Environmental Product Declaration

Polymacro® from polyfibers®
REINFORCEMENT SOLUTIONS

In accordance with ISO 14025 & EN 15804:2012 + A2:2019

PROGRAMME
The International EPD® System
www.environdec.com

PROGRAMME OPERATOR
EPD® International AB

LOCAL OPERATOR
EPD® Turkey

EPD REGISTRATION No
S-P-04127

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2027.04.19

EPD® THE INTERNATIONAL EPD® SYSTEM

TURKEY EPD® ENVIRONMENTAL PRODUCT DECLARATIONS

ECO PLATFORM EPD VERIFIED

An EPD should provide current information and may be updated if conditions change.
The stated validity is therefore subject to the continued registration and publication at: environdec.com

General Information

Programme Information

Programme: The International EPD® System
Address: EPD International AB Box 21060 SE-100 31 Stockholm, Sweden
Website: www.environdec.com
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Information about verification and reference PCR:

CEN standard EN 15804 serves as the Core Product Category Rules (PCR)

Product category rules (PCR)
PCR 2019:14 Construction products (EN 15804:A2) Version 1.1

PCR review was conducted by
The Technical Committee of the International EPD® System. See www.environdec.com/TC for a list of members.
Review chair: Claudia A. Peña, University of Concepción, Chile.
The review panel may be contacted via the Secretariat www.environdec.com/contact.

Independent verification of the declaration and data, according to ISO 14025:2006:

☐ EPD process verification ☑ EPD verification

Third party verifier	Approved by
Vladimír Kočí, PhD Šárecká 5, 16000 Prague 6, Czech Republic	The International EPD® System Technical Committee, supported by the Secretariat

Procedure for follow-up of data during EPD validity involves third party verifier:

☐ Yes ☑ No

LCA Study & EPD Design Conducted by
Semtrio Sustainability Consulting
BUDOTEK Teknopark, No 8/27
Umraniye / Istanbul Turkey
www.semtrio.com

SEMTRIO

Polipropilen Elyaf San. Ve Dış Tic. A.Ş. (Polyfibers®) has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804. For further information about comparability, see EN 15804 and ISO 14025.

Company Information

Polyfibers®

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Polyfibers® established in 2001, is the first producer of micro and macro synthetic fiber concrete reinforcement products in Turkey.

Through an ongoing commitment to research and development, Polyfibers® has transformed and revolutionized its products by combining high technology synthetic materials with unique designs and manufacturing methods.

As of 2022, Polyfibers® became the largest producer in EMEA region with its new investments and acquisitions. Thanks to its experienced production team and technical sales team, Polyfibers® offer innovative solutions of concrete reinforcement with the complete range of high performance micro and macro synthetic fibers, specifically engineered to provide right solution to all kinds of industrial floor, tunnel, pavement, transportation, infrastructure, mining and precast clients.

In order to provide sustainable solutions, Polyfibers® has established state-of-the-art testing laboratory performing fiber reinforced concrete evaluations and gives design engineering consultancy to clients and tailor-made solutions for the major projects.

Polyfibers® along with ISO 9001-14001 certified manufacturing facilities is proud to serve the world market as a key global player. With offices and authorized distributors at different locations of 5 continents of the world, **Polyfibers® exports to over 50 countries its high performance fiber reinforcement products.**

Production Site
Polipropilen Elyaf San. Ve Dış Tic. A.Ş. (Polyfibers®)
Hürriyet 2. Osb mahallesi 18. Cadde No:7
Merkez / Bilecik

Product Information

Polymacro®

Macro Synthetic Fiber

With the wide-spread use of ready mixed concrete in many application areas such as residences, bridges, tunnels, floors of large industrial facilities; many research and development activities are carried out in order to make **more advanced, more environmentally friendly, more economical and faster applications**. One of the innovations that have come in view as a result of these activities is concrete strengthening and service life extending micro and macro synthetic poly fiber reinforcement products that are used instead of steel reinforcements in certain concrete applications. When they are added to ready mixed concrete, synthetic fiber products developed with advanced technologies minimize cracking, increase concrete performance and provide long-term durability in different applications as they are brought together in unique designs and forms.

