

ENVIRONMENTAL PRODUCT DECLARATION for ECONYL® BCF REPROCESSED YARNS



EPD®

**PCR 2012:01 CONSTRUCTION PRODUCTS AND CONSTRUCTION SERVICES, VERSION 2.31,
APPENDIX B TO PCR 2012:01 CONSTRUCTION PRODUCTS AND CONSTRUCTION SERVICES, VERSION 2.31
CPC: 355 & 264**

Program: The International EPD® System, www.environdec.com
Program operator: EPD International AB

This environmental product declaration is compliant with ISO 14025 and EN15804+A1.

Owner of the declaration:
Aquafil S.p.A., Via Linfano 9, 38062 Arco Italy

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Valid until: 2025 - 05 - 07



COMPANY AND PRODUCT

Related information

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THE COMPANY

Aquafil Group history began in 1969, when the Bonazzi's family built the first manufacturing plant in Arco (Trentino Alto Adige region, Italy). In 1970, the Group began the polymerization and production of polyamide 6 at this facility, which started Aquafil's market share acquisition in the BCF yarn sector (polyamide yarn for textile flooring). During the '80s, significant investments allowed a consolidation and diversification of the Group's activities. The most significant diversification of the Group's operation occurred in 1995 when the Aquafil Group finalized the first privatization of a public company in the newly born Republic of Slovenia. This acquisition allowed Aquafil to start its Nylon Textile Filament (NTF) product area.

Meanwhile, the Group continued to widen its product offering by opening several production plants in Europe and entering (with its "Polyamide products priority focus" always in mind) the Engineering Plastics business to supply engineering plastics to the automotive, electronics and construction industries.

At the same time, the Group started its internationalization process with the creation of Aquafil USA, based in Cartersville, Georgia (USA).

Between 2000 and 2010, the Group expanded its presence in all three key markets where it was operating (carpet yarn, textile yarn and engineering plastics), gradually becoming a global leader in the manufacturing of Polyamide 6 fibers.

In 2005, a manufacturing facility was established in Thailand for processing and marketing BCF products for the carpet industry in the Asian area. In 2009, a new manufacturing facility was built in China to assist in the ever-growing Asian market. In 2013, the Group sold the Engineering Plastics division to DOMO and acquired DOMO's BCF business Xentrys.

In 2007 the company started the development of a visionary project aligned with its manufacturing and market growth focus. Driven by a genuine concern for the environment, resources and investments were dedicated to the design and construction of the **ECONYL® Regeneration Plant** (the recycling of pre- and post-consumer Polyamide 6 waste material), which was launched in 2011.

As of 2019, the Group operates 16 manufacturing plants worldwide with more than 2,900 employees, in eight countries (Italy, Slovenia, Croatia, Germany, United Kingdom, USA, Thailand and China) on three continents (Europe, North America and Asia).

IT OPERATES 2 DIFFERENT PRODUCT AREAS:

- **BCF** *Carpet yarn for the flooring market*
 - **NTF** *Special yarns for sportswear and fashion applications*
-

In 2008, during the engineering and design phase of Aquafil's **ECONYL® Regeneration System**, a third operational unit was created - Energy & Recycling.

This Energy & Recycling operational unit is dedicated to the promotion of sustainability and environmental issues. It has a transverse nature in respect to the other product areas, providing solutions and innovative technologies in the area of energy, recycling and the promotion of the culture of sustainability both inside and outside of the Group.

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PROGRAM INFORMATION

PROGRAM OPERATOR

EPD international AB: Valhallavägen 81, SE-114 27 Stockholm Sweden;
E-mail: info.environdec.com

and

Institute Bauen und Umwelt e.V. (IBU): Panoramstr.1, 10178 Berlin;
www.bau-umwelt.de

COMPARABILITY

EPDs within the same product category but from different programs may not be comparable. EPDs of construction products may not be comparable if they do not comply with EN 15804.

OWNERSHIP

The EPD owner has the sole ownership, liability, and responsibility for this EPD.

