



Technical Properties of Synthetic Fibres

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Technical Properties of Synthetic Fibres

Material	High Modulus Polyethylene	High Modulus Polyester (Liquid Crystal Polymer)	High Modulus Polyamide (Para-aramid)	PBO	Polyester	Polyamide	Polypropylene	Spun Polypropylene
Trade Names	Dyneema® Spectra®	Vectran®	Technora® Twaron®, Kevlar®	Zylon®	Dacron®, Trevira®	Nylon, Perlon®	PP Multi-filament	Barry Spun PP
Tenacity in g/den	38	23	22-28	37	9	8-6	5-8	5-6
Tenacity in daN/mm ²	360	230	250-400	Ca. 400	110	90-95	50-75	50-55
Elongation at Break	3,80%	3,30%	3,40%	2,8%	10-17%	18-24%	13-17%	14-17%
Specific Gravity in g/cm ³	0,97	1,4	1,44-1,45	1,52	1,40	1,14	0,91	0,91
Modulus in daN/mm ²	10 500	10 000	13 000 - 15 000	18 000	1 000 - 1 500	25 - 350	50 - 500	400
Melting Point in °C	140 - 150°C	280-330°C	Carbonisation at 500°C does not burn or melt	Carbonisation at 650°	225-240°C	215-260°C	165-175°C	165-175°C
Resistance to short-term heat in °C	70°C	200°C	350°C	500°C	170°C	130°C	80°C	80°C
UV-Resistance	Excellent	Limited	Limited	Limited	Excellent	Good	Sufficient	Excellent
Resistance to Alkalis	Excellent	Excellent	Predominantly good	Excellent	Good at room temp.	Good at low concentration	Excellent	Excellent
Resistance to Acids	Excellent	Excellent	Predominantly good	Good	Predominantly good	Predominantly good	Excellent	Excellent
Resistance to Petroleum Based products	Excellent	Excellent	Excellent	Excellent	Excellent	Good	Excellent	Excellent
Resistance to bleaches – solvents	Excellent	Excellent	Poor in bleach. Excellent solvent resistance	unknown	Excellent	Will bleach. Degrades in mineral acids & oxidizing agents. Insoluble in organic solvents	Excellent	Excellent
Creep	Creeps at high loads	Immeasurable	Hardly measurable	Immeasurable	Hardly measurable	Slight creep und. Load	At high loads	At high loads
Residual Knot Strength	~ 50%	~ 50%	~ 30%	~ 50%	~ 50%	~ 50%	~ 50%	~ 50%

(Source : Producers literature)

Tensile Properties of Synthetic Fibres

Fibres		Density	Tensile Strength		Tensile Modulus		Elongation at break
		g/cm ³	cN/dtex	kg/mm ²	cN/dtex	kg/mm ²	%
Aramid	Technora	1.39	25	350	520	7400	3.4
	PPTA (reg)	1.44	19	285	410	6000	3.8
	PPTA (HM)	1.45	19	285	880	13000	2.4
	MPIA	1.38	4.9	70	53	800	38
Organic Fibre	Polyester	1.38	8.1	115	88	1300	13
	Nylon 6	1.14	8.3	100	44	500	19
	HMPE	0.98	29	265	880	8800	3.8
	Polyarylate	1.4	20	290	490	7100	3.7
Inorganic Fibre	Steel	7.85	3	240	250	20000	1.7
	E-glass	2.54	8.5	220	250	7000	4
	Carbon (PAN HT)	1.8	23	420	1240	24000	1.7
	Carbon (PAN HM)	1.81	13	250	2120	40000	0.6
	Carbon(Gp)	1.65	4.4	75	180	3000	1.3

Chemical Resistance of Dyneema®

Chemical Resistance of HMPE (Applies only to rope made of Dyneema®)		
Resistance to acids		Excellent
Resistance to alkali		Excellent
Resistance to most materials		Excellent
Resistance to water		Excellent
Aviation jet A fuel (ISO 1817 test liquid F)	RTCA DO160	Excellent
Hydraulic fluid (ISO 1817 test liquid 103)	RTCA DO160	Excellent
Lubricating oil (ISO 1817 test liquid 101)	RTCA DO160	Excellent
Solvents and cleaning fluid (Isopropyl alcohol)	RTCA DO160	Excellent
De-icing fluid (Ethylene glycol)	RTCA DO160	Excellent
Insecticide (Pyrethroid pesticide)	RTCA DO160	Excellent
Fire extinguishant (Protein, Fluoroprotein)	RTCA DO160	Excellent
(Reference: Royal DSM N.V. – Dyneema literature)		

