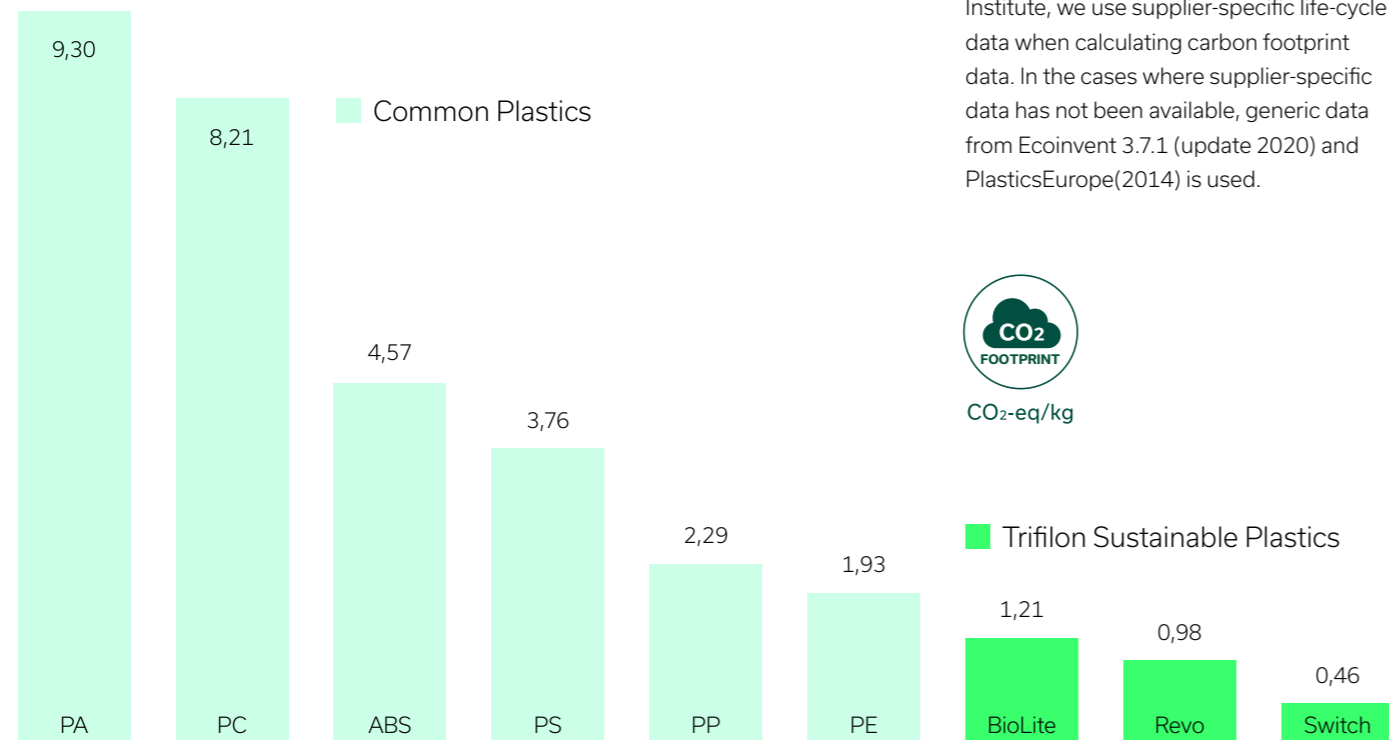
Carbon footprint: Methodology

We appreciate that people want to make a difference and lower their CO2 impact, especially in the goods that they buy on a daily basis. To ensure that we give the most accurate account, we follow an applied carbon footprint methodology that is consistent with ISO 14040/44:2006. Working together with the Swedish Environmental Institute, we use supplier-specific life-cycle data when calculating carbon footprint data. In the cases where supplier-specific data has not been available, generic data from Ecoinvent 3.7.1 (update 2020) and PlasticsEurope(2014) is used.