Macro synthetic fiber Polymacro® has been specifically designed for shotcrete applications and tunnel linings to increase impact and flexural resistance and will last **the lifetime** of the concrete in which they are cast. These structural fibers which are made of monofilament fiber bundles disperse excellently within concrete with robust adherence. These non-corrosive fibers which provide long-term durability and decrease shrinkage cracks and the effects of thermal expansions and shrinkage; enhance concrete impact and abrasion resistance. Joint spacing can be increased **by pouring wider slabs** with synthetic fiber reinforced concretes, as well.

Due to 0.91 g/cm3 gravity, high number of fibers can be obtained in lower weights in comparison to steel fibers. Thus, three-dimensional reinforcement of concrete mix is achieved. Synthetic fibers also increase energy absorption capacity while giving ductility to concrete. Polymacro® fibers eliminate the need for steel fiber and steel mesh, by providing residual flexural strength structurally. In addition to all these features, synthetic fibers do not require concrete cover; can reduce the concrete thickness and eliminate overlap length losses in steel mesh. It's non-corrosive structure increases service life of concrete and help reducing the maintenance costs. Ultimately, Polymacro® fibers provide **significant saving in operational and labor costs** while **eliminating labor related risks and potential hazards** from the work site related to steel mesh and steel fiber.

Product Information

Polymacro®

Macro Synthetic Fiber

Applications Areas

Field Applications

- Industrial Floors
- Underground Stations & Walkways
- Concrete Pavements
- Logistics Facility Floors
- Slabtrack and Sleepers

Coastal Structures & Ports

- Ports and Piers
- Shipyards
- Marinas

Water Structures

- Hydroelectric Power Plants
- Irrigation Projects
- Channels
- Drinking Water Projects

Residential Applications

- Parking Lot Floors
- Screed Concrete

Precast Elements

- Concrete Pipes and Blocks
- Segments
- Retaining Walls

Mining

- Shotcrete Applications
- Underground Spaces
- Walkway Concrete

Tunnels

- Linings & Segments
- Slope Stabilization
- Shotcrete

Technical Specifications

Product Group Classification

UN CPC Code: 353 - Man made fibers

Composition	100% Virgin Polypropylene Copolymer
Type	Macro Synthetic Fiber Reinforcement for Structural Use
Geometric Shape	Embossed Pattern
Standard	EN 14889 Part II Type 1A, ASTM C1116 Type III ,ASTM D7508
Length	Range of 40-54 mm
Aspect Ratio	Range of 50-90
Color	White or Grey and Its Shades
Specific Weight	0.91 gram / cm^3
Elastic Modulus	11 GPa
Tensile Strength	640 MPa
Corrosion	Non-Corrosive
Water Absorption	N/A
Chemical Resistance	Excellent Alkali Resistance
Oxidant Resistance	Excellent
Biological Resistance	Excellent
Cement Compatibility	Excellent
Magnetism	Non-Magnetic
Melting Point	165°C
Ignition Point	> 360°C

For the latest table, please contact the local sales executive.

LCA Information

Declared Unit:
1 kg of Polymacro® Macro Synthetic Fiber Concrete Reinforcement

Time representativeness:
The production data in this LCA study represents the period of 1st April 2021 and 30th September 2021.

Database(s) and LCA software used:
SimaPro v9.2 and Ecoinvent v3.7.1

Description of system boundaries:
Cradle to gate (A1–A3).

Data quality and data collection:
According to EN 15804:2012+A2:2019, specific data was used for module A3 (Processes the manufacturer has influence over) and was gathered from Polyfibers® production plant. Specific data includes actual product weights, amounts of raw materials used, product content, energy and water consumption, transport figures, and amounts of wastes and wastewater. According to EN 15804:2012+A2:2019, generic data was applied and was obtained from Ecoinvent v3.7.1

Allocation:
Mass allocation has not been applied in this study

Waste:
The *"polluter pays principle"* is followed. Processes of waste processing was assigned to the product system that generates the waste until the end-of-waste state is reached. Therefore, system boundary of this study includes disposal of waste arising from module A3, only including those reached the end-of-waste stage.

Cut-off rules:
Life Cycle Inventory data for a minimum of 99% of total inflows to the life cycle assessment have been included and a cut-off rule of 1% regarding energy, mass and environmental relevance was applied. Impacts caused by treatment operations, impacts caused by producing packaging materials both meant for product and incoming raw materials, upstream transport of product packaging materials, ink used for printing on packaging materials have been calculated lower than %1 environmental relevance.

