Let's talk about

Biodegradability of Plastic

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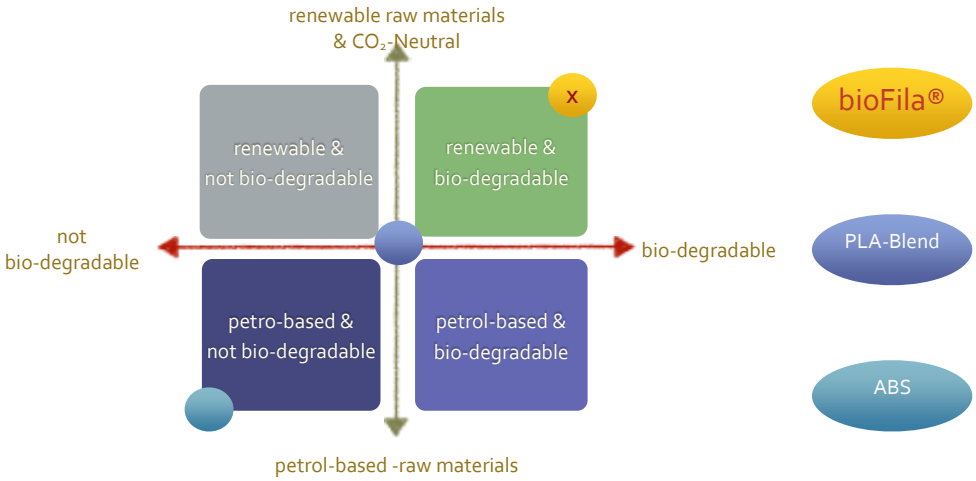
GENERAL INFORMATION

bioFila® are compounds made of biopolymers and optimized for 3D printing. They are also usable for extrusion and molding.
Newest informationare available on our homepage: http://www.two-bears.eu, section data sheets.



Ender's classification of biopolymers:

Qualification & Certificates

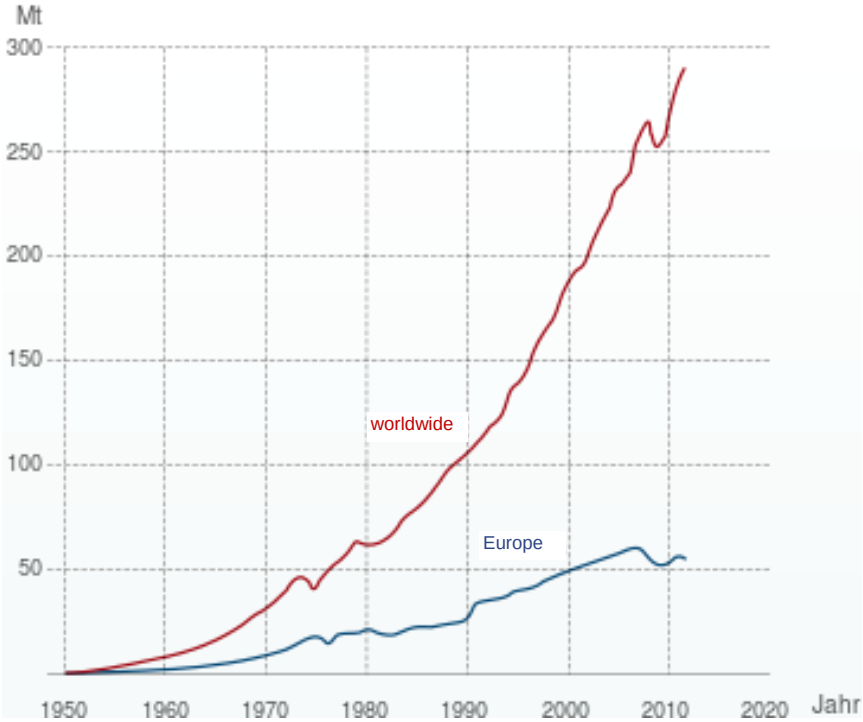
Sustainable materials

Our materials are biopolymers out of sustainable raw materials like wood, stark or lignin.
Our materials do not depend form changes of the oil market and they will stay available after the oil age. They can be reintegrated into the natural material cycle and have a neutral CO_2–balance.

Biodegradability

bioFila® materials are tested for biodegradability in line with the standards DIN/ISO 14851/14852.
Our materials are biodegradable like wood and can be re-integrated into the natural cycles, without wasting the environment, not like petrol based plastic.
All ingediences used (even pigments for colors) are biodegradable.
No waste, no impact to environment and human health. The perfect material for a clean industrial future.

Current situation



Plastic production in Europe and worldwide. source: Plastics Europe

be Produced quantity of plastic worldwide in 2013: about 300 mio. metric tons.

Only 43% of the waste will recycled and 55% will be used for energy production.

- The varietal recycling is difficult because of the use of different plastics, additives and fillers. Only with PET as varietal recycling is possible.
- The highest share of the produced plastics will be brunt, is lost for the recycling cycle and have an impact to our atmosphere.
- About 6 Mio to. of plastic are wasting the oceans every year and create a lot of problems. Keyword: “Great Pacific Garbage Patch”. Today you’ll find in the oceans 6 times more plastic than plankton. In some regions it is even 46 times more.

Plastic and Ocean

How the waste arrives in the oceans?

Today 80% of the global waste come by inflow and 20% of the waste are created by shipping, fishing and their lost equipment or the offshore industry, research, oil and gas platforms or the aqua cultures.

Which are the sources of the waste in the oceans?

The main inflow is from municipal effluent, localised flatting out of dumpsites and illegal dumping and the tourism. Rivers and floods bring the swimming waste into the ocean.