CO₂-eq/kg

Carbon Footprint Comparison

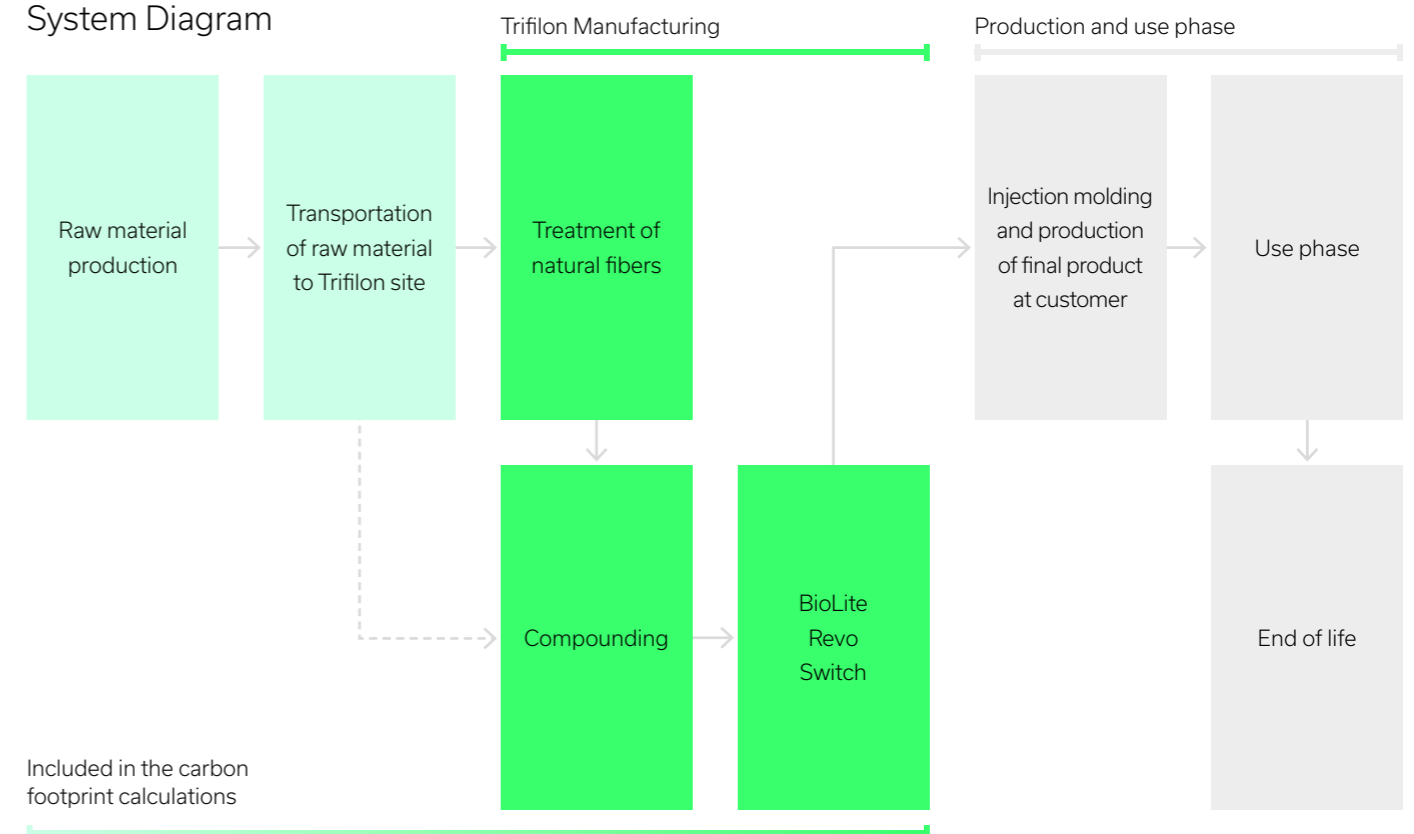


Trifilon factory in Nyköping, Sweden.

System Boundary

The scope of our CO₂ method covers cradle-to-factory gate and includes the following lifecycle stages: raw material production, transportation of raw material and manufacturing.

System Diagram





Elevate your brand with climate smart plastics

Sustainability is important for more and more consumers, especially millennials and Gen-Z. The look and feel of Trifilon's unique materials tell a sustainability story directly. By integrating Trifilon's materials, brand owners like Silva can showcase their sustainability ambitions and take concrete steps toward reducing their CO2 footprints.

Position your company as a sustainability leader.

In 2024, the EU's Corporate Sustainability Reporting Directive will come into force. This and other ESG reporting requirements make it critical that brand owners have facts and figures they can rely on.