Electricity consumption in the project has been modelled using the Turkey mix data have been obtained from Ecoinvent v3.7 as secondary data.

Turkey electricity mix was 2% deep geothermal, 17% hard coal, 10% hydro, 15% lignite, 31% natural gas, 2.7% natural gas (conventional) 0.2% oil, 0.4% wind (<1 MW), 0.9% wind (>3MW), 5.2% wind (1-3 MW), 0.8% import from BG, 0.2% import from GE, 0.01% import from IR, 0.6% heat and power cogeneration biogas, 0.2% heat and power cogeneration natural gas (combined cycled power plant), 0.8% heat and power co-generation natural gas (conventional power plant), 0.1% heat and power co-generation wood chips, 4.8% market with a carbon intensity of 1 kg CO2eq for Polymacro®

Environmental impacts relating to personnel, infrastructure, and production equipment not directly consumed in the process are excluded from the system boundary as per the PCR 2019:14 Section 4.3.1.

Modules declared, geographical scope, share of specific data (in GWP-GHG indicator) and data variation

	PRODUCT STAGE			CONSTRUCTION PROCESS STAGE		USE STAGE							END OF LIFE STAGE				RESOURCE RECOVERY STAGE
	Raw material supply	Transport	Manufacturing	Transport from the gate to the site	Assembly	Use	Maintanence	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction	Transport	Waste processing	Disposal	Reuse - Recovery - Recycling Potential
MODULES	A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D
Module declared	X	X	X	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND	ND
Geography	GLO	GLO	TR	-	-	-	-	-	-	-	-	-	-	-	-	-	-
Specific data used	>99.5%			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation-products	Not Relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-
Variation-sites	Not Relevant			-	-	-	-	-	-	-	-	-	-	-	-	-	-

System Diagram

A1 - Raw Materials Supply

This stage takes into account raw material extraction, processing and energy used in the production process.

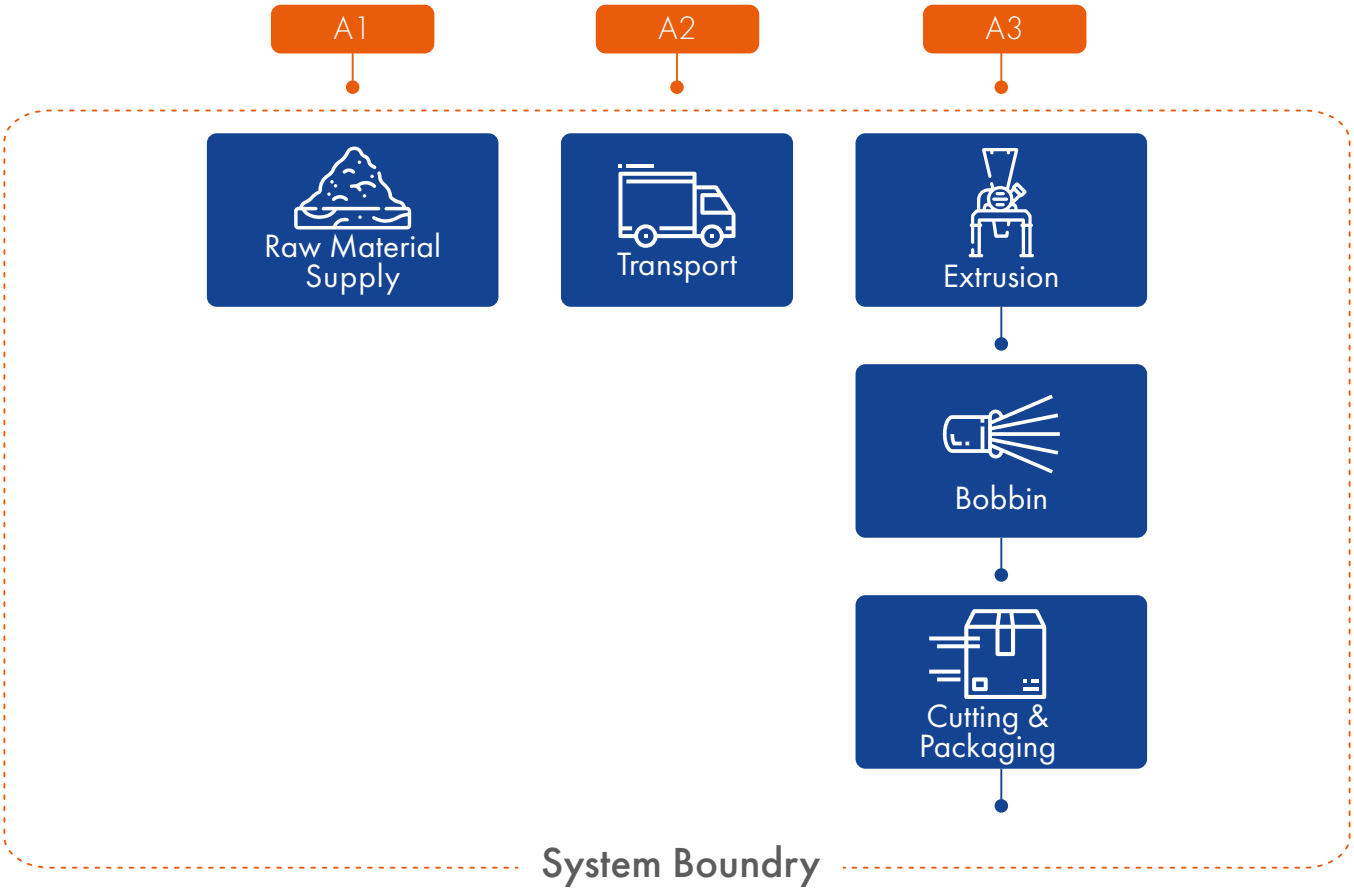
Polymacro® consists of %100 virgin polypropylene, polyethylene and dye, along with "puck" packaging film, supplied from various suppliers, analysed thoroughly to endow with Polyfibers® supplier appraisement, assessing environmental, social, and economic praxis of the source.

