

Polyester: What It Is, Properties, Uses and How It Is Made

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In one paragraph

Polyester is a synthetic fibre made from a plastic, almost always polyethylene terephthalate (PET), the same polymer most drinks bottles are made of. PET is made from two chemicals that come from oil and natural gas, purified terephthalic acid and monoethylene glycol; it is melted and pushed through fine holes to make filaments. Polyester fabric is strong, dries fast, resists creasing and shrinking, and absorbs very little water, which is also why it can feel clammy. It is the most produced fibre in the world: 59% of all fibre made in 2024, according to Textile Exchange.

At a glance

Polyester vs cotton

	Polyester	Cotton
What it is	A synthetic polymer, PET, made from oil and gas	A natural cellulose fibre, the seed hair of the cotton plant
Share of world fibre production, 2024	59%, about 78 million tonnes	19%, about 24.5 million tonnes (2023/24 crop)
Price, Chinese futures, 30 September 2026	Staple fibre: 8,208 CNY a tonne	Cotton: 15,620 CNY a tonne
Density	1.38 g/cm ³	1.52 to 1.56 g/cm ³
Moisture regain	About 0.4%	7.0 to 8.5%
Moisture allowance in EU fibre-content calculations	1.50%	8.50%
Effect of water on strength	Takes up almost no water	Stronger wet than dry
Heat	Softens, then melts at 250 to 260 °C; iron at two dots, no more than 160 °C	Does not melt; decomposes, rapidly above about 246 °C; iron at up to three dots, 210 °C
Creasing	Resists creases; holds heat-set pleats	Creases easily
End of life	Does not biodegrade; can be remelted	Biodegrades

Properties of polyester fibre

Property	Value	Source
Density	1.38 g/cm ³ (amorphous PET 1.335, crystalline 1.455)	MiniFIBERS data sheet; Di Lorenzo (2024)
Tenacity, apparel staple fibre	6.0 to 6.7 g/den (5.3 to 5.9 cN/dtex)	Indo Rama Synthetics staple fibre grades
Tenacity, high-tenacity industrial filament	5.8 to 8.2 cN/dtex (583 to 820 mN/tex)	Diolen industrial yarn data, as reproduced by Politecnico di Milano
Tenacity, all grades	2.2 to 9.5 g/den	CAMEO
Elongation at break	Apparel staple 18 to 27%; industrial filament 14.7 to 20.5%; all grades 10 to 50%	Indo Rama; Diolen; CAMEO, as above

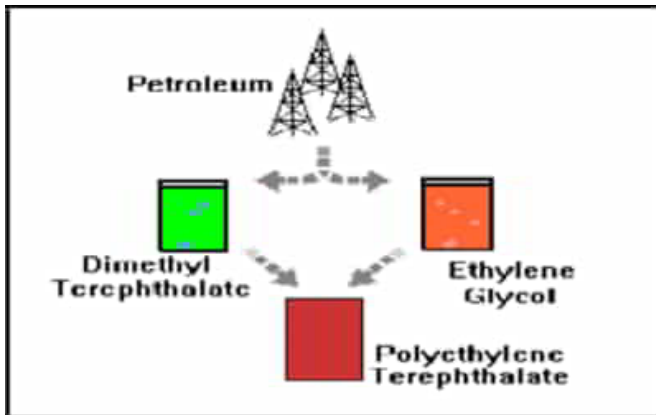
Property	Value	Source
Moisture regain	About 0.4% (0.1 to 0.4%)	CAMEO
Agreed moisture allowance, EU	1.50%	Regulation 1007/2011, Annex IX
Glass transition temperature	About 69 °C for amorphous PET; higher as crystallinity rises (69 to 115 °C measured on PET chips)	Di Lorenzo (2024); Kim and colleagues (2026)
Melting point	250 to 260 °C	Di Lorenzo (2024), about 250 °C; MiniFIBERS, 260 °C
Limiting oxygen index (LOI)	About 21%: 21.1% for an untreated PET fabric, 21.4% for moulded PET	Inprasit and colleagues (2026), tested to ASTM D2863; Xiang and colleagues (2022)

