

Typical Properties:

PHYSICAL PROPERTIES	TEST METHOD	UNITS	SPECIFICATION
Colour and Form of feedstock			Off -White beads
Bulk Density (in octabin)	ISO 1183	g/cm ³	0,80
VOC Content		%	0%
Moisture content		%	<2%
Flame retardant properties	EN 11925-2:2002		Meets Euroclass E for 30-40kg/m ³ Test report R0529 Effectis (TNO) dd 22-4-2010
Thermal insulation properties Comparison EPS and BioFoam	ISO 2796-1980	°C	Thermal Insulation W/mK*
			Type
			0,034 at 17 gr/l 0,034 at 35 kg/m ³ 0,033 at 30kg/m ³ BioFoam-HR BioFoam EPS
Flame retardant properties	BS-5852		Meets Class crib 5 suitable as filling in bags for public areas Crib 5, comparable to the energy of a compressed burning paper

Mechanical properties :

property	BioFoam moulded		BioFoam C-continuously formed drainage board		BioFoam HR loose bead cavity wall with glue	
	Kg/m ³	value	Kg/m ³	value	Kg/m ³	value
white/green mW/mk	31	34	35	37,5	13	38
grey mW/mk		na		na	17	32
bending strength, kPa	35	300	35	170		na
tensile strength, kPa	40	200	40	160		na
compressive modulus MPa	40	4		na		na
shear strength kPa	35	140		na		na
shear modulus, Mpa	35	3,1		na		na
C-value for cushioning	35	2,6	35	2,6		na
halogens present		no		no		no
Fire: Euroclass E		pass		pass		pass

na = not applicable

HR means High R value and is common abbreviation for grey insulating foam with an improved low thermal conductivity.

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Granulometry control

Representative samples are taken from every octabin. One in five bins is controlled for conformity to the granulometry spec by sieving. If a deviation would be found the bin in question is disqualified and all sequential bins and previous bins are and quarantined and measured. Beads size of unexpanded raw material can be either 0,7-1,0 (BF710) and 1,0-1,6 mm (BF1016).

Propertjes

BioFoam has been specially developed to serve as a feedstock for shape moulding. Minimal Achievable density 30 kg/m³, in one pass , typical range 25-50kg/m³ : loose beads are used in densities between 13 -19 kg/m³

Cradle to Cradle certification

BioFoam was recertified July 2015 by EPEA to meet the stringent C2C requirements



In addition a material health certificate was given by EPEA and

100% carbon Neutral

As off July 1st 2015 BioFoam was declared by EPEA to be 100% Carbon neutral.

