

Chemical resistance of UHMWPE fiber from DSM Dyneema

UHMWPE fibers are very resistant against chemicals.

UHMWPE fibers from DSM Dyneema are produced from ultrahigh-molecular weight polyethylene. It is highly crystalline and does not contain any chemical groups as aromatic rings, amide, hydroxyl or other that are susceptible to attack by aggressive agents. The result is that UHMWPE fibers are very resistant against chemicals. UHMWPE fibers from DSM Dyneema do not swell, hydrolyze or otherwise degrade in water, seawater or moisture. Properties such as tension fatigue, yarn on yarn abrasion and bending fatigue may improve through contact with water. This is attributed to the cooling or lubricating effect of the water.

The chemical resistance has been analyzed using loss of tensile strength as key indicator. To classify the impact of chemicals the following categories are being used.

Tensile Strength Loss Levels

| Impact of Chemicals | Loss of Tensile Strength |
|---------------------|--------------------------|
| None | 0-10% |
| Slight | 11-20% |
| Moderate | 21-40% |
| Appreciable | 41-80% |
| Degraded | 81-100% |

Tensile Strength & Chemical Exposure

The chemical resistance against various Aviation fluids has been analyzed according to RTCA DO160E Section 11

| Chemical | Conditions | | | | Effect on Tensile Strength |
|---|-------------------|------------------|--------------------|----------------------|----------------------------|
| | Concentration (%) | Temperature (°C) | Wetting Cycle (hr) | Storage at 65°C (hr) | |
| Aviation Jet A fuel (ISO 1817 test liquid F) | 100 | 40 | 24 | 160 | None |
| Hydraulic fluid (ISO 1817 test liquid 103) | 100 | 70 | 24 | 160 | None |
| Lubricating oil (ISO 1817 test liquid 101) | 100 | 70 | 24 | 160 | None |
| Solvents and cleaning fluid (Isopropyl alcohol) | 100 | 50 | 24 | 160 | None |
| De-icing fluid (Ethylene glycol) | 100 | 50 | 24 | 160 | None |
| Insecticide (Pyrethroid pesticide) | 100 | 23 | 24 | 160 | None |
| Fire extinguishant (Protein, Fluoroprotein) | 100 | 23 | 24 | 160 | None |

Tensile Strength & Chemical Exposure

| 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 |
| Petrol | 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 | 0 | 5000 | None |
| Sea water | 100 | 20 | 5000 | None |
| Detergent in aqueous solution | 30 | 20 | 5000 | None |

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