VERIFICATION INFORMATION

Product category rules used: PCR 2012:01
Construction products and Construction services, Version 2.31,
Appendix B to PCR 2012:01 Construction products and construction services,
Version 2.31
PRC review was conducted by: IVL Swedish Environmental Research Institute,
Secretariat of the International EPD System

Independent third-party verification of the declaration and data, according to
ISO 14025:2010:

EPD process certification EPD verification

Third party verifier:

Bureau Veritas, accredited by SWEDAC

www.bureauveritas.com

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

YES

NO

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PRODUCT INFORMATION

OWNER OF THE EPD

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DESCRIPTION OF THE PRODUCT

ECONYL® BCF yarns are bulk continuous filament yarns, made from 100% recycled PA6 polymer. BCF yarns can be further reprocessed by twisting and/or air entangling. As such are delivered to customers for manufacturing carpet tiles and tufted or woven carpets, within the scope of construction product.

This EPD refers to three groups of Bulk Continuous Filament yarns

- **ECONYL®** Air entangled yarns (dope dyed)
- **ECONYL®** 2700 Dens (dope dyed)
- **ECONYL®** Twisted yarns (dope dyed)
- **ECONYL®** Direct Extrusion yarns (dope dyed)

Environmental performances for each group of yarn is reported separately. Each group of yarn is consisting of several similar products, but differences in terms of parameters are not significant for all three groups of products.

IDENTIFICATION OF THE PRODUCT ACCORDING TO THE UN CPC SCHEME

355 – man-made fibers

PRODUCTION SITES INCLUDED IN EPD

- **AquafilSLO - Ljubljana** (Letališka cesta 15, 1000 Ljubljana, Slovenia)
> process B, C
- **AquafilSLO - Ajdovščina** (Tovarniška cesta 15, 5270 Ajdovščina, Slovenia)
> process A
- **AquafilUSA INC.** (1 Aquafil Drive & 101 Fiber drive, GA 30120, Cartersville, USA)
> process D,F,G,H,E
- **Aquafil Carpet Recycling (ACR#1)** Phoenix (3555 W. Washington street, 85009 Phoenix, USA)
> process S

ISO standard	AquafilSLO Ljubljana	AquafilSLO Ajdovscina	AquafilSLO INC	ACR#1
ISO 9001 : 2015	X	X	X	
ISO 14001 : 2015	X	X		
OHSAS 18001 : 2007	X	X		

PRODUCT CHARACTERISTICS

A. ECONYL® AIR ENTANGLED YARNS (DOPE DYED)

PARAMETER	UM	VALUE	TESTING METHOD
Linear density	dtex	3100 +/- 200	DIN 53830 Modified
Tenacity at break	cN/dtex	3,3 +/- 0,3	ISO EN 2062
Elongation at break	%	35-55	ISO EN 2062

B. ECONYL® 2700 DENS (DOPE DYED)

PARAMETER	UM	VALUE	TESTING METHOD
Linear density	dtex	3000 +/- 30	DIN 53830 Modified
Tenacity at break	cN/dtex	3,15 +/- 0,45	ISO EN 2062
Elongation at break	%	35-55	ISO EN 2062

C. ECONYL® TWISTED YARNS (DOPE DYED)

PARAMETER	UM	VALUE	TESTING METHOD
Linear density	dtex	2050 +/- 100	DIN 53830 Modified
Tenacity at break	cN/dtex	3,2 +/- 0,3	ISO EN 2062
Elongation at break	%	35-55	ISO EN 2062

D .ECONYL® DIRECT EXTRUSION YARN (DOPE DYED)

PARAMETER	UM	VALUE	TESTING METHOD
Linear density	dtex	2050 +/- 100	DIN 53830 Modified
Tenacity at break	cN/dtex	3,2 +/- 0,3	ISO EN 2062
Elongation at break	%	35-55	ISO EN 2062

GEOGRAPHICAL SCOPE OF THE EPD

Global

DECLARED UNIT

Declared unit is 1 kg of ECONYL® BCF reprocessed yarn delivered and including primary packaging.

REFERENCE SERVICE LIFE

This EPD does not indicate RSL

DATA COLLECTION

Life cycle assessment primary data of processes owned by Aquafil group were collected from period of January 2019 to December 2019.

