Environmental Product Declaration

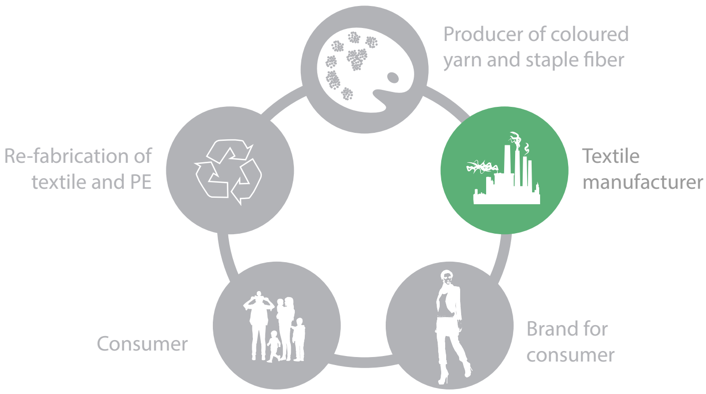
In accordance with ISO 14025 for: Polyester fabrics (dope dyed and piece dyed versions) from SMARTEX Solution Co., Ltd.

EPD registration number: S-P-01440

EPD®

e-dye® Integrated™

SMARTEX™



SMARTEX™

About SMARTEX

FABRIC EXCELLENCE AS e.dye® INTEGRATED PARTNER
SMARTEX is an exclusive converter of solution dyed polyester fabrics using the e.dye process. SMARTEX has converted 1,500 different fabrics using the e.dye process for technical performance knits through to workwear woven fabrics sold worldwide to brands requiring the highest technical standards.

Bult into everything SMARTEX do is not only pride of craftsmanship in the textile we produce, but through its use of e.dye extruded yarn, SMARTEX has pioneered the development of sustainable textiles: using less water, energy and chemicals that traditional piece dye which uses water, chemicals and heat to dye fabrics.

In addition, SMARTEX can offer superior color performance in resistance to fading in light (4X times the UV fade resistance than traditional piece dye according to our exclusive "Weather Test "results) and streamlined color management through its use of e.dye exclusive masterbatch extrusion process.

Vast color development capabilities
Through its use of e.dye extruded yarns SMARTEX, leads the industry in color development. Using a base of 2,500 colors of solution dye masterbatch made by e.dye, SMARTEX provides performance brands worldwide with superior color matching and color consistency. Our color development software, small batch production and testing from yarn right through to textiles is not matched anywhere else in our segment.

Innovation since 1985
The founder of SMARTEX started textile development in 1985 and utilizes the expertise of a group of dedicated fabric technicians and lab support developed over the last 35 years at our predecessor company. We currently ship to garment and equipment manufacturers throughout the globe. We currently have offices in Taiwan, Vietnam and China with active sales support in the USA and Europe.

R&D Support that constantly pushes the bounds of textile performance
In addition to our advanced fabric creation abilities, all of our products follow our simple principle with regards to performance guarantees: "testing, testing, testing." Our finished fabric lab has a full complement of world class testing equipment meeting global brand standards.

About e.dye

With over 20 years of experience, e.dye Ltd has the R&D and know-how to offer customers a wide range of support and value added services that provide a competitive edge.

By controlling the entire supply chain, we make our own recipe by producing our masterbatch 100% in-house. This is then sent throughout the supply chain with clear instructions for the best end result on fabric ready for Gmt production. We ensure that quality meets the highest standards.

e.dye® Waterless Color System™ offers an environmentally sustainable process for dyeing fabrics. Using the solution dyed polyester process, e.dye® requires no water to dye synthetics. By adding the color before the polymers are extruded, the color is inside the yarn, resulting in superior color performance.

e.dye is a solution dyed polyester color system with over 2,500 colors and a sophisticated color-matching process for garment textiles. e.dye is a paradigm shift in textile dyeing, because e.dye actually puts the color inside the yarn.

About EPD

An Environmental Product Declaration (EPD) is an independently verified and registered document that communicates transparent and comparable information about the life cycle environmental impact of products. The relevant standard for Environmental Product Declarations is ISO 14025, where they are referred to as "Type III environmental declarations". A Type III environmental declaration is created and registered in the framework of a programme, such as the International EPD® System.

The International EPD® System has, as a main objective, the ambition to enable and support organisations in any country to communicate quantified environmental information on the life cycle of their products in a credible, comparable, and understandable way. All EPDs registered in the International EPD® System are publically available and free to download on this website: www.environdec.com.

All EPDs are based on Product Category Rules providing rules, requirements, and guidelines for a defined product category. The overall goal of an EPD is to provide relevant and verified information to meet the communication needs in the various applications: procurement, ecodesign or environmental management systems. An important aspect of EPD is to provide the basis of a fair comparison of products and services by its environmental performance. EPDs can reflect the continuous environmental improvement of products and services over time and are able to communicate and add up relevant environmental information along a product's supply chain.