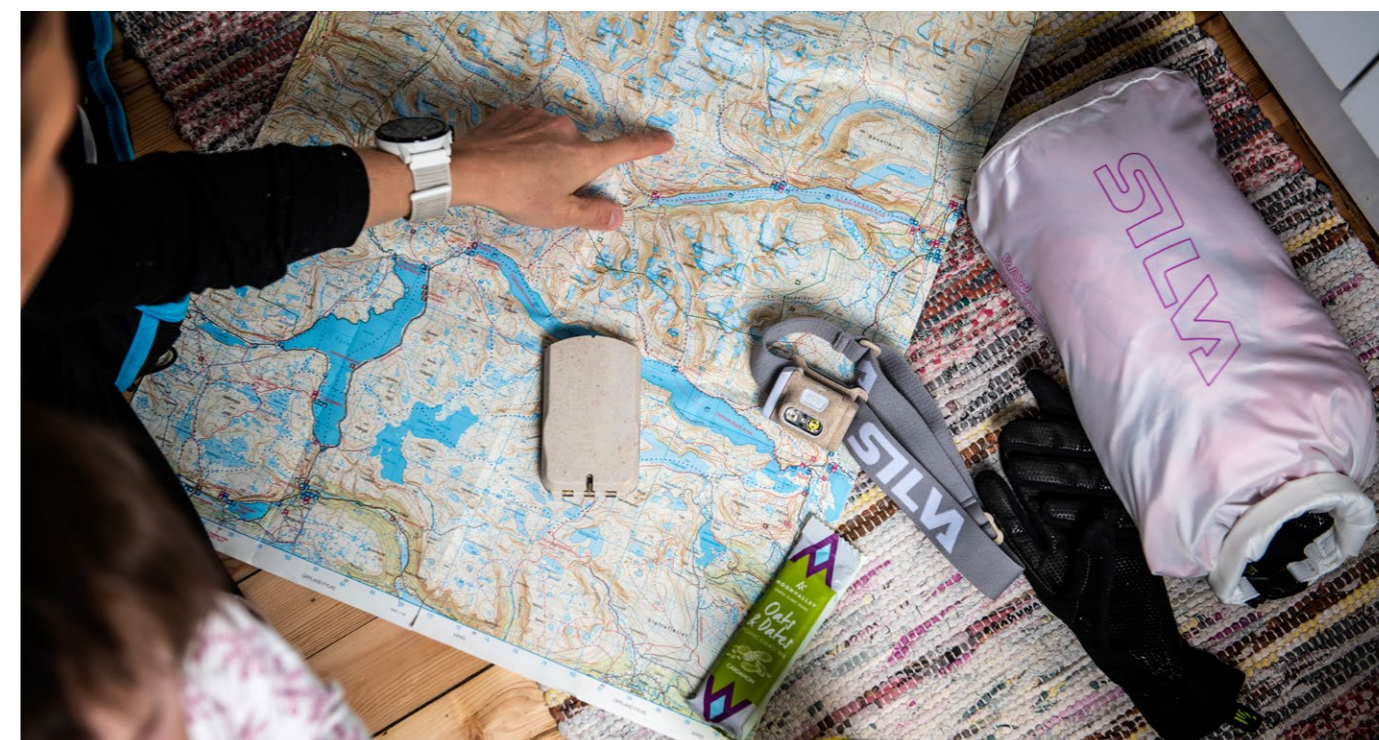
Scope 3 emissions, those related to the input materials in a product, often account for the majority of brand owners' CO2 footprints. Choosing a lower CO2 plastic like Trifilon's biocomposites is an easy way to make a significant impact in Scope 3. Trifilon is one of the few plastic providers that has 3rd party verified LCAs and EPD's available.



Launch a winning sustainable product

Based on Silva's existing Scout 3 model, the Terra Scout was launched as a light-house that quickly over delivered.

"Our idea and goal was to see if we could make this model more sustainable," explains Madelene Jonsson Öhlin, Head of Sales and Marketing. She emphasizes: "In cooperation with our material supplier Trifilon, we have redesigned and adapted the Scout 3 headlamp so that we can produce it from Revo1041. We also want to bring sustainability into the headlamp category and also challenge ourselves – embark on a journey into a better future."



Trifilon functional samples

The Trifilon Functional Sample (TFS) was specifically developed for designers and engineers to provide a physical representation of the unique aspects of Trifilon's natural fiber reinforced materials. The TFS allows product developers to see and feel a multitude of material characteristics before making a critical project decision.

Trifilon Aesthetic Swatch

The Trifilon Aesthetic Swatch (TAS) provides a tangible and practical way for designers to explore and compare different colors, surface finishes and even fiber visibility that is necessary for the creative aspects of their work.

Please visit [Trifilon.com](https://www.trifilon.com) for more info on the Aesthetic Swatches and Functional Samples



Functional Sample features

1. Surface quality:

Surface quality plays a crucial role in the aesthetics, functionality, and performance of any final product. The TFS presents 3 distinct VDI 3400 in decreasing roughness - VDI 36, 27 and 21.

2. Material fluidity:

Filling thin-walled components can be a challenge with some materials. The TFS captures this challenge in the two windows that have decreasing thickness, from 0.8 mm to 0.2 mm.

3. Creep and stress cracking:

The TFS provides a number of test points to experiment creep and stress cracking on. Push and pull to your hearts content.

4. Integral hinge:

Many products contain integrated hinges. We designed the dual hinges at the bottom of the TFS specifically for hinge assessment.

5. Screw towers:

Most products today have multiple parts and are often screwed together. The TFS has five screw towers with 3.5mm and 4.0mm diameters for thread and pull-out assessment.