BACKGROUND DATA AND METHOD

All the background data relevant for modelling were taken from Gabi database – service pack 40, (update 2020). Gabi EN15804 +A1 assessment method is used.

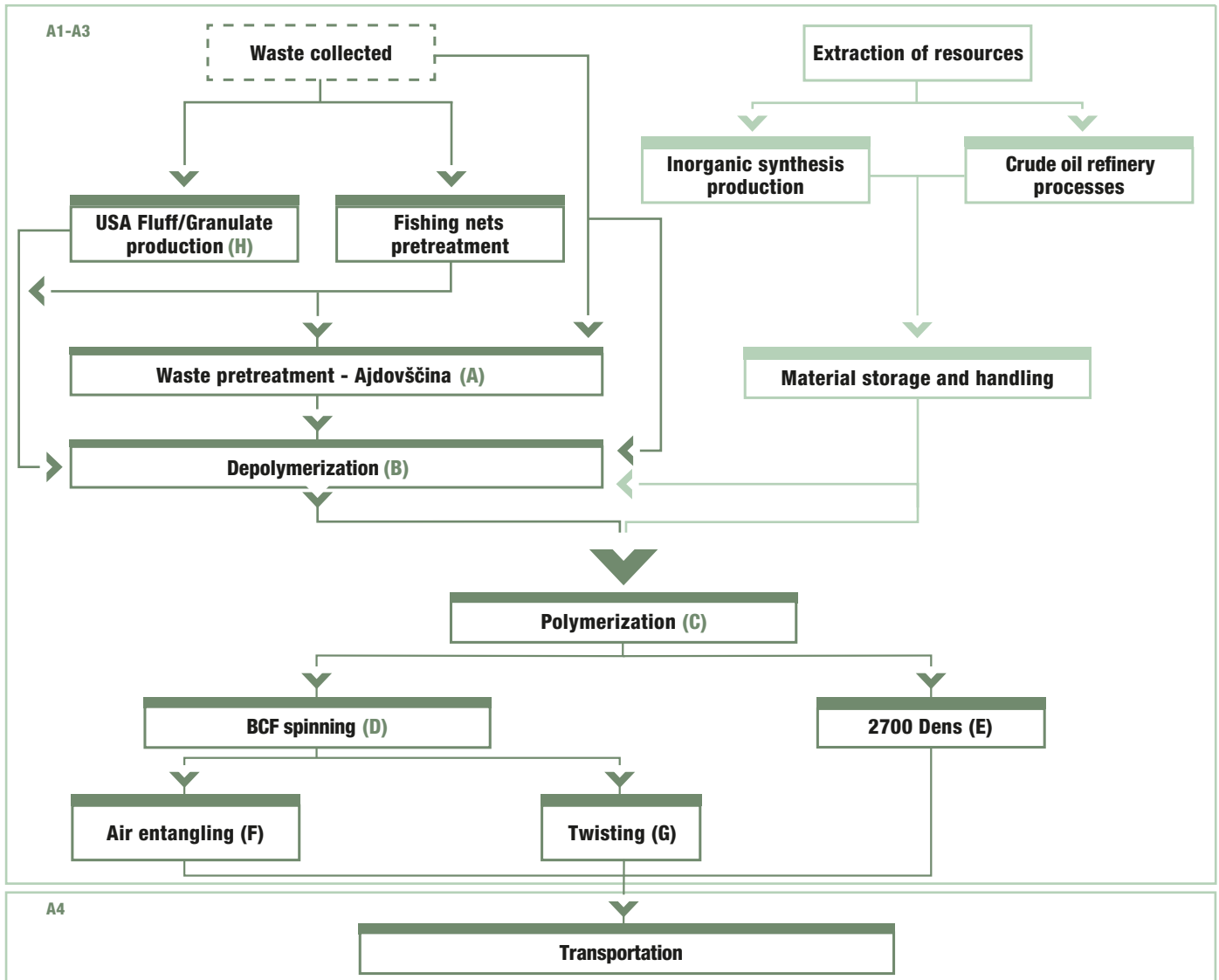
SYSTEM BOUNDARIES

This is a »Cradle-to-gate« with options EPD, including modules A1-A4 and D module. Modules A1-A3 are reported as one number.