This is the e.dye technique

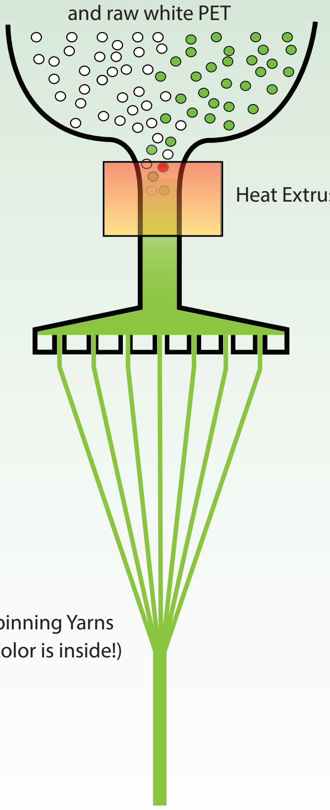
e.dye is a solution dyed polyester color system with over 2,500 colors and a sophisticated color-matching process for textiles. Solution dyeing means putting color inside the masterbatch chips, melt spun and extruded into yarn in color, instead of extruding raw white yarn that is later dyed in traditional water dye process.

What is e.dye?

Raw stock PET or rPET
Lusters available: bright, semidull and full dull. Up to 95% recycled.
GRS Certified.

Masterbatch Colors - in stock
Made in-house by e.dye, according to a recipe tied to 2,500 colors in the e.dye Color Bank.

Dosing Masterbatch
and raw white PET



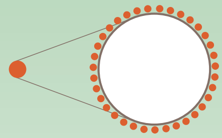
Heat Extrusion

Spinning Yarns
(Color is inside!)

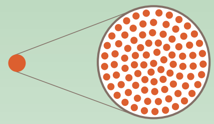
This process eliminates water consumption and reduces chemical use, energy comsumption and CO_2 emissions.

Why is e.dye better?

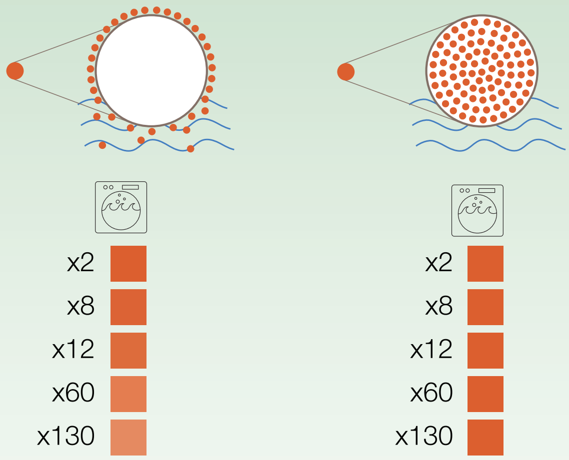
Traditional Piece Dye
Color is outside - of the surface of the yarn filament.



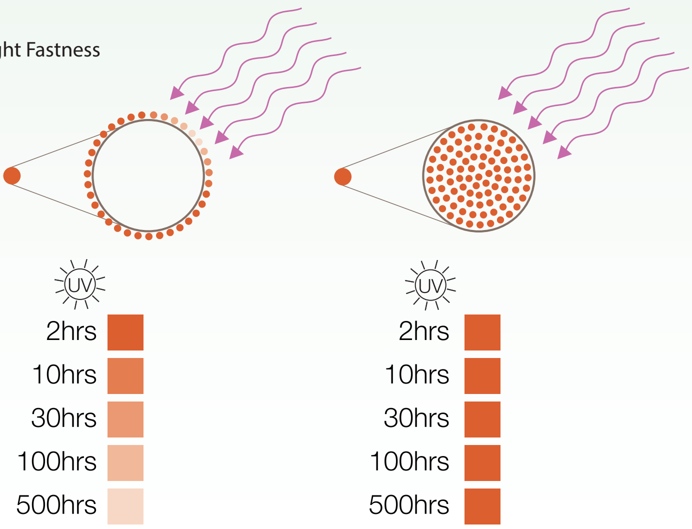
e.dye® Waterless Color System™
Color is inside - evenly dispersed throughout the entire yarn filament.



Wash Fastness



Light Fastness



Product information

Polyester fabrics (dope dyed and piece dyed versions)

Three types of 100 % polyester filament yarn fabrics have been studied in two versions: dope dye and piece dye, see Table 1.

The fabrics cover the most common fabric construction for garments: base layer (close to body), mid layer (for shell garments) and outer layer (protection layer).