Termite proof



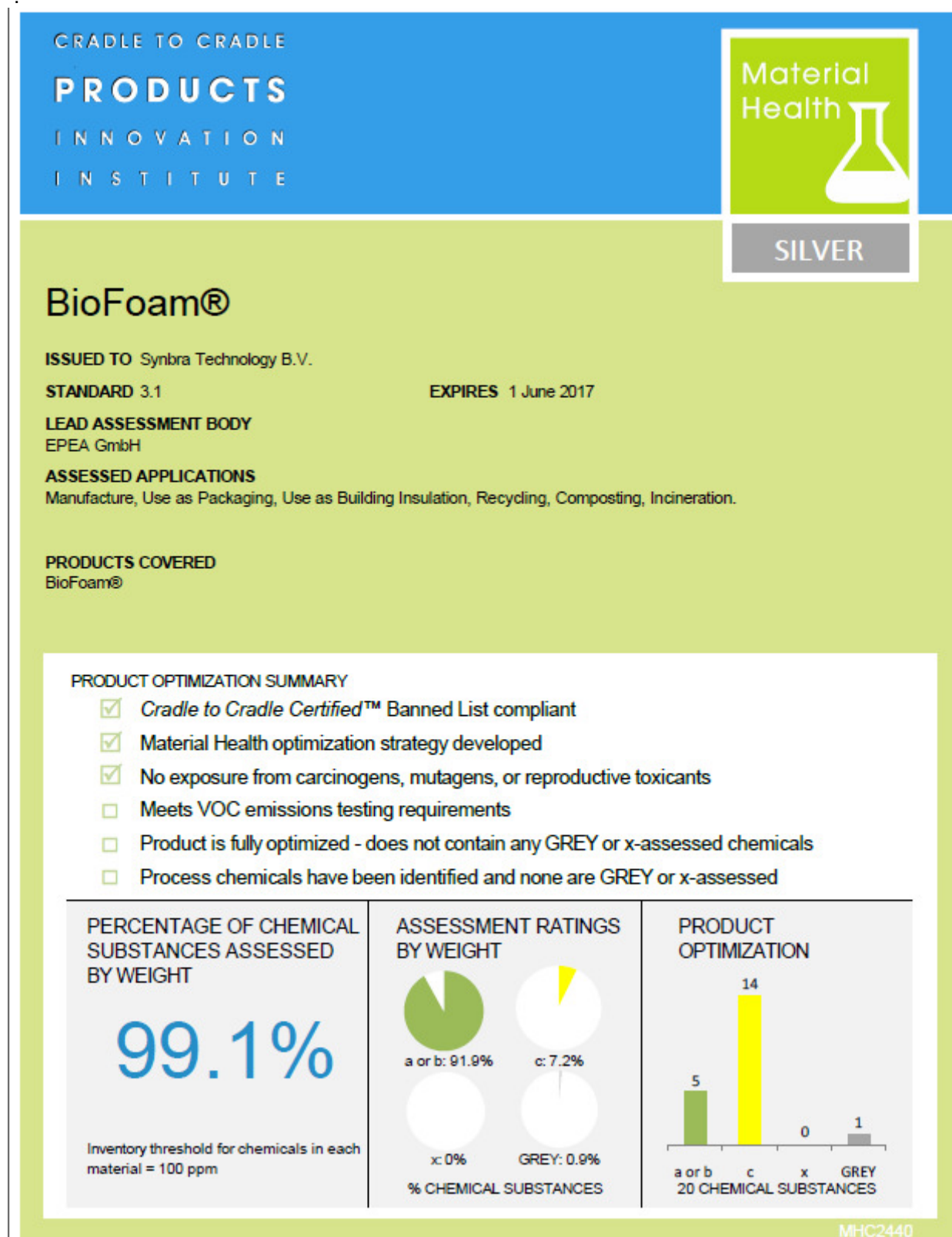
Photo of termites.

Termit test All Termites died after a formal 6 weeks test , there are minor traces of attack but all termites died probably due to lack of nutrients. Conclusion was that BioFoam is not sensitive to attack by termites conform the standard EN 117/118.

