SOLVAY
asking more from chemistry®

Chemical Resistance of Medical-Grade Specialty Polymers

Solvay offers the industry's broadest portfolio of medical-grade specialty polymers. These high-performance polymers cover a wide range of physical, thermal and mechanical properties, making them suitable for a multitude of demanding medical device applications.

In this bulletin, the chemical resistance of three unreinforced grades and one glass fiber filled grade (Ixef® PARA) of medical-grade polymers (see Table 1) is reported in order to provide a performance base line and a side-by-side comparison. These results should be used with the understanding that most factors that contribute to a material's chemical resistance will not deviate significantly from the values collected in this series of testing.

The environmental stress-crack resistance, color and mechanical properties of each material were evaluated after a 7-day exposure to multiple chemicals commonly used in the healthcare industry.

Table 1: Medical-grade polymers tested

Product	Polymer	Grade
KetaSpire® PEEK	Polyetheretherketone	KT-880
Udel® PSU	Polysulfone	P-1700
Radel® PPSU	Polyphenylsulfone	R-5800
Ixef® PARA	Polyarylamide	GS 1022 WH01

Environmental Stress-Cracking Resistance

ASTM D790 flex bars were loaded onto jigs that correspond to strain ratios of 0.28 %, 0.55 %, 0.83 %, and 1.11 %. Once locked down, the bars were immersed in a chemical bath for 7 days. All grades were tested in a wide variety of chemicals at constant room temperature.

Testing under strain allows the various chemicals to more readily permeate into the core of the polymer, thereby encouraging stress cracking if it is a possible reaction. Test specimens were checked every 24 hours for signs of stress cracking or a chemical reaction of any kind. If the material showed no signs of cracking or crazing after 7 days, it passed the test. If the material showed cracking or crazing, it failed the test. Results are summarized in Table 3.

Table 3: ESCR test results

Chemical	Ixef® PARA	Udel® PSU	Radel® PPSU	KetaSpire® PEEK
3M™ Quat Disinfectant Ready-to-Use Cleaner	√	√	√	√
3M™ Twits 'n Fill™Neutral Quat Disinfectant Cleaner #23	√	√	√	√
3M™ Twist 'n Fill™ Phenolic Disinfectant Cleaner #18 Ready-to-Use	√	√	√	√
3M™ Twist 'n Fill™ Quat Disinfectant Cleaner #5 Ready- to-Use	√	√	√	√
409® Glass & Surface Cleaner	√	√	√	√
70% Isopropyl Alcohol	√	√	√	√
Alcohol Prep Pads	√	√	√	√
Asepticare® TB+II	√	√	√	√
Brulin Formula 815 GD™	√	√	√	√
CaviCide® wipes	√	√	√	√
Cidex® plus	√	√	√	√
Cimperial® 1070B	√	√	√	√
Cimstar® 3890	√	√	√	√
Cimstar® 540	√	√	√	√
Cimstar® Qualstar	√	√	√	√
Cimtech® 310	√	√	√	√
Cimtech® 495	√	√	√	√
Cimtech® 95	√	√	√	√
Clean-Cide® Wipes	√	√	√	√
Clean-Cide® Ready-to-Use Cleaner	√	√	√	√
Clorox® Germicidal Wipes	√	√	√	√
Clorox® Healthcare Hydrogen Peroxide Cleaner Disinfectant Wipes	√	√	√	√
Dawn® Dish Soap	√	√	√	√
Dispatch® Hospital Cleaner Disinfectant Towels	√	√	√	√
Ecolab® Neutral Disinfectant C	√	√	√	√
Envirocide®	√	√	√	√
Hype-Wipe® Disinfectant Bleach Towelettes	√	√	√	√
MicroKill™ Plus Germicidal Wipes	√	√	√	√
Micro-Kill™ Germicidal Wipes Bleach Free, Alcohol Free	√	√	√	√
Liqui-Nox® Critical Cleaning Liquid Detergent	√	√	√	√
MadaCide-1	√	√	√	√
Mar-V-Cide®	√	X	√	√
Micro-Kill™	√	√	√	√
Mineral spirits	√	√	√	√
Mini Hype-Wipe® Disinfectant Bleach Towelettes	√	√	√	√
Opti-Cide 3®	√	√	√	√
Opti-Cide 3® Surface Wipes	√	√	√	√
Oxivir® TB Cleaner	√	√	√	√
Oxivir® TB Wipes	√	√	√	√
PQ-256	√	X	√	√
ProSpray™ Wipes	√	√	√	√
Sani-Cloth® AF3	√	√	√	√
Sani-Cloth® AF	√	√	√	√
Sanicare® Disinfectant Wipes	√	√	√	√
Sani-Cloth® AF II	√	√	√	√
Sani-Cloth® Bleach Wipes	√	√	√	√
Sani-Cloth® Plus Wipes	√	√	√	√