Table 1. 100 % polyester fabrics.

	base layer	mid layer	outer layer
dope dye	Fabric 1: DSJ267-3SDAH	Fabric 3: DFL079-SDIBVI	Fabric 5: DPX038-2SD6R
piece dye	Fabric 2: KSJ284-2SDDA	Fabric 4: KPL229-4D1BVI	Fabric 6: PX1059-2DR

Other product information

Product identification:
CPC 267 Woven, knitted or crocheted fabrics

UN CPC code:
267

Geographical scope:
Global

LCA information

Goal of the study

An LCA study has been conducted in accordance with ISO 14044 and the requirements stated in the General Programme Instructions by The International EPD® System (EPD International, 2017).

The goal of the present LCA study has been to calculate environmental impact values for polyester fabrics (see Table 1), both dope dye and piece dye versions to create this Environmental Product Declaration, to be used for communicating environmental performance to customers.

Scope of the study

The scope of this study is cradle to gate to include all processes until fabric is produced, see Figure 1. All material and resource consumption is tracked back to the point of raw material extraction, mainly by using cradle-to-gate data from the Ecoinvent database. The functional unit of the study is 1 (one) square meter of fabric, in accordance with the Product Category Rules (PCR) (EPD International, 2012).

Data collection

The inventory for the LCA study was carried out during April/May 2018, collecting data for 2017 and 2018. The on-site visits covered all manufacturing processes:

- masterbatch production: single pigment colour (SPC) or multipigment colour (MPC),
- polyester filament yarn ´manufacturing: melt spinning, drawing and texturizing,
- knitting/weaving,
- fabric wet treatment (scouring, dyeing and finishing).

Allocation

Whenever it has been necessary to partition the system inputs and outputs, mass criteria has been used in accordance with the PCR (EPD International, 2012). Such situations have for example been when the share of energy and water consumption of an entire production plant has been allocated to the specific fabric based on the total production volume of the plant.

Cut-off rules

The PCR states that life cycle inventory data for a minimum of 99 % of total inflows to the three life cycle stages (up-stream, core and down-stream modules) shall be included and a cut-off rule of 1% regarding energy, mass and environmental relevance shall apply (EPD International, 2012).

The downstream process included in the system boundary, the transport to the customer (garment makers), gives a negligible contribution to the environmental impact (<1% for all categories) and is not included.

Assumptions and limitations

Some general assumptions have been made around transport vehicle to fit the database data from Ecoinvent (Ecoinvent, 2018). Country electricity mix datasets have been used for electricity when the site reports that they use the country electricity net.

Generally, the LCA data should be used with precaution if interpreted for any other purpose than this EPD.

Data quality

The data quality has been considerably increased by the experience from making a similar study in the past (EPD International, 2015).

Additional information about the LCA study

Time representativeness:
2017-2018

Database(s) and LCA software used:
SimaPro version 8.5.0.0,
(PRé Consultants, 2018)
ecoinvent version 3.4,
(Ecoinvent, 2018)

Description of system boundaries:
cradle-to-gate

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[1] Cradle-to-gate = all processes from cradle (mining site, forest etc.) to gate (until the goods is produced and ready for delivery at the factory gate).

4 Enviromental Product Declaration for SMARTEX

System diagram

The system boundaries of this EPD are decided by the Product Category Rules (PCR) and illustrated by Figure 1.

Garment manufacturing, retail, use and end-of-life processes are not included. The only downstream process included in the system boundary, the transport to the customer (garment makers), was found to give a negligible contribution to the environmental impact (<1% for all categories). Therefore the downstream phase is not reported separately.