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Material Health Certificate

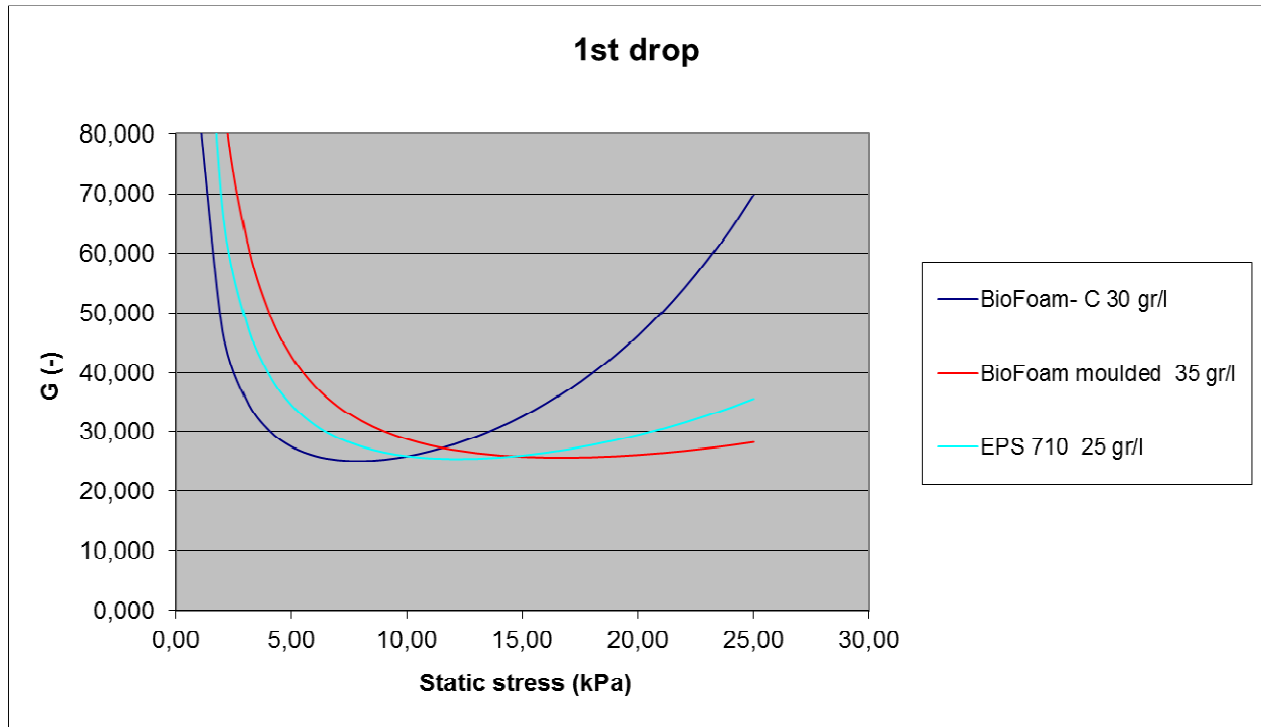
In addition a Silver material health certificate was given by EPEA and the ticked boxes apply.



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Cushioning

Dynamic Shock Cushioning Characteristics of Packaging Materials mentioned in ASTM norm 1596.
Sample 60x60x2,5 height 76 cm, 10kg Drop, First drop 25G
More drop testing graphs are available on request.

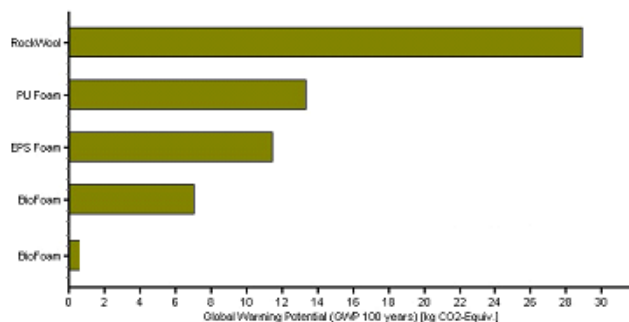


ROHS listing

All ingredients in BioFoam comply with European Directive EC1994/45/EC with regard to absence of heavy metals and mutagenic and carcinogenic substances, and therefore also complies with European Directives 2002/95/EC and 2000/53/EC

CO2 footprint

BioFoam has a very low CO2 footprint compared to other materials and is even better than the already very good insulant EPS. The emissions of CO2 to produce a functional unit for a flat roof which is walkable and has an Rc of 3,5 are shown below. A formal LCA has been completed by Akzo Nobel sustainable systems and was peer reviewed. BioFoam moulded in 2015 is officially carbon neutral.