How long stays the waste in the ocean?

The waste contains 75% plastic, which is nearly undestroyable. Plastic decay after several decades and sometimes over centuries under the impact of salt water, sun and abrasion. An example, a plastic bag needs 10-20 years, a polystyrene cup 50 years and a PET bottle about 450 years

Why is plastic in the ocean so dangerous?

On one hand, plastic decay very slow by the impact of salt water, sun and abrasion into smaller parts by releasing toxic substances into the environment. On the other, many animals die, because of lost fishing equipment or by swallowing waste, they can't digest.

What is the scale of the pollution?

Every year, we produce about 300 million metric tons of plastic and about 10 million metric tons ends as waste in the sea (UNEP).

So, you can find 18.000 plastic parts per square kilometer on the surface of the sea.

How the waste is spread?

15 % of the waste swims on the surface of the sea, more than 70% sinks to the seabed and about 15% is stranded on the coast.

Summary:

Recycling of plastic is an approach, which is usable for a limited number of plastics and which can not 100% ensure that plastic will not pollute our environment. Plastic in the environment effects the ecological systems and is a danger for our livelihood, because of the very long decay times of 400-1000 years.

The industrial production of plastic start in the 1950's, meaning 65 years ago. The first plastic produced 65 years ago still exist in the environment and needs another 350 years for the complete degradation.
In other words, all plastic ever produced still exist in our environment, exceptional they have been burned. With the increase of the world population, this problem grows and grows and we won't picture the effect.

But it does not help to close the eyes and we start to develop bioplastics, which does not pollute the environment, which can be reintegrated into the natural ecological cycles and which are based on sustainable sources.

In the environment our bioplastic needs the same time like wood for biodegradation. That means a natural time for biological degradation of about 10 years.

So, our material can be the raw material of the grow of plants in future.

Why bioFila®?

If you have a look to the technical features of PLA and other BioPlastics, you will recognize that these plastics are not usable for technical demanding products.

PLA blends have normally a softening temperature of 55°C and the Charpy values shows also a limited use for technical products.

Therefore, twoBEars set oneself to develop a new generation of high performance plastics.

Our newest product is bioFila plaTec, with a softening temperature of 120°C and Charpy impact strength of more than 200kg/m² (10 times higher than ABS).

SO, BIOFILA PLATEC IS THE FIRST BIOPLASTIC WHICH A REAL COMPETITOR FOR EXISTING HIGH PERFORMANCE PLASTICS

bioFila® plaTec is not only optimized for 3D printing, it can used also for extrusion and injection molding.

This enable you to use one material form prototype to serial production.

Some data for orientation you'll find below.

3D PRINTING PARAMETERS

Temperatures & speed

Depending for the printer the temperatures should be in the following range:

Product	Dim.	bioFila® plaTec
Hotend	(°C)	185-205°C
Heat-bed	(°C)	55-65°C
speed	mm/sec	30 - 120
decomposition temperature	°C	215

Attention:

Please be aware, if you print with higher material temperature than the decomposition temperature, the material could emit unknown products, which could be dangerous. Please have a look to our Safety Data Sheets (SDS) on our homepage and respect the general rules for 3D printing. Material temperature is not equal to hot-end temperature, because you have to respect the dwell times for heating up the material. One indication that you print with too high temperature is a smell of the print and that the material turn dark.

Please work general in save environment with filtering systems, ventilation system and/or extractor hood.

Start easy printing

The printing with bioFila® is very easy. Set the parameters above and start to print. But every printer is different and if it does not work, here a short description how to start.

1. Start in park position and with the lowest temperature (see table)
2. Try to extrude with your hot-end 10mm material.
3. If the material sticks, increase the temperature by 5 degrees and continue with point 2 until the material start to flow. This is the minimum temperature for printing. (
4. With 10 degrees higher than the minimum temperature you will have the best process temperature for printing with the lowest speed (here 30mm/sec)

Optimization of printing

If you want to increase the speed of printing you normally need some optimization loops.

As rule of thumb you should increase the temperature by 10°C if you print 20mm/s faster.

At the end the sojourn time is responsible for the material temperature, which should not be higher than the decomposition temperature. If you print with very high speed, you have to minimize the ramp-up and stop times to prevent / minimize a decomposition of the material.

For any problems with the printing, don't hesitate to contact us and we will help you to solve it.

EXTRUSION & INJECTION MOLDING

Both materials are tested for injection molding and extrusion, so it's easy for you to use prototype parts out of the 3D printer and transfer the results to a mass production line. General you will get better mechanical results in your extrusion or injection molding than in 3D-printing. That will be a further safety margin for your design.

You will be faster and better if you use bioFila® from design to production.

For any question or support, don't hesitate to contact us.

MATERIAL DATA OVERVIEW

bioFila vs. PLA & ABS

Measurement	Test method	Dim.	bioFila silk	bioFila linen	bioFila plaTec	PLA	ABS
Density 23°C	DIN EN ISO 1183	g/cm³	1,25	1,40	1,40	1,28	1,07
Tensile test Stress at yield	DIN EN ISO 527-2	MPa	51	43	44	55	48
Tensile modulus	DIN EN ISO 527-1	GPa	2,50	2,70	2,60	5,10	2,20
Charpy impact strength 23°C	DIN EN ISO 179/1eU	kJ/m²	60	58	217	8	55
Softening temperatur (Vicat / VST A50)	DIN EN ISO 306	°C	57	58	120	60	100
Melding temperature	ISO 11357	°C	165	153	180	180	180

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sources: Bund, Plastic Europe, Wikipedia, Umweltbundesamt (exp:: 63/2015), NABU, WWF

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