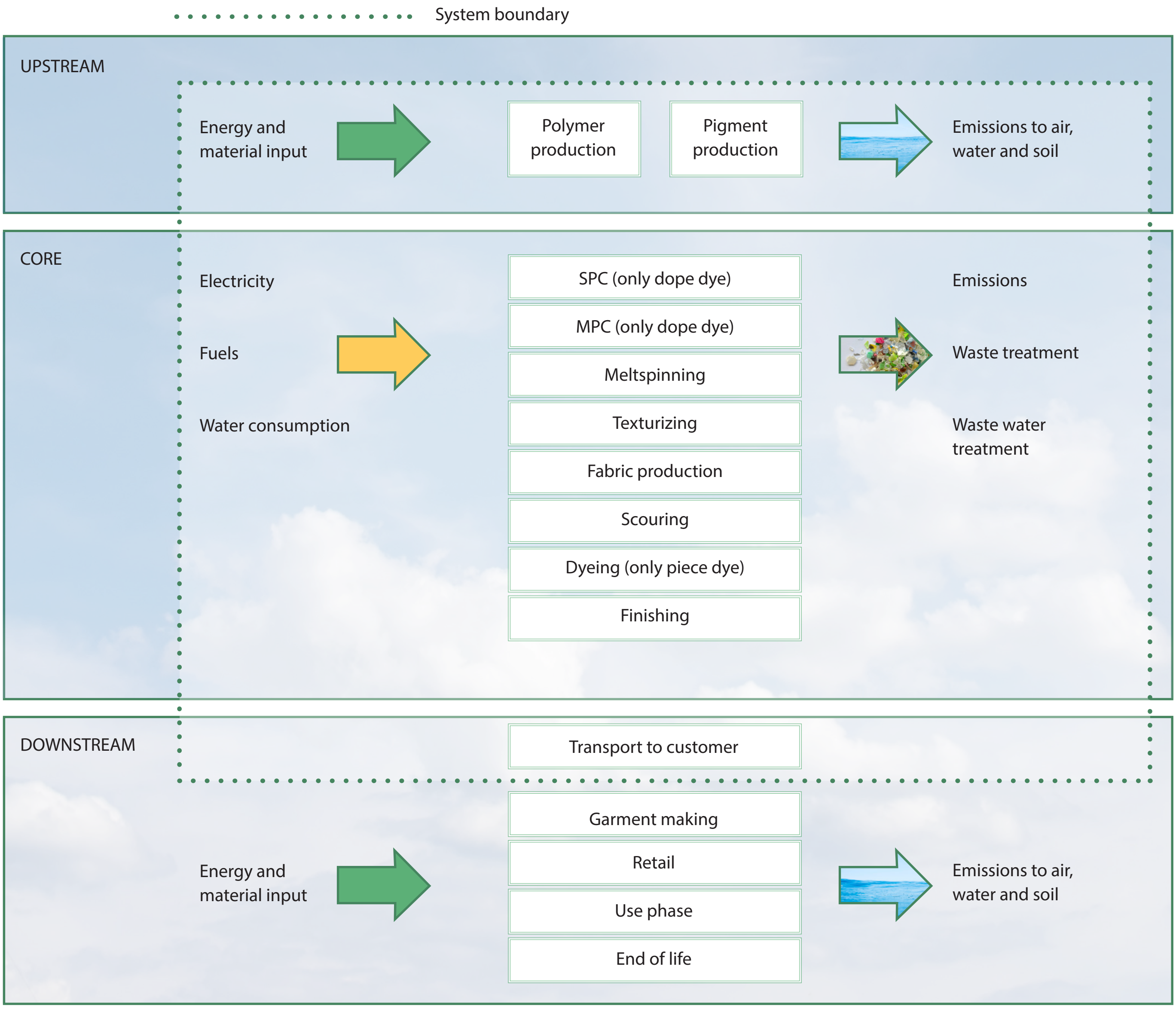


Figure 1. The system boundaries include upstream, core and downstream processes.

Content declaration

Product

The fabrics consist of 100 % polyester fabrics (PES, polyethylene terephthalate). The presence of substances above the restricted levels in applicable regulations (e.g. the European Regulations on substances and preparations) is controlled by Oeko-tex certification and supplier dialogue.

Recycled material

Provenience of recycled materials (pre-consumer or post-consumer) in the product:
The polyester is recycled post-consumer waste, certified via Global Recycle Standard (GRS).

Product characteristics

The product characteristics are presented in Table 2.

Table 2. Product Characteristics.

PRODUCT CHARACTERISTICS						
FABRICS	1. Base layer, dope dyed	2. Base layer, piece dyed	3. Mid-layer, dope dyed	4. Mid-layer, piece dyed	5. Outer layer, dope dyed	6. Outer layer, piece dyed
	DSJ267-3SDAH	KSJ284-2SDDA	DFL079-SDIBVI	KPL229-4D1BVI	DPX038-2SD6R	PX1059-2DR
CONSTRUCTIVE CHARACTERISTICS						
Composition Regulation (EU) No 1007/2011	PES: 100 %	PES: 100 %	PES: 100 %	PES: 100 %	PES: 100 %	PES: 100 %
Weave	Knitted fabrics ISO 8388/98				Woven fabrics ISO 3572/76	
Mass per unit area [g/m2] ISO 3801 EN 12127	160	160	140	140	150	150
Width [cm]	152	152	155	155	152	152
DYEING						
Colour Index	Solvent blue 122 ; Pigment blue 15:3 ; Carbon black CAS:1333-86-4		Carbon black CAS:1333-86-4		Pigment green 7 Solvent yellow 98	
PERFORMANCE CHARACTERISTICS						
Martindale Pilling test EN ISO 12945/02 - Part 2 (2000 rub)	4	4	3	3	N/A for woven	N/A for woven
Martindale Abrasion test EN ISO 12947/00, 12kpa	N/A for knitted	N/A for knitted	N/A for knitted	N/A for knitted	30,000	30,000
pH of water extract EN ISO 3071/06	5-7.5	5-7.5	5-7.5	5-7.5	5-7.5	5-7.5
Dimensional change to washing at 40°C[%] EN ISO 6330:2002 Tumble dry 50°C	+/-5%	+/-5%	+/-5%	+/-5%	+/-3%	+/-3%
COLOUR FASTNESS						
Light Xenon test UNI EN ISO 105 B02/04	6	4	6	4	6	4
Washing with mild detergent at 40°C ISO 105 C10:2006	4-5	4	4-5	4	4-5	4
Wash with commercial household detergent at 60°C UNI EN ISO 105 C06/99	4	3	4	3	4	3
Water UNI EN ISO 105 E01/98	4-5	4	4-5	4	4-5	4
Chlorine UNI EN ISO 105 E03/98	4-5	4	4-5	4	4-5	4
Acid and alkaline perspiration UNI EN ISO 105 E04/98	4-5	4	4-5	4	4-5	4
Dry and wet rubbing UNI EN ISO 105 X12/03	DRY 4-5 WET 4-5		DRY 4-5 WET 4-5		DRY 4-5 WET 4-5	