√ = Pass, X=Fail

Table 3: ESCR test results (continued)

Chemical	Ixef® PARA	Udel® PSU	Radel® PPSU	KetaSpire® PEEK
Sani-Cloth® HB Wipes	√	√	√	√
Solujet® Low Foaming Phosphate-Free Detergent	√	√	√	√
Super Sani-Cloth® Wipes	√	√	√	√
Trim® MicroSol® 585XT	√	√	√	√
Trim® E206	√	√	√	√
Viraguard® Wipes	√	√	√	√
Virex® 256	√	X	√	√
Virex® TB Cleaner	√	X	√	√
Windex® Blue	√	X	√	√

√ = Pass, X=Fail

Coloration Testing

Coloration testing is used to determine aesthetic color changes due to chemical exposure. It does not account for changes due to crazing or cracking and test results only apply to overall color of the specimen.

Test results are plotted on a three-dimensional axis, often referred to as L*a*b*. Lightness, L*, represents darkest black at L* = 0 and the brightest white at L* = 100. The red/green opponent colors are represented along the a* axis, with cyan at negative a* values and magenta at positive a* values. The yellow/blue opponent colors are represented along the b* axis, with blue at negative b* values and yellow at positive b* values.

Delta E (ΔE) is the difference in color between the two specimens before exposure and after exposure. Results reported in Table 4 were classified based on the following:

- 🟢 = No apparent change (ΔE <1)
- 🟡 = Slightly noticeable change (1 ≤ ΔE ≤ 2)
- 🔴 = Noticeable change (ΔE > 2)

Table 4: Coloration test results

Chemical	Ixef® PARA	Udel® PSU	Radel® PPSU	KetaSpire® PEEK
3M™ Quat Disinfectant Ready-to-Use Cleaner	🟡	🟢	🟡	🟢
3M™ Twits 'n Fill™Neutral Quat Disinfectant Cleaner #23	🟢	🟢	🟢	🟢
3M™ Twist 'n Fill™ Phenolic Disinfectant Cleaner #18 Ready-to-Use	🔴	🔴	🟡	🟡
3M™ Twist 'n Fill™ Quat Disinfectant Cleaner #5 Ready- to-Use	🟢	🟢	🟢	🟢
409® Glass & Surface Cleaner	🟢	🟢	🟢	🟢
70% Isopropyl Alcohol	🟢	🟢	🟢	🟢
Alcohol Prep Pads	🟢	🟢	🟢	🟢
Asepticare® TB+II	🟢	🟢	🟢	🟢
CaviCide® wipes	🟢	🟢	🟢	🟢
Cidex® plus	🔴	🟢	🟢	🟡
Clean-Cide® Wipes	🟢	🟢	🟢	🟢
Clean-Cide® Ready-to-Use Cleaner	🟢	🟢	🟢	🔴
Clorox® Germicidal Wipes	🟡	🟢	🟢	🟢
Clorox® Healthcare Hydrogen Peroxide Cleaner Disinfectant Wipes	🔴	🟢	🟢	🟢
Dawn® Dish Soap	🟢	🟢	🟢	🟢
Dispatch® Hospital Cleaner Disinfectant Towels	🟢	🟢	🟢	🟢
Ecolab® Neutral Disinfectant C	🟡	🟢	🟢	🟡
Envirocide®	🟢	🟢	🟢	🟡
Hype-Wipe® Disinfectant Bleach Towelettes	🟡	🟢	🟢	🟢

Table 4: Coloration test results (continued)