Chemical Resistance of Dyneema® (continued)

Chemical	Conditions			Effect on Tensile Strength
	Concentration (%)	Temperature (°C)	Exposure Time (hr)	
Inorganic Acids				
Hydrochloric acid	10	20	5000	None
Nitric acid	10	20	5000	None
Sulfuric acid	0.24	60	168	None
Organic Acids				
Glacial acetic acid	100	20	5000	None
Alkalis				
Ammonium hydroxide	28	20	5000	None
Calcium hydroxide	0.25	60	168	None
Sodium hydroxide	10	20	5000	None
Strong Oxidizing Agent				
Kalium permanganate in sulfuric acid	0.6 25	23	720	Slight
Organic compounds				
Acetone	100	20	5000	None
Ethanol	100	20	5000	None
Oil	100	20	4320	None
	100	40	4320	None
	100	80	4320	None
Petroleum	100	20	4320	None
	100	40	4320	None
	100	80	4320	None
Toluene	100	20	5000	None
Trichloromethane	100	20	5000	None
Miscellaneous				
Distilled water	100	20	5000	None
Sea water	100	20	5000	None
Detergent in aqueous solution	30	20	5000	None

(Reference: Royal DSM N.V. – Dyneema literature)

Chemical Resistance of Technora®

Chemicals	Condition			Retention of Strength(%)				
	Conc. (wt.%)	Temp (°C)	Time (hrs.)	Technora	PPTA (reg.)	PPTA (HM)	MPIA (FY)	PET
Sulfuric acid	20	95	20	99	13	50	65	-
	20	95	100	93	2	29	20	-
	40	95	100	89	1	20	2	-
Hydrochloric acid	20	20	100	98	42	87	74	-
Nitric acid	10	20	100	99	52	90	77	-
	20	70	366	14	-	-	-	-
Phosphoric acid	10	20	100	96	11	57	84	-
Sodium hydroxide	10	95	20	93	15	38	20	-
	10	95	100	75	4	18	0	-
Portland cement	saturated	95	100	98	23	67	60	2
	saturated	180	15	70	13	25	50	0
Sodium hypochlorite	10	95	20	95	8	-	-	-
Hydrofluoric acid	100ppm	20	336	100	99	-	96	-
Sea water	3	95	1000	98	85	89	98	64
Water	100	100	100	100	90	-	-	98
	100	160	100	84	17	-	-	0
	100	180	100	40	10	-	-	0

Chemical Resistance of Technora® (continued)

Chemicals	Condition			Retention of strength (%)				
	Conc. (wt.%)	Temp (°C)	Time (hrs.)	Technora	PPTA (reg.)	PPTA (HM)	MPIA (FY)	PET
Formic acid	90	95	100	82	10	32	62	-
Acetic acid	40	95	100	97	10	70	90	-
Gasoline	100	20	784	>95	>95	>95	>95	-
Benzene	100	20	784	>95	>95	>95	>95	-
Para-xylene	100	95	100	97	94	92	100	99
Methyl ethyl ketone	100	20	1000	97	94	94	100	100
Ethyl acetate	100	20	1000	96	96	95	97	100
Ethylene chloride	100	20	1000	100	94	96	100	100
Ethylene glycol	100	95	300	94	96	92	90	63
Phenol	100	95	300	95	97	95	95	0
N-Methyl pyrrolidone	100	95	100	31	96	93	16	-

Trademark Reference

Trade Name	Trademark Registration
Dyneema®	Royal DSM N.V.
Spectra®	Honeywell International, Inc.
Vectran®	Kuraray America, Inc.
Technora®	Teijin, Ltd.
Twaron®	Teijin, Ltd.
Kevlar®	E.I. Du Pont de Nemours Co., Inc.
Zylon®	Toyobo Co, Ltd.
Dacron®	E.I. Du Pont de Nemours Co., Inc.
Trevira®	Hoechst
Nylon	generic
Perlon®	Hoechst
PP Multifilament	generic