Environmental performance

The only downstream process included in the system boundary, the transport to the customer (garment makers), was found to give a negligible contribution to the environmental impact (<1% for all categories). Therefore the downstream phase is not reported separately.

Potential environmental impact

PARAMETER		UNIT	Fabric	Upstream	Core	TOTAL
Global warming potential (GWP)	Fossil	kg CO2 eq.	1.Base layer, dope dyed	0.36	1.69	2.05
			2.Base layer, piece dyed	0.32	1.93	2.25
			3.Mid-layer, dope dyed	0.35	1.76	2.11
			4.Mid-layer, piece dyed	0.31	1.99	2.30
			5.Outer layer, dope dyed	0.36	1.71	2.07
			6.Outer layer, piece dyed	0.32	1.96	2.29
	Biogenic	kg CO2 eq.	1.Base layer, dope dyed	0.050	0.101	0.151
			2.Base layer, piece dyed	0.049	0.167	0.215
			3.Mid-layer, dope dyed	0.049	0.094	0.142
			4.Mid-layer, piece dyed	0.048	0.156	0.204
			5.Outer layer, dope dyed	0.050	0.078	0.128
			6.Outer layer, piece dyed	0.049	0.164	0.214
	Land use and land transformation	kg CO2 eq.	1.Base layer, dope dyed	0.0004	0.0010	0.0014
			2.Base layer, piece dyed	0.0004	0.0026	0.0030
			3.Mid-layer, dope dyed	0.0004	0.0009	0.0013
			4.Mid-layer, piece dyed	0.0004	0.0024	0.0027
			5.Outer layer, dope dyed	0.0004	0.0010	0.0014
			6.Outer layer, piece dyed	0.0004	0.0027	0.0030
	TOTAL	kg CO2 eq.	1.Base layer, dope dyed	0.40	1.72	2.12
			2.base layer piece dye	0.36	2.03	2.39
			3.Mid-layer, dope dyed	0.39	1.80	2.18
			4.Mid-layer, piece dyed	0.35	2.08	2.43
			5.Outer layer, dope dyed	0.40	1.73	2.13
			6.Outer layer, piece dyed	0.36	2.08	2.44
Depletion potential of the stratospheric ozone layer (ODP)		kg CFC 11 eq.	1.Base layer, dope dyed	3.43E-08	2.72E-08	6.14E-08
			2.Base layer, piece dyed	3.08E-08	8.62E-08	1.17E-07
			3.Mid-layer, dope dyed	3.29E-08	2.58E-08	5.87E-08
			4.Mid-layer, piece dyed	3.01E-08	7.76E-08	1.08E-07
			5.Outer layer, dope dyed	3.38E-08	2.89E-08	6.26E-08
			6.Outer layer, piece dyed	3.11E-08	8.23E-08	1.13E-07
Acidification potential (AP)		kg SO2 eq.	1.Base layer, dope dyed	1.70E-03	8.10E-03	9.81E-03
			2.Base layer, piece dyed	1.34E-03	9.40E-03	1.07E-02
			3.Mid-layer, dope dyed	1.62E-03	8.53E-03	1.01E-02
			4.Mid-layer, piece dyed	1.31E-03	9.72E-03	1.10E-02
			5.Outer layer, dope dyed	1.67E-03	8.17E-03	9.83E-03
			6.Outer layer, piece dyed	1.35E-03	9.50E-03	1.09E-02