A2 - Transport to the Manufacturer

This stages include transportation of the raw materials from supplier to factory gate. Transportation types are considered as seaway, road, railroad, etc.

A3 - Manufacturing

This stage includes energy and water consumption during the manufacturing process. Additionally, packaging materials are covered by this stage. The raw materials are subjected to extrusion, cooling, stretching, embossing, and oven-drying, winding and lastly, fibers are cut into the appropriate lengths and packaged ready for distribution.



Description of Declared Modules

Content Declaration

Content Declaration by mass%

Content declaration of 1kg of Polymacro®	
Product components	**Mass Composition**
Virgin Polypropylene	>80%
High density Polyethylene	<20%
Dye	<0.5%
Renewable Material	0

PVA Packaging

Content declaration of 1kg of Polymacro®	
Packaging materials	**Weight-% (versus the product)**
PVA Water Soluble Film	%0.90
Parcel	%8.56
Wooden Pallet	%3.15
TOTAL	**%12.61**

The product does not content "Candidate List of Substances of Very High Concern (SVHC)" compounds.

Environmental Performance

Potential Environmental Impact

Mandatory Indicators According to EN 15804

Results for 1kg of Polymacro®		
Indicator	**Unit**	**A1:A3**
GWP-fossil	kg CO_2 eq	3.39
GWP-biogenic	kg CO_2 eq	-0.16
GWP-luluc	kg CO_2 eq	0.01
GWP-total	kg CO_2 eq	5.55
ODP	kg CFC 11 eq	9.91E-08
AP	mol H+ eq	0.02
EP-Freshwater	kg PO43- eq	1.39E-03
	kg P eq	1.42E-04
EP-Marine	kg N eq	2.65E-03
EP-Terrestrial	kg N eq	0.03
POCP	kg NMVOC eq	0.01
ADP-minerals &metals*	kg Sb eq	1.77E-05
ADP-fossil*	MJ	93.5
WDP	m^3	2.01