Modules A1-A3 include processes, that provide materials and energy input for the system, manufacturing and transport processes up to the factory gate, as well as the waste processing.

Module A4 includes transport to the customers.

Module D indicates credits resulting from energy recovery of output waste from depolymerization process.



CONSIDERED LIFE CYCLE STAGES

Product stage			Construction process stage		Use stage							End of life stage				Resource recovery stage	
Raw materials	Transport	Manufacturing	Transport	Construction installation	Use	Maintenance	Repair	Replacement	Refurbishment	Operational energy use	Operational water use	De-construction demolition	Transport	Waste processing	Disposal	Reuse-Recovery-Recycling potential	
A1	A2	A3	A4	A5	B1	B2	B3	B4	B5	B6	B7	C1	C2	C3	C4	D	
X	X	X	X	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	MNA	X

(X = included in the LCA; MNA = module not assessed)

CUT OFF CRITERIA

Life Cycle Inventory data for a minimum of 99% of total inflows (mass and energy) module A is included.

All the energy inflows were considered in the study.

Primary packaging material was considered:

- **polymerization process: tank truck**
- **spinning, air entangling: paper tubes**

Excluded secondary packaging materials: paper boxes & separators, wooden pallets, labels, plastic bags, extensible film & adhesive tape.

TRANSPORT TO SITE (A4)

Means of transport: truck

Transport distance: average distance to customers 500 km

Capacity utilization: 85%

Fuel type: diesel

MODULE D

Waste sludge generated in module A3 is an input to energy recovery plant located outside Aquafil group. Burdens of waste combustion are considered in module A, while credits for avoiding production of electrical and thermal energy, in module D.

4 CONTENT DECLARATION

CONTENT OF THE PRODUCT

MATERIAL	SUBSTANCE	WEIGHT (%)	CAS NUMBER
polymer	polyamide 6	92-96	25038-54-4
pigments	several	0-3	several
spin finish	several	max.1	several
water	-	3-4	7732-18-5
TOTAL		100	-

ECONYL® BCF yarns do not contain any materials / substances hazardous to health and the environment (carcinogenic, mutagenic or toxic to reproduction, PBT, vPvB) or substances of very high concern (SVHC), according to Regulation (EC) No 1907/2006 and Regulation (EC) No 1272/2008.

All types of yarns are produced out of 100 % recycled PA6 polymer, with post-consumer and post-industrial recycled content certified by independent third party UL 13CA08665.

5 ENVIRONMENTAL PERFORMANCE

POTENTIAL ENVIRONMENTAL IMPACTS

A. ECONYL® AIR ENTANGLED YARNS

PARAMETER	UNIT	A1 - A3	A4	TOTAL	D
GWP100*	kg CO ₂ eq	1,37	0,03	1,40	-0,27
Ozone depletion potential	kg CFC-11 eq	4,59E-09	5,26E-18	4,59E-09	-6,13E-15
Acidification potential	kg SO ₂ eq	0,01	1,46E-04	0,01	-2,37E-04
Photochemical ozone creation potential	kg C ₂ H ₄ eq	9,50E-04	1,36E-05	9,64E-04	-2,34E-05
Eutrophication potential	kg PO ₄ -eq	2,71E-03	3,58E-05	2,75E-03	-4,50E-05
Abiotic depletion potential (elements)	kg Sb eq	1,14E-06	2,36E-09	1,14E-06	-6,43E-08
Abiotic depletion potential (fossil)	MJ	12,86	0,44	13,30	-3,46

Totals may not match, because of rounded data
*emissions and removal of fossil and biogenic carbon are considered