Eutrophication potential (EP)	kg PO43- eq.	1.Base layer, dope dyed	7.10E-04	1.48E-03	2.19E-03
		2.Base layer, piece dyed	6.15E-04	2.00E-03	2.62E-03
		3.Mid-layer, dope dyed	6.80E-04	1.52E-03	2.20E-03
		4.Mid-layer, piece dyed	6.01E-04	2.00E-03	2.60E-03
		5.Outer layer, dope dyed	6.99E-04	1.44E-03	2.14E-03
		6.Outer layer, piece dyed	6.21E-04	1.99E-03	2.62E-03
Formation potential of tropospheric ozone (POCP)	kg C2H4 eq.	1.Base layer, dope dyed	3.28E-04	1.01E-04	4.29E-04
		2.Base layer, piece dyed	3.92E-04	7.22E-05	4.65E-04
		3.Mid-layer, dope dyed	3.43E-04	9.53E-05	4.38E-04
		4.Mid-layer, piece dyed	4.01E-04	7.06E-05	4.72E-04
		5.Outer layer, dope dyed	3.27E-04	9.86E-05	4.26E-04
		6.Outer layer, piece dyed	3.95E-04	7.30E-05	4.68E-04
Water scarcity potential	m^3 eq.	1.Base layer, dope dyed	0.087	0.629	0.716
		2.Base layer, piece dyed	0.061	5.778	5.839
		3.Mid-layer, dope dyed	0.082	0.502	0.584
		4.Mid-layer, piece dyed	0.060	5.148	5.208
		5.Outer layer, dope dyed	0.085	0.672	0.757
		6.Outer layer, piece dyed	0.062	5.808	5.870

Use of resources

PARAMETER		UNIT	Fabric	Upstream	Core	TOTAL
Primary energy resources – Renewable	Use as energy carrier	MJ, net calorific value	1.Base layer, dope dyed	0.30	2.00	2.30
			2.Base layer, piece dyed	0.27	2.51	2.78
			3.Mid-layer, dope dyed	0.29	2.06	2.35
			4.Mid-layer, piece dyed	0.26	2.55	2.81
			5.Outer layer, dope dyed	0.30	2.05	2.35
			6.Outer layer, piece dyed	0.27	2.59	2.86
	Used as raw materials	MJ, net calorific value	All fabrics[2]	0	0	0
	TOTAL	MJ, net calorific value	1.Base layer, dope dyed	0.30	2.00	2.30
			2.Base layer, piece dyed	0.27	2.51	2.78
			3.Mid-layer, dope dyed	0.29	2.06	2.35
			4.Mid-layer, piece dyed	0.26	2.55	2.81
			5.Outer layer, dope dyed	0.30	2.05	2.35
			6.Outer layer, piece dyed	0.27	2.59	2.86
Primary energy resources – Non-renewable	Use as energy carrier	MJ, net calorific value	1.Base layer, dope dyed	5.36	16.16	21.51
			2.Base layer, piece dyed	4.85	20.51	25.37
			3.Mid-layer, dope dyed	5.15	16.80	21.95
			4.Mid-layer, piece dyed	4.75	20.68	25.42
			5.Outer layer, dope dyed	5.29	16.91	22.19
			6.Outer layer, piece dyed	4.91	21.30	26.20
	Used as raw materials	MJ, net calorific value	1.Base layer, dope dyed	1.01E-02	0.00E+00	1.01E-02
			2.Base layer, piece dyed	9.99E-03	0.00E+00	9.99E-03
			3.Mid-layer, dope dyed	9.78E-03	0.00E+00	9.78E-03
			4.Mid-layer, piece dyed	9.77E-03	0.00E+00	9.77E-03
			5.Outer layer, dope dyed	1.00E-02	0.00E+00	1.90E-02
			6.Outer layer, piece dyed	1.01E-02	0.00E+00	1.01E-02

[2] No renewable primary energy resources are used as raw materials for either fabric 1, 2, 3, 4, 5 or 6.

Primary energy resources – Non-renewable	TOTAL	MJ, net calorific value	1.Base layer, dope dyed	5.37	16.16	21.52
			2.Base layer, piece dyed	4.86	20.51	25.38
			3.Mid-layer, dope dyed	5.16	16.80	21.95
			4.Mid-layer, piece dyed	4.76	20.68	25.43
			5.Outer layer, dope dyed	5.30	16.91	22.21
			6.Outer layer, piece dyed	4.92	21.30	26.21
Secondary material		kg	1.Base layer, dope dyed	0.192	0	0.192
			2.Base layer, piece dyed	0.190	0	0.190
			3.Mid-layer, dope dyed	0.186	0	0.186
			4.Mid-layer, piece dyed	0.186	0	0.186
			5.Outer layer, dope dyed	0.190	0	0.190
			6.Outer layer, piece dyed	0.192	0	0.192
Renewable secondary fuels		MJ, net calorific value	All fabrics	0	0	0
Non-renewable secondary fuels		MJ, net calorific value	All fabrics	0	0	0
Net use of fresh water		m^3	1.Base layer, dope dyed	0	0.0032	0.0032
			2.Base layer, piece dyed	0	0.0246	0.0246
			3.Mid-layer, dope dyed	0	0.0028	0.0028
			4.Mid-layer, piece dyed	0	0.0216	0.0216
			5.Outer layer, dope dyed	0	0.0030	0.0030
			6.Outer layer, piece dyed	0	0.0231	0.0231