Key figures and their sources

- The EU's textile-names regulation describes polyester as a "fibre formed of linear macromolecules comprising at least 85% (by mass) in the chain of an ester of a diol and terephthalic acid" (Regulation (EU) No 1007/2011, Annex I).
Source: Regulation (EU) No 1007/2011 (eur-lex.europa.eu)
- The US rule, 16 CFR 303.7(c), is broader: a manufactured fibre of "any long chain synthetic polymer composed of at least 85% by weight of an ester of a substituted aromatic carboxylic acid".
Source: 16 CFR 303.7(c) (ecfr.gov)
- Its moisture regain, the water it holds as a percentage of its dry weight, is about 0.4%, against 7.0 to 8.5% for cotton, according to the conservation reference CAMEO of the Museum of Fine Arts, Boston (polyester, cotton).
Source: polyester (cameo.mfa.org)
- The fibre is supplied stabilised too: one producer specifies no more than 5.5% shrinkage in dry heat at 160 °C for its apparel staple (Indo Rama Synthetics).
Source: Indo Rama Synthetics (indoramaindia.com)
- Under the EU allowances in Annex IX of Regulation 1007/2011, 1.50% for polyester and 8.50% for cotton, the blend's allowance is 3.95%.
Source: Annex IX of Regulation 1007/2011 (eur-lex.europa.eu)
- GINETEX explains that the number in the wash tub is the maximum washing temperature, and that the dots in the iron set the maximum sole-plate temperature: one dot 120 °C, two dots 160 °C, which it equates with the "wool/silk/polyester/viscose" setting of an iron, and three dots 210 °C (GINETEX care symbols).
Source: GINETEX care symbols (ginetex.net)
- In the usual continuous process the two are first esterified at 240 to 260 °C under pressure, then polymerised in the melt as the temperature is raised to 280 to 290 °C under a vacuum below 25 Pa, which draws off the glycol released as the chains grow; antimony trioxide is the usual catalyst (NPTEL course notes, IIT Delhi).
Source: NPTEL course notes, IIT Delhi (archive.nptel.ac.in)
- A Goodyear patent gives about 280 to 310 °C as the preferred temperature at which PET is extruded (US 5,049,339).
Source: US 5,049,339 (patents.google.com)

Formulas and diagrams

Tenacity is quoted both in grams per denier, the unit producers still use, and in centinewtons per decitex ($1 \text{ g/den} = 0.883 \text{ cN/dtex}$); the textile unit converter does the conversion.



The older DMT route from petroleum to PET. Most plants now start from purified terephthalic acid instead of DMT.

Revision questions

The questions readers ask most, with the article's own answer.

Is polyester plastic?

Yes. Polyester fibre is a thermoplastic, and the law defines it by its chemistry.

Is polyester breathable?

Breathability has two parts, and polyester scores differently on each. The first is whether air and water vapour pass through the fabric, which depends on the yarn and the construction far more than on the fibre: an open polyester knit breathes, a dense polyester taffeta barely does.

Does polyester shrink?

Not in normal washing, once the fabric has been heat-set. In finishing, the fabric is held at its finished width and heated in dry air, typically at 190 to 220 °C (heat setting), far above any washing temperature.

Does polyester pill?

Spun polyester can, and its pills tend to stay. Rubbing teases fibre ends out of the surface and rolls them into small balls.

Test yourself

Ten questions on this topic. Answer them without looking, then check on the last page.

1. What polymer is polyester fibre almost always made of?
2. What is the moisture regain of polyester compared with cotton (CAMEO)?
3. At what temperature is polyester fabric typically heat-set in finishing?
4. Why do pills on polyester fabric stay on the surface?
5. What is the glass transition temperature of amorphous PET?
6. How does polyester behave in a burn test?

7. At what temperatures are PTA and MEG first esterified in the usual continuous PET process?
8. What is DTY in polyester filament yarn?
9. Why is polyester dyed with disperse dyes?
10. Who discovered polyethylene terephthalate?

Answers

Each answer is stated in the article; the section to read again is named after it.

1. **Polyethylene terephthalate (PET).**
See: Opening
2. **About 0.4%, against 7.0 to 8.5% for cotton (CAMEO).**
See: Is polyester breathable?
3. **190 to 220 °C, in dry air.**
See: Does polyester shrink?
4. **Owing to the high strength of polyester fibres, the pills cannot drop off.**
See: Does polyester pill?
5. **About 69 °C.**
See: Properties of polyester fibre
6. **It melts and burns with a shiny, yellow-orange, sooty flame and a sweetish smell, and leaves a hard bead.**
See: How to identify polyester: the burn test and the microscope
7. **240 to 260 °C under pressure.**
See: How polyester is made › From oil and gas to PET
8. **Draw-textured yarn: POY drawn and crimped on a texturing machine.**
See: How polyester is made › Drawing: POY, FDY and DTY
9. **It has none of the chemical sites that the dyes for cotton or wool attach to.**
See: How polyester is made › Heat setting and dyeing
10. **John Rex Whinfield and James Tennant Dickson of the Calico Printers' Association.**
See: A short history

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