B. ECONYL® 2700 DENS

PARAMETER	UNIT	A1 - A3	A4	TOTAL	D
GWP100*	kg CO ₂ eq	1,33	0,03	1,36	-0,26
Ozone depletion potential	kg CFC-11 eq	2,97E-09	5,26E-18	2,79E-09	-5,96E-15
Acidification potential	kg SO ₂ eq	0,01	1,46E-04	0,01	-2,31E-04
Photochemical ozone creation potential	kg C ₂ H ₄ eq	9,20E-04	1,36E-05	9,34E-04	-2,27E-05
Eutrophication potential	kg PO ₄ -eq	2,59E-03	3,58E-05	2,63E-03	-4,38E-05
Abiotic depletion potential (elements)	kg Sb eq	9,43E-07	2,36E-09	9,45E-07	-6,25E-08
Abiotic depletion potential (fossil)	MJ	12,26	0,44	12,70	-3,36

Totals may not match, because of rounded data
*emissions and removal of fossil and biogenic carbon are considered

C. ECONYL® TWISTED YARNS

PARAMETER	UNIT	A1 - A3	A4	TOTAL	D
GWP100*	kg CO ₂ eq	1,38	0,03	1,41	-0,27
Ozone depletion potential	kg CFC-11 eq	4,61E-09	5,26E-18	4,61E-09	-6,17E-15
Acidification potential	kg SO ₂ eq	0,01	1,46E-04	0,01	-2,39E-04
Photochemical ozone creation potential	kg C ₂ H ₄ eq	9,56E-04	1,36E-05	9,70E-04	-2,35E-05
Eutrophication potential	kg PO ₄ -eq	2,73E-03	3,58E-05	2,77E-03	-4,53E-05
Abiotic depletion potential (elements)	kg Sb eq	1,15E-06	2,36E-09	1,15E-06	-6,47E-08
Abiotic depletion potential (fossil)	MJ	12,96	0,44	13,40	-3,48

*Totals may not match, because of rounded data
emissions and removal of fossil and biogenic carbon are considered

D. ECONYL® DIRECT EXTRUSION YARNS

PARAMETER	UNIT	A1 - A3	A4	TOTAL	D
GWP100*	kg CO ₂ eq	1,32	0,03	1,35	-0,26
Ozone depletion potential	kg CFC-11 eq	2,97E-09	5,26E-18	2,79E-09	-5,98E-15
Acidification potential	kg SO ₂ eq	0,01	1,46E-04	0,01	-2,31E-04
Photochemical ozone creation potential	kg C ₂ H ₄ eq	9,19E-04	1,36E-05	9,33E-04	-2,28E-05
Eutrophication potential	kg PO ₄ -eq	2,59E-03	3,58E-05	2,63E-03	-4,39E-05
Abiotic depletion potential (elements)	kg Sb eq	7,75E-07	2,36E-09	7,77E-07	-6,27E-08
Abiotic depletion potential (fossil)	MJ	12,16	0,44	12,60	-3,37

*Totals may not match, because of rounded data
emissions and removal of fossil and biogenic carbon are considered

USE OF RESOURCES

A. ECONYL® AIR ENTANGLED YARNS

PARAMETER	UNIT	A1-A3	A4	TOTAL	D
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	55,85	0,02	55,87	-1,08
Use of renewable primary energy resources used as raw materials	MJ	0	0	0	0
Total use of renewable primary energy resources; primary energy and primary energy resources used as raw materials	MJ	55,85	0,02	55,87	-1,08
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	13,23	0,44	13,67	-3,85
Use of non-renewable primary energy resources used as raw materials	MJ	34,75	0	34,75	0
Total use of non-renewable primary energy resources; primary energy and primary energy resources used as raw materials	MJ	47,98	0,44	48,42	-3,85
Use of secondary material	Kg	1,69	0	1,69	0
Use of renewable secondary fuels	MJ	0	0	0	0
Use of non-renewable secondary fuels	MJ	0	0	0	0
Use of net fresh water	m ³	0,03	2,84E-05	0,03	-5,87E-04