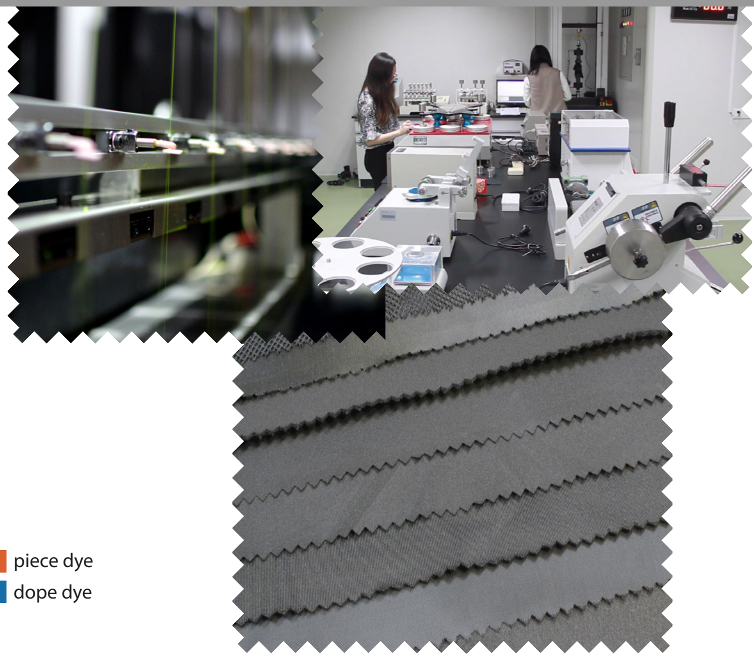
Waste production and output flows

Waste production

PARAMETER	UNIT	Fabric	Upstream	Core	TOTAL
Hazardous waste disposed	kg	All fabrics	0	0	0
Non-hazardous waste disposed	kg	1.Base layer, dope dyed	0	0.09	0.09
		2.Base layer, piece dyed	0	0.06	0.06
		3.Mid-layer, dope dyed	0	0.08	0.08
		4.Mid-layer, piece dyed	0	0.06	0.06
		5.Outer layer, dope dyed	0	0.06	0.06
		6.Outer layer, piece dyed	0	0.06	0.06
Radioactive waste disposed	kg	All fabrics	0	0	0

[3] No renewable secondary fuels are used for neither fabric 1, 2, 3, 4, 5 or 6.
[4] No non-renewable secondary fuels are used for neither fabric 1, 2, 3, 4, 5 or 6.
[5] No hazardous waste is disposed for neither fabric 1, 2, 3, 4, 5 or 6.
[6] No radioactive waste is disposed for neither fabric 1, 2, 3, 4, 5 or 6.

Additional information



The diagrams below show selected results from the Environmental performance tables per kilogram (kg) fabric.

The water savings from e.dye technology for the knitted base layer is illustrated in Figure 2. 134 litres of water are saved for each kilogram fabric that is produced with e.dye technology instead of conventional dyeing[7].

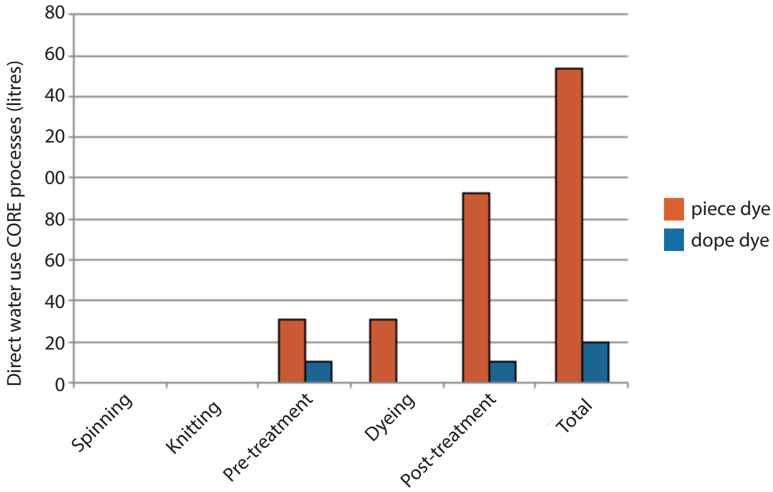


Figure 2. The water savings with the e.dye process (dope dye) compared to conventional dyeing (piece dye) for the core processes. Figures per kg of fabric.

