

Fiber Properties Comparison							
FIBER PROPERTY	NYLON 6	PET	PLA	RAYON	COTTON	SILK	WOOL
Specific Gravity	1.14	1.39	1.25	1.52	1.52	1.34	1.31
Tg (°C)	90	125	55 - 60	-	-	-	-
Tm (°C)	215	255	130 - 175	None	None	None	None
Tenacity (g/d)	5.5	2.4 - 7.0	2.0 - 6.0	2.5	4.0	4.0	1.6
Moisture Regain (%)	4.1	0.2 - 0.4	0.4 - 0.6	11	7.5	10	14 - 18
Elastic Recovery (5% strain)	89	65	93	32	52	52	69
Heat of Combustion (MJ/kg)	3.1	25 - 30	19	17	17	-	21
Flammability	Medium smoke; Melts	High smoke; Burns 6 min. after flame removed	Low smoke; Burns 2 min. after flame removed	Burns	Burns	Burns	Burns slowly; Self-extinguishing
LOI (%)	20 - 24	20 - 22	26 - 35	17 - 19	16 - 17	-	24 - 25
UV Resistance	Poor	Fair	Excellent	Poor	Fair - Poor	Fair - Poor	Fair
Refractive Index	1.52	1.54	1.35 - 1.45	1.52	1.53	1.54	1.54
Contact Angle (°)	70	82	76	-	-	-	-
Wicking (L-W slope higher slope, more wicking)	-	0.7 - 0.8 (no finish)	6.3 - 7.5 (no finish); 19 - 26 (with finish)	-	-	-	-

Key Points from Fiber Comparisons

Positives:

PLA is the only melt processable natural based polymer

PLA has a lower specific gravity than natural fibers

Optical composition allows control of crystalline melting point

The tenacity of PLA is higher than natural fibers

Moisture regain of PLA is significantly lower than natural fibers

Elastic recovery is superior to all other fibers compared at 5% strain

PLA has a lower heat of combustion than PET

Burns with lower smoke than synthetic polymers compared

PLA has outstanding UV resistance

PLA has a low refractive index which produces intense colors on dyeing

The low contact angle compared with PET leads to improved wicking with water

PLA shows faster moisture spread than PET

Negatives:

Poor alkali resistance causes strength loss in conventional disperse dye process

Low crystalline melt temperature leads to low ironing temperature

Reference for Properties in Table

specific gravity

Nylon 6, Nylon 6-6, PET, Rayon, Cotton, Silk, Wool, Acrylic-Fiber Science; Warner, Steven B.; Prentice-Hall, 1995; p. 40.

PLA-NatureWorks Internal Reports

Tm

Nylon 6, PET, Acrylic-Synthetic Fibers; Fourné, Franz; Hanser/Gardener Publications, Inc.; 1999; pp. 846-849.

PLA-NatureWorks Test Data, sample 015-015-05; ASTM E-1356; NatureWorks Internal Reports

tenacity

Nylon 6, Rayon, Cotton, Silk, Wool, Acrylic-Fiber Science; Warner, Steven B.; Prentice-Hall, 1995; p. 40.

PET-2003 Man-Made Fiber Chart, Textile World, Vol. 152, No. 11, November, 2002

PLA-2003 Man-Made Fiber Chart, Textile World, Vol. 152, No. 11, November, 2002

moisture regain

Nylon 6, Nylon 6-6, PET, Cotton, Silk, Wool, Acrylic-ASTM D-2654-89a, Fiber Science; Warner, Steven B.; Prentice-Hall, 1995; p. 105.

Rayon-Wellington Sears Handbook; ASTM D1909-1994;

PLA-University of Nebraska Research Report; ASTM D-2654-89a; Dr. Lois Scheyer; November 24, 1998.

Reference for Properties in Table (cont'd)

elastic recovery

Nylon 6, PET, Rayon, Cotton, Silk, wool, acrylic-5% Strain, ASTM D1774-94; Fiber Science; Warner, Steven B.; Prentice-Hall, 1995

PLA-Report by Dr. B. Pourdeyhimi, Report-ASTM D-1774-95; 1999.

heat of combustion

Nylon 6, PET, Acrylic-Fire Protection Handbook, 18th ed.; 1997

PLA-Cargill Research Report by S. Chessen; Also Akzo Nobel Report; ASTM E1354-90

flammability

Cotton, PET, PLA-Testing done by VTEC Report of Results; ASTM E-1354

Generic Descriptions, other various fibers; Various sources

LOI%

Nylon 6, Nylon 6-6, PET, Cotton, Silk, Wool, Acrylic-Fire

Protection Handbook, 18th ed.; table A-2

PLA-Reports by VTEC and Akzo; ASTM D-2863.

UV resistance

Acrylic, Nylon, Cotton, Wool-Encyclopedia of Polymer Science & Engineering, 2nd ed., Vol. 1; p. 342

PET, PLA-NatureWorks Internal Report; PLA Fiber/NW Stability Under UV Radiation; Exposure ASTM G26-96, method 3; Fiber Tenacity ASTM D-2256; Nonwoven Tensile Properties ASTM D-5035; Tim Vanyo; 12/10/1998

refractive index

Rayon, cotton, wool, Nylon, PET-Fiber Science; Warner, Steven B.; Prentice-Hall, 1995; p. 217

PLA-High Speed Spinning; Tokyo Institute of Technology; Dr. Takahashi, 1/06/00

contact angle, wicking

PLA, PET-TRI report, ARS #689 10/1998

Ingeo Worldwide Offices

Amsterdam, Hong Kong, London,
Milan, Minneapolis, New York and Tokyo

Contact

1 800 66 IN GEO (USA only)
+1 989 633 1746 (Worldwide)

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15305 Minnetonka Blvd., Minnetonka MN 55345
GSFIB18092005V2



www.ingeofibers.com

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