Totals may not match, because of rounded data

B. ECONYL® 2700 DENS

PARAMETER	UNIT	A1-A3	A4	TOTAL	D
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	46,23	0,02	46,25	-1,05
Use of renewable primary energy resources used as raw materials	MJ	0	0	0	0
Total use of renewable primary energy resources; primary energy and primary energy resources used as raw materials	MJ	46,23	0,02	46,25	-1,05
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	12,54	0,44	12,97	-3,75
Use of non-renewable primary energy resources used as raw materials	MJ	33,79	0	33,79	0
Total use of non-renewable primary energy resources; primary energy and primary energy resources used as raw materials	MJ	46,33	0,44	46,77	-3,75
Use of secondary material	Kg	1,65	0	1,65	0
Use of renewable secondary fuels	MJ	0	0	0	0
Use of non-renewable secondary fuels	MJ	0	0	0	0
Use of net fresh water	m ³	0,03	2,84E-05	0,03	-5,70E-04

Totals may not match, because of rounded data

C. ECONYL® TWISTED YARNS (DOPE DYED)

PARAMETER	UNIT	A1-A3	A4	TOTAL	D
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	56,07	0,02	56,10	-1,08
Use of renewable primary energy resources used as raw materials	MJ	0	0	0	0
Total use of renewable primary energy resources; primary energy and primary energy resources used as raw materials	MJ	56,07	0,02	56,10	-1,08
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	13,30	0,44	13,74	-3,88
Use of non-renewable primary energy resources used as raw materials	MJ	34,95	0	34,95	0
Total use of non-renewable primary energy resources; primary energy and primary energy resources used as raw materials	MJ	48,25	0,44	48,69	-3,88
Use of secondary material	Kg	1,70	0	1,70	0
Use of renewable secondary fuels	MJ	0	0	0	0
Use of non-renewable secondary fuels	MJ	0	0	0	0
Use of net fresh water	m ³	0,03	2,84E-05	0,03	-5,90E-04

Totals may not match, because of rounded data

D. ECONYL® DIRECT EXTRUSION YARNS

PARAMETER	UNIT	A1-A3	A4	TOTAL	D
Use of renewable primary energy excluding renewable primary energy resources used as raw materials	MJ	38,02	0,02	38,05	-1,05
Use of renewable primary energy resources used as raw materials	MJ	0	0	0	0
Total use of renewable primary energy resources; primary energy and primary energy resources used as raw materials	MJ	38,02	0,02	38,05	-1,05
Use of non-renewable primary energy excluding non-renewable primary energy resources used as raw materials	MJ	12,41	0,44	12,85	-3,76
Use of non-renewable primary energy resources used as raw materials	MJ	33,90	0	33,90	0
Total use of non-renewable primary energy resources; primary energy and primary energy resources used as raw materials	MJ	46,31	0,44	46,75	-3,76
Use of secondary material	Kg	1,65	0	1,65	0
Use of renewable secondary fuels	MJ	0	0	0	0
Use of non-renewable secondary fuels	MJ	0	0	0	0
Use of net fresh water	m ³	0,03	2,84E-05	0,03	-5,72E-04

Totals may not match, because of rounded data

WASTE PRODUCTION AND OUTPUT FLOWS

A. ECONYL® AIR ENTANGLED YARNS

PARAMETER	UNIT	A1 - A3	A4	TOTAL	D
Hazardous waste disposed	kg	2,53E-03	2,04E-08	2,53E-03	- 2,08E-09
Non-Hazardous waste disposed	kg	0,35	6,69E-05	0,35	- 1,92E-03
Radioactive waste disposed	kg	1,12E-04	5,41E-07	1,13E-04	- 1,57E-04

PARAMETER	UNIT	A1 - A3	A4	TOTAL	D
Components for re-use	kg	0	0	0	0
Materials for recycling	kg	0,34	0	0,34	0
Materials for energy recovery	kg	0	0	0	0
Exported energy	MJ	3,27	0	3,27	0

Totals may not match, because of rounded data

B. ECONYL® 2700 DENS

PARAMETER	UNIT	A1 - A3	A4	TOTAL	D
Hazardous waste disposed	kg	2,47E-03	2,04E-08	2,47E-03	-2,02E-09
Non-Hazardous waste disposed	kg	0,33	6,69E-05	0,33	-1,87E-03
Radioactive waste disposed	kg	9,57E-05	5,41E-07	9,62E-05	-1,52E-04