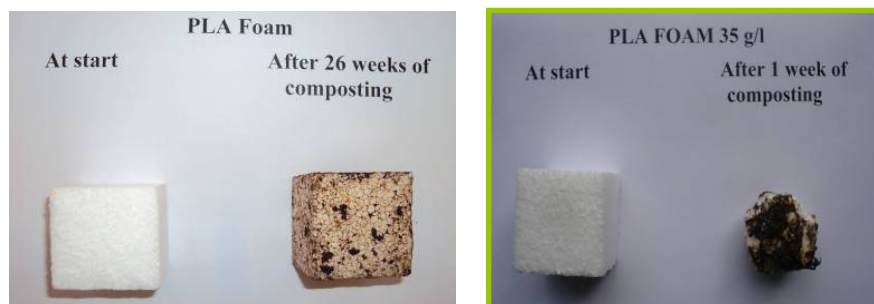
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Chemical resistance against solvents

BioFoam is hardly attacked by styrene solvent present in curing formulations and has been used successfully as a sustainable filler, saving weight during thermosetting polyester/styrene/glass- fibre systems . It thus enabled a contribution to a reduction of styrene emission during the subsequent curing process and assists in mitigating styrene emission according to the tightened Dutch Emission (NER) guidelines per 30 November 2010.

Composting

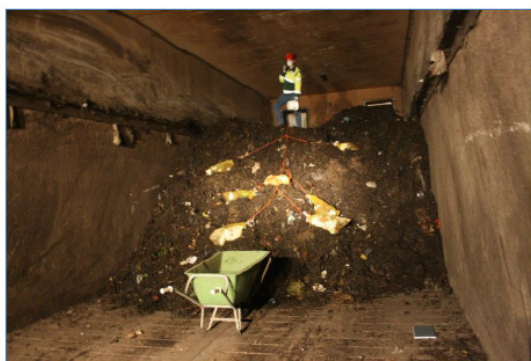
BioFoam at 35 g/l does **not** disintegrate after 26 weeks of composting at room temperature at 20oC . BioFoam is therefore not home compostable as proven by tests carried out by Organic waste Systems (OWS) Gent finished March 2010. Test was terminated according to the norm without visible alteration.



At room temperature (no degradation) at 70oC

BioFoam disintegrates only during **Industrial composting** at elevated temperature under the influence of moisture, bacteria and constant agitation. At room temperature it does not disintegrate

An industrial composting trial with plant roots intergrown in BioFoam-C was carried out by Attero in Venlo, the Netherlands



*FBR Report 1561
- Final - April
2015 -
Composting
trial.pdf*



All tested BioFoam® materials were completely disintegrated after a second industrial composting cycle. As source separated municipal solid biowaste ('GFT') generally takes several composting cycles to disintegrate sufficiently to pass the 15 mm sieve, it is concluded that BioFoam® disintegrates at least as fast.



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Proven Stability in construction

Naked foam displayed no degradation after 5 years in a Forest. (TNO surveyed) and as perimeter insulation it displays no degradation. Photo of house below

In all applications below the usage temperature of 55°C is not exceeded.



Perimeter insulation



Deco BioBio Sandwich renovation



Unprotected use in duration test in forest

In cavity fill green BioFoam is used and a Grey BioFoam has been developed to improve thermal conductivity in cavity fill applications. BioFoam grey and green is used by Termokomfort for cavity fill insulation.



Unlike with EPS there is no experience in excess of 5 years in a construction. So a 100 years guarantee is not possible as to not sufficient data have been generated to support that claim.