The global warming potential for the core processes for the base layer is shown in Figure 3. The spinning step includes masterbatch production as well as polyester filament fibre spinning, and wet treatment includes scouring, dyeing and finishing. The global warming potential for the spinning step is very high compared with the knitting and wet treatment. Please note that the figures report the current situation where the fibre production is performed in small scale at SMARTEX Solution Co., Ltd. The results are foreseen to improve with higher efficiency expected at a large scale production facility. The relative importance of the wet treatment step will then increase and the reduction of climate impact in percentage from the e.dye technology will be higher.

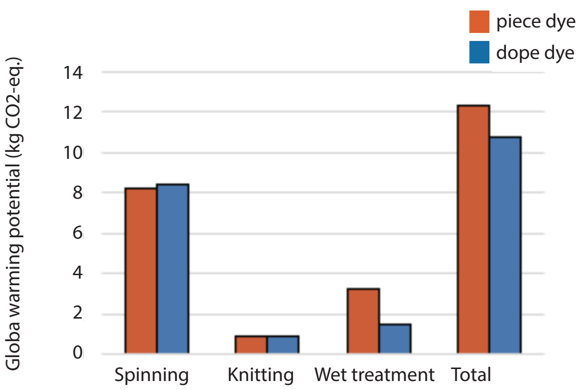


Figure 3. The global warming potential with the e.dye process (dope dye) compared to conventional dyeing (piece dye) for the core processes. Figures per kg of fabric.

Figure 4 shows the use of chemicals (amounts of input chemicals) for the core processes for the base layer.

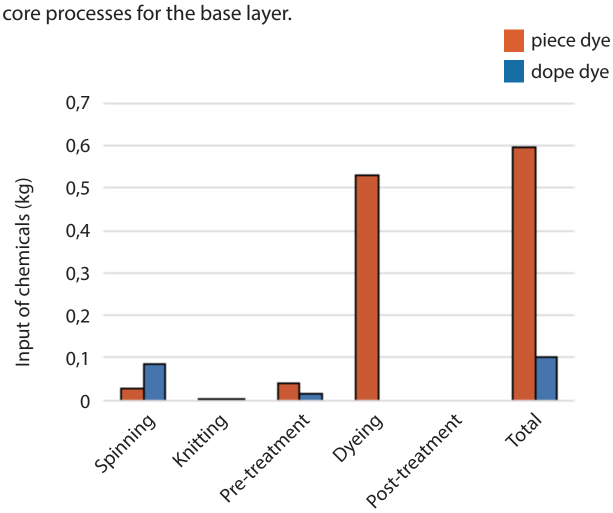


Figure 4. The amount of input chemicals for the e.dye process (dope dye) compared to conventional dyeing (piece dye) for the core processes. Figures per kg of fabric.

[7] The Taimao factory has a rather large rate of rework, and the average consumption of water is reported to 154 kg water per kg fabric. The theoretical water usage for piece dye is 50 liters of water per kg fabric.

Programme-related information and verification

The EPD owner has the sole ownership, liability, and responsibility for the EPD. EPDs within the same product category but from different programmes may not be comparable.

Programme:
The International EPD® System

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EPD registration number:
S-P-01440

Published:
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Product Category Rules:
pcr2012-14 v2.0 Woven knitted or crocheted fabrics

Product group classification:
UN CPC 267 Woven fabrics (except special fabrics) of man-made filaments and staple fibres
UN CPC 281 Knitted or crocheted fabrics

Reference year for data:
2017-2018

Geographical scope:
Global

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Product category rules (PCR):
pcr2012-14 v2.0 Woven knitted or crocheted fabrics
UN CPC 267 Woven fabrics (except special fabrics) of man-made filaments and staple fibres
UN CPC 281 Knitted or crocheted fabrics

PCR review was conducted by:
The Technical Committee of the International EPD® System

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

☐ EPD process certification ☒ EPD verification

Third party verifier:

Marcus Wendin
Miljögiraff AB

Approved by: The International EPD® System

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

☐ Yes ☒ No

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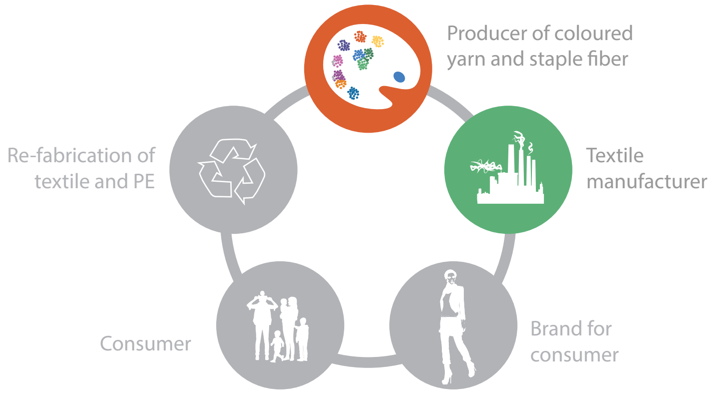

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