GWP-fossil = Global Warming Potential fossil fuels;
GWP-biogenic = Global Warming Potential biogenic;
GWP-luluc = Global Warming Potential land use and land use change;
ODP = Depletion potential of the stratospheric ozone layer;
AP = Acidification potential, Accumulated Exceedance;
EP-freshwater = Eutrophication potential, fraction of nutrients reaching freshwater end compartment;
EP-marine = Eutrophication potential, fraction of nutrients reaching marine end compartment;
EP-terrestrial = Eutrophication potential, Accumulated Exceedance;
POCP = Formation potential of tropospheric ozone;
ADP-minerals&metals = Abiotic depletion potential for non-fossil resources;
ADP-fossil = Abiotic depletion for fossil resources potential;
WDP = Water (user) deprivation potential, deprivation-weighted water consumption

Environmental Performance

Potential Environmental Impact

Additional Mandatory and Voluntary Indicators

Results according to PCR2019:14 for 1kg of Polymacro®		
Indicator	**Unit**	**A1:A3**
GWP-GHG[1]	kg CO_2 eq	2.87
Results according to EN 15804+A2 for 1kg of Polymacro®		
PM	[disease inc.]	1.06E-07
IRP	[kBq U235 eq]	0.07
ET-freshwater	[CTUe]	22.5
HT-cancer	[CTUh]	9.13E-10
HT-non-cancer	[CTUh]	2.06E-08
SQP	[pt]	27.9

GWP-GHG = Global Warming Potential total excl. biogenic carbon following IPCC AR5 methodology;
IRP = Ionizing radiation, human health;
ET-freshwater = Eco-toxicity (freshwater);
HT-cancer = Human toxicity, cancer effects;
HT-non-cancer = Human toxicity, non-cancer effects;
SQP = Potential soil quality index (SQP)

Information on biogenic carbon content according to EN 15804+A2		
Biogenic Carbon Content	**Unit**	**Quantity**
Biogenic carbon content in product	kg C	2.88E-05
Biogenic carbon content in packaging	kg C	1.78E-04

Environmental Performance

Potential Environmental Impact

Use of Resources

Results according to EN 15804+A2 for 1kg of Polymacro®		
Indicator	**Unit**	**A1:A3**
PERE	MJ, net calorific value	8.14
PERM		0
PERT		8.1
PENRE	MJ, net calorific value	101
PENRM		0
PENRT		101
SM	kg	0
RSF	MJ, net calorific value	0
NRSF		0
FW	m^3	0.19

PERE = Use of renewable primary energy excluding renewable primary energy resources used as raw materials;
PERM = Use of renewable primary energy resources used as raw materials;
PERT = Total use of renewable primary energy resources;
PENRE = Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials;
PENRM = Use of non-renewable primary energy resources used as raw materials;
PENRT = Total use of non-renewable primary energy resources;
SM = Use of secondary material;
RSF = Use of renewable secondary fuels;
NRSF = Use of non-renewable secondary fuels;
FW = Use of net fresh water

Environmental Performance

Potential Environmental Impact

Waste Production

Results according to EN 15804+A2 for 1kg of Polymacro®		
Indicator	Unit	A1:A3
Hazardous waste disposed	kg	5.08E-05
Non-hazardous waste disposed	kg	0
Radioactive waste disposed	kg	0

Output Flows

Results according to EN 15804+A2 for 1kg of Polymacro®		
Indicator	Unit	A1:A3
Components for re-use	kg	0
Materials for recycling	kg	0
Materials for energy recycling	kg	0
Exported energy, electricity	MJ	0
Radioactive waste disposed	MJ	0

References

- **ISO 14040** 2006 Environmental management - Life cycle assessment - Principles and framework
- **ISO 14044** 2006 Environmental management - Life cycle assessment - Requirements and guidelines
- **ISO 14025** 2006 Environmental labels and declarations - Type III environmental declarations - Principles and procedures
- **ISO 14020** 2000 Environmental labels and declarations - General principles
- **EN 15804:2012+A2:2019** Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products
- **The International EPD® System** www.environdec.com
- **The International EPD® System** The General Programme Instructions v3.01
- **The International EPD® System** PCR 2019:14 Construction products v1.1 (EN 15804:A2)
- **Ecoinvent 3.7** www.ecoinvent.org
- **SimaPro LCA Software** www.simapro.com
- **Polipropilen Elyaf San. Ve Dış Tic. A.Ş. (Polyfibers®)** www.polyfibers.com

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More information about POLYFIBERS® approach to sustainability and its corporate social resposibility initiatives are available via faraz@polyfibers.com