Chemical	Ixef® PARA	Udel® PSU	Radel® PPSU	KetaSpire® PEEK
MicroKill™ Plus Germicidal Wipes	🟢	🟢	🟢	🟢
Micro-Kill™ Germicidal Wipes Bleach Free, Alcohol Free	🟢	🟢	🟢	🟢
Liqui-Nox® Critical Cleaning Liquid Detergent	🟢	🟢	🟢	🟢
MadaCide-1	🟢	🟢	🟢	🟡
Mar-V-Cide®	🟢	🟢	🟢	🟡
Micro-Kill™	🟢	🟢	🟡	🟡
Mineral spirits	🟢	🟢	🟡	🟡
Mini Hype-Wipe® Disinfectant Bleach Towelettes	🟡	🟢	🟢	🟢
Opti-Cide 3®	🟢	🟢	🟢	🟡
Opti-Cide 3® Surface Wipes	🟢	🟢	🟢	🟡
Oxivir® TB Cleaner	🟡	🟢	🟢	🟢
Oxivir® TB Wipes	🔴	🟢	🟢	🟢
PQ-256	🟢	🟢	🟢	🟡
ProSpray™ Wipes	🟢	🟢	🟢	🟢
Sani-Cloth® AF3	🟢	🟢	🟢	🟢
Sani-Cloth® AF	🟢	🟢	🟢	🟢
Sanicare® Disinfectant Wipes	🟢	🟢	🟢	🟢
Sani-Cloth® AF II	🟢	🟢	🟢	🟡
Sani-Cloth® Bleach Wipes	🟡	🟢	🟢	🟡
Sani-Cloth® Plus Wipes	🟢	🟢	🟢	🟡
Sani-Cloth® HB Wipes	🟢	🟢	🟢	🟢
Solujet® Low Foaming Phosphate-Free Detergent	🟡	🟢	🟢	🟡
Super Sani-Cloth® Wipes	🟢	🟢	🟢	🟢
Viraguard® Wipes	🟢	🟢	🟢	🟢
Virex® 256	🟢	🟢	🟢	🟢
Virex® TB Cleaner	🟢	🟢	🟢	🟢
Windex® Blue	🔴	🟢	🟢	🟢

Tensile Properties Testing

Testing was conducted based on ASTM D638 to evaluate tensile modulus and tensile strength on post-chemically exposed specimens. Test results higher than 90% of control values are considered passing. Results are summarized in Table 6.

Table 5: Control values for tensile properties

Product	Tensile Modulus [MPa (ksi)]	Tensile Strength at Yield [MPa (ksi)]
KetaSpire® PEEK	3,650 (530)	100 (14.5)
Udel® PSU	2,480 (360)	71 (10.2)
Radel® PPSU	2,340 (340)	69 (10.1)
Ixef® PARA	20,000 (2,900)	260 (37.7)

Dynatup Impact Testing

Dynatup testing measures the toughness of a material by vertically dropping a load from a calculated distance onto a fixed test specimen. The weight at which the specimen breaks is the maximum load value for the material. The average of the maximum loads for each specimen after chemical exposure was compared against the average of the control values for Udel® PSU, Radel® PPSU and KetaSpire® PEEK. Ixef® PARA was not included in this testing due to its glass fiber filled content, which skews the test results.

Test results higher than 90% of control values are considered passing. Results are summarized in Table 7.

Table 6: Tensile test results

Chemical	Ixef® PARA	Udel® PSU	Radel® PPSU	KetaSpire® PEEK
3M™ Quat Disinfectant Ready-to-Use Cleaner	√	√	√	√
3M™ Twits 'n Fill™Neutral Quat Disinfectant Cleaner #23	√	√	√	√
3M™ Twist 'n Fill™ Phenolic Disinfectant Cleaner #18 Ready-to-Use	√	√	√	√
3M™ Twist 'n Fill™ Quat Disinfectant Cleaner #5 Ready- to-Use	√	√	√	√
409® Glass & Surface Cleaner	√	√	√	√
70% Isopropyl Alcohol	√	√	√	√
Alcohol Prep Pads	√	√	√	√
Asepticare® TB+II	√	√	√	√
CaviCide® wipes	√	√	√	√
Cidex® plus	√	√	√	√
Clean-Cide® Wipes	√	√	√	√
Clean-Cide® Ready-to-Use Cleaner	√	√	√	√
Clorox® Germicidal Wipes	√	√	√	√
Clorox® Healthcare Hydrogen Peroxide Cleaner Disinfectant Wipes	√	√	√	√
Dawn® Dish Soap	√	√	√	√
Dispatch® Hospital Cleaner Disinfectant Towels	√	√	√	√
Ecolab® Neutral Disinfectant C	√	√	√	√
Envirocide®	√	√	√	√
Hype-Wipe® Disinfectant Bleach Towelettes	√	√	√	√
MicroKill™ Plus Germicidal Wipes	√	√	√	√
Micro-Kill™ Germicidal Wipes Bleach Free, Alcohol Free	√	√	√	√
Liqui-Nox® Critical Cleaning Liquid Detergent	√	√	√	√
MadaCide-1	√	√	√	√
Mar-V-Cide®	√	√	√	√
Micro-Kill™	√	√	√	√
Mineral spirits	√	√	√	√
Mini Hype-Wipe® Disinfectant Bleach Towelettes	√	√	√	√
Opti-Cide 3®	√	√	√	√
Opti-Cide 3® Surface Wipes	√	√	√	√
Oxivir® TB Cleaner	√	√	√	√
Oxivir® TB Wipes	√	√	√	√
PQ-256	√	√	√	√
ProSpray™ Wipes	√	√	√	√
Sani-Cloth® AF3	√	√	√	√
Sani-Cloth® AF	√	√	√	√
Sanicare® Disinfectant Wipes	√	√	√	√
Sani-Cloth® AF II	√	√	√	√
Sani-Cloth® Bleach Wipes	√	√	√	√
Sani-Cloth® Plus Wipes	√	√	√	√
Sani-Cloth® HB Wipes	√	√	√	√
Solujet® Low Foaming Phosphate-Free Detergent	√	√	√	√
Super Sani-Cloth® Wipes	√	√	√	√
Viraguard® Wipes	√	√	√	√
Virex® 256	√	√	√	√
Virex® TB Cleaner	√	√	√	√
Windex® Blue	√	√	√	√