PARAMETER	UNIT	A1 - A3	A4	TOTAL	D
Components for re-use	kg	0	0	0	0
Materials for recycling	kg	0,28	0	0,28	0
Materials for energy recovery	kg	0	0	0	0
Exported energy	MJ	3,18	0	3,18	0

Totals may not match, because of rounded data

C. ECONYL® TWISTED YARNS

PARAMETER	UNIT	A1 - A3	A4	TOTAL	D
Hazardous waste disposed	kg	2,54E-03	2,04E-08	2,54E-03	-2,09E-09
Non-Hazardous waste disposed	kg	0,35	6,69E-05	0,35	-1,93E-03
Radioactive waste disposed	kg	1,13E-04	5,41E-07	1,14E-04	-1,57E-04

PARAMETER	UNIT	A1 - A3	A4	TOTAL	D
Components for re-use	kg	0	0	0	0
Materials for recycling	kg	0,34	0	0,34	0
Materials for energy recovery	kg	0	0	0	0
Exported energy	MJ	3,29	0	3,29	0

Totals may not match, because of rounded data

D. ECONYL® DIRECT EXTRUSION YARNS

PARAMETER	UNIT	A1 - A3	A4	TOTAL	D
Hazardous waste disposed	kg	2,47E-03	2,04E-08	2,47E-03	-2,02E-09
Non-Hazardous waste disposed	kg	0,33	6,69E-05	0,33	-1,87E-03
Radioactive waste disposed	kg	9,35E-05	5,41E-07	9,40E-05	-1,53E-04

PARAMETER	UNIT	A1 - A3	A4	TOTAL	D
Components for re-use	kg	0	0	0	0
Materials for recycling	kg	0,28	0	0,28	0
Materials for energy recovery	kg	0	0	0	0
Exported energy	MJ	3,18	0	3,18	0

Totals may not match, because of rounded data



ADDITIONAL INFORMATION

6

ADDITIONAL INFORMATION

This chapter is intended to provide specific additional information about the ECONYL® Regeneration System as well as some comments of its environmental benefit.

In 2009 we set ourselves the challenge of collecting waste material all over the world and turning it into recycled polymers. It is possible to mention other environmental benefits, besides those appreciated from the impact categories investigated in the present study. In fact, part of virgin raw materials extraction and natural resources exploitation is prevented by the use of waste otherwise disposed of.

The European Commission has estimated that the EU discards 5,8 million tons of textiles and apparel every year, 75% of this is sent to landfill or incinerated, but the vast bulk is destined for landfill. The USA generates 12,7 million tons of textile waste; of this only 14,9% is recycled (US Environmental Protection Agency, 2009), which means more than 85% is waste, again largely being sent to landfill.

To put this number in context, in 2009 a total of 71,6 million tons of fiber was used around the world. This means that the EU and the USA in one year alone discarded 18,5 million tons which is equal to 26% of annual global fiber usage.

Another aspect not directly emerging from the present study, which is worth a mention, is the contribution to the prevention of oceans pollution from the collection of fishing nets in their end-of-life.

7

DIFFERENCES VERSUS PREVIOUS VERSION OF EPD

The main reason for GWP reduction compared to previous version of EPD is due to implementation of 100% biomass steam consumption in AquafilSLO d.o.o. Ljubljana plant.

References

> **ISO 14025:2010**

Environmental labels and declarations — Type III environmental declarations — Principles and procedures

> **EN 15804:2012+A1**

Sustainability of construction works - Environmental product declarations - Core rules for the product category of construction products

> **General Programme instructions 3.01**

PCR 2012:01 Construction products and Construction services, Version 2.31,
Appendix B to PCR 2012:01 Construction products and construction services, Version 2.31

> **DIN 53830 Modified**

Testing of textiles; determination of linear density of single and plied yarns; simple yarns and plied yarns, textured yarns, short length method - Modified

> **ISO EN 2062**

Determination of single-end breaking force and elongation at break using constant rate of extension (CRE) tester

> **ISO 9001 : 2015**

Quality management systems — Requirements

> **ISO 14001 : 2015**

Environmental management systems — Requirements with guidance for use

> **OHSAS 18001: 2007**

Occupational Health and Safety Management