PU chemical resistance: general information

Acids and bases:
Polyurethanes show good resistance to dilute acids and bases. However, they are subject to attack by concentrated solutions and strongly oxidizing acids.

Oils, fats and fuels:
PU offer excellent resistance to pure mineral oils and fats. ASTM test oils 1, 2 and 3 causes no loss of strength at 20°C or after three weeks of exposure at 100°C. PU are also resistant to diesel, kerosene and the FAM test fluid Fuel A (ASTM D 471), showing no loss of strength, and show limited resistance to Fuels B and C.

Saturated aliphatic hydrocarbons:
In contact with isooctane and petroleum ether, for example, there is a small degree of reversible swelling (about 1 to 3%), accompanied by a drop in tensile strength of less than 20%. There is no degradation of the material.

Aromatic hydrocarbons:
PUR swells strongly – up to 50% – in contact with benzene, toluene and xylene, for example, and loses a similar proportion of strength.

Solvents:
Alcohols, such as ethanol and isopropanol, cause about 15 to 30% swelling and a decrease in tensile strength of 40 to 60%. Cetones, such as acetone, methyl ethyl ketone (MEK) and cyclohexanone and aliphatic esters, such as ethyl acetate and butyl acetate, act as partial solvents,
so PUR is not suitable for long-term use. Highly polar organic solvents, such as dimethylformamide (DMF), N-methylpyrrolidone and tetrahydrofuran (THF), dissolve polyurethanes

Water:
Polyurethanes can remain in water at 20°. Polyester polyurethanes in contact with warm water or steam at about 60°C or higher undergo irreversible degradation (hydrolysis) of the polyester chains.
Polyurethane made from polyether in place of polyester are not sensitive to hydrolytic degradation and are an even better solution in such cases.

Heat aging:
Generally, PU are also stabilised against hot air aging and are able to achieve an extremely long service life under heat conditions. Thus even after a year of usage at 100°C, half the tensile strength remains.

Weathering:
PUR has good resistance to oxygen, ozone and UV light. Intensive, long-term weathering leads to yellowing and a loss of mechanical properties. In such cases, additional UV stabilisers or colouring pigments should be added.

Energetic radiation:
The resistance of polyurethane α-, β- and γ-radiation is superior to most other plastic materials, such as PTFE, natural rubbers, PE, PVC, silicones, etc.). However, at doses of 108 rad, the material does become brittle.

Microbiological:
Ester PU in long-term contact with soils and similar substances or heavy contamination under conditions favourable to microbes can be destroyed by enzymes from the organisms which attack the chemical bonds. Under very unfavourable conditions the first signs of damage can be seen after 8 to 24 weeks.
Ether polyurethanes are inherently resistant to microbiological attack over long periods. This is clearly a better solution than ester-polyurethanes.
With ester-polyurethanes there is a risk that the additive will leach out, causing the level to fall below that required for protection as the additive migrates to the surface and comes in contact with the user and the material transported.