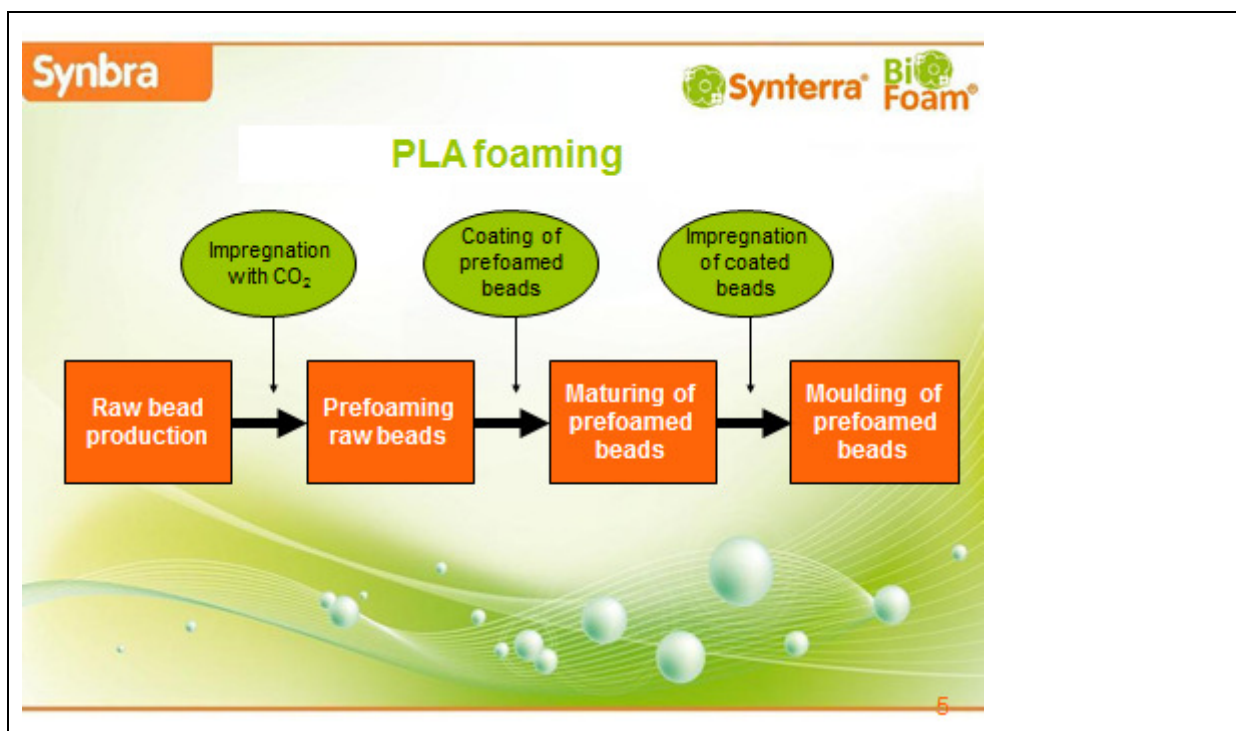
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Awards

BioFoam was awarded the first position of the 2010 MKB Top 100 SME awards innovation on May 25th 2010



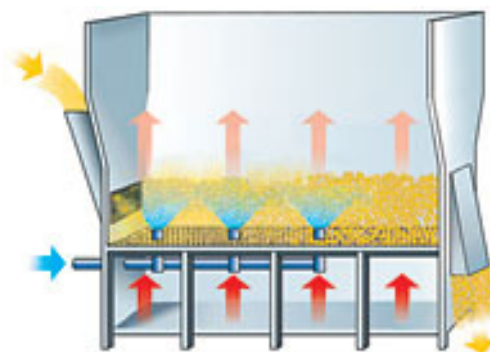
Processing steps of BioFoam



Processing Steps

Raw material for prefoaming is E-PLA beads with a diameter range of about 0,7-1,5 mm. This is an (almost) ready to use raw material made by Synbra. It only lacks the blowing agent.

1. Impregnation with CO₂ is required in a **special pressure vessel**.
2. The impregnated beads are then released in a conventional EPS pre-expander which can process E-PLA **with a small technical modification**.
3. The expanded beads are then coated with a proprietary coating, in a **proprietary coating line**. Patented technology: WO 2008130226
4. After coating the material can be stored indefinitely (up to 2 years) and be reactivated by impregnation the blowing agent CO₂ **in a special pressure vessel**. This feeds the impregnated beads into a standard EPS moulding machine, which has **a small technical modification**.



In bold are the technical modifications needed to process E-PLA in conventional EPS equipment. This requires an investment in hardware.

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