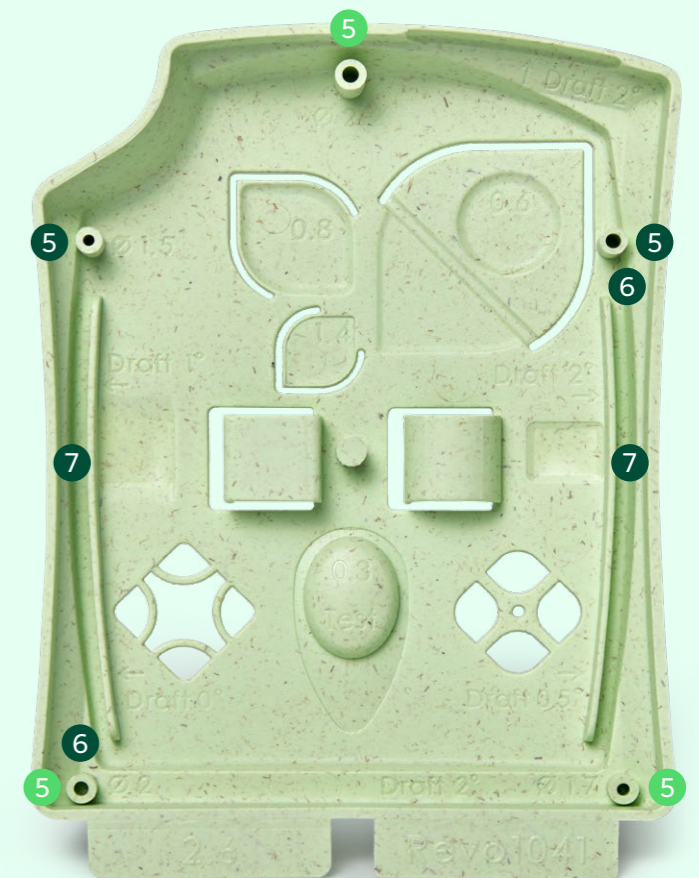
- 3.5mm diameter
- 4.0mm diameter

6. Sink marks and warpage:

The aesthetics of a beautifully designed product can be ruined by unnecessary sink marks and warpage. The TFS has two areas where sink marks and warpage can be examined and assessed.

7. Draft angle vs surface roughness:

A rougher surface finish requires more of a draft angle. To help designers better assess this interplay, the two rear ribs of the TFS are VDI 27, with the other rear surfaces have a VDI of 31.



Trifilon Technical Data

Product name	Physical Properties			Mechanical Properties									Thermal Properties						
	Density [g/cm3] ISO 1183	MFR [g/10min] ISO 1133	Shrinkage % with flow/across flow ISO 294-4	Tensile Modulus [MPa] ISO 527-2	Tensile Stress at Yield [MPa] ISO 527-2	Tensile Strain at Yield [%] ISO 527-2	Tensile Stress at Break [MPa] ISO 527-2	Tensile Strain at Break [%] ISO 527-2	Charpy Impact Strength Notched (20°C) [kJ/m2] ISO 179/1eU	Charpy Impact Strength Unnotched (20°C) [kJ/m2] ISO 1791/eU	Charpy Impact Strength Unnotched (-20°C) [kJ/m2] ISO 179/1eU	Heat Deflection Temperature (1.8 MPa) ISO 75-2/A	Heat Deflection Temperature (0.45 MPa) ISO 75-2/B	Food Migration Compliant (EU10/2011)	Toy Safe Compliant EN71-3	Visible Natural Fibers	Recycled Content	Compostable ISO 20200	
Biolite240	1.04	9	0.68 / 1.17	1400	28	10	27	14	3.2	37	—	—	—	●					
BioLite3004	0.97	11	1.26 / 1.28	1000	14	1.58	No Break	No Break	13.8	95	—	48	—		●	●			
Revo1035	1.02	8	1.33 / 1.37	990	19	15	18	27	5.2	62	20	51	90			●	●		
Revo1036	1.01	10	1.34 / 1.47	1200	22	11	21	19	4.1	75	28	56	101			●	●		
Revo1041	1.02	9	1.42 / 1.57	2720	33	5	32	6	7.4	23	15	74	133			●	●		
Revo1042	1.02	9	1.48 / 1.61	2680	34	5	33	12	1.8	32	7	74	133			●	●		
Revo1043	0.98	10	1.65 / 1.60	1400	21	9	22	12	6.7	36	—	—	—			●	●		
Revo1044	0.99	13	1.64 / 1.67	2160	28	5	29	5	4	17	—	—	—			●	●		
Switch2099	1.43	15	0.36 / 0.38	2700	35	2	32	2	2.6	15	—	—	54			●		●	



trifilon.com