√ = Pass, X=Fail

Table 7: Dynatup test results

Chemical	Udel® PSU	Radel® PPSU	KetaSpire® PEEK
3M™ Quat Disinfectant Ready-to-Use Cleaner	√	√	√
3M™ Twits 'n Fill™Neutral Quat Disinfectant Cleaner #23	√	√	√
3M™ Twist 'n Fill™ Phenolic Disinfectant Cleaner #18 Ready-to-Use	√	√	√
3M™ Twist 'n Fill™ Quat Disinfectant Cleaner #5 Ready- to-Use	√	√	√
409® Glass & Surface Cleaner	√	√	√
70% Isopropyl Alcohol	√	√	√
Alcohol Prep Pads	√	√	√
Asepticare® TB+II	√	√	√
CaviCide® wipes	√	√	√
Cidex® plus	√	√	√
Clean-Cide® Wipes	√	√	√
Clean-Cide® Ready-to-Use Cleaner	√	√	√
Clorox® Germicidal Wipes	√	√	√
Clorox® Healthcare Hydrogen Peroxide Cleaner Disinfectant Wipes	√	√	√
Dawn® Dish Soap	√	√	√
Dispatch® Hospital Cleaner Disinfectant Towels	√	√	√
Ecolab® Neutral Disinfectant C	√	√	√
Envirocide®	√	√	√
Hype-Wipe® Disinfectant Bleach Towelettes	√	√	√
MicroKill™ Plus Germicidal Wipes	√	√	√
Micro-Kill™ Germicidal Wipes Bleach Free, Alcohol Free	√	√	√
Liqui-Nox® Critical Cleaning Liquid Detergent	√	√	√
MadaCide-1	√	√	√
Mar-V-Cide®	√	√	√
Micro-Kill™	√	√	√
Mineral spirits	√	√	√
Mini Hype-Wipe® Disinfectant Bleach Towelettes	√	√	√
Opti-Cide 3®	√	√	√
Opti-Cide 3® Surface Wipes	√	√	√
Oxivir® TB Cleaner	√	√	√
Oxivir® TB Wipes	√	√	√
PQ-256	√	√	√
ProSpray™ Wipes	√	√	√
Sani-Cloth® AF3	√	√	√
Sani-Cloth® AF	√	√	√
Sanicare® Disinfectant Wipes	√	√	√
Sani-Cloth® AF II	√	√	√
Sani-Cloth® Bleach Wipes	√	√	√
Sani-Cloth® Plus Wipes	√	√	√
Sani-Cloth® HB Wipes	√	√	√
Solujet® Low Foaming Phosphate-Free Detergent	√	√	√
Super Sani-Cloth® Wipes	√	√	√
Viraguard® Wipes	√	√	√
Virex® 256	√	√	√
Virex® TB Cleaner	X	√	√
Windex® Blue	√	√	√

√ = Pass, X=Fail

SOLVAY

asking more from chemistry®

www.solvay.com

SpecialtyPolymers.EMEA@solvay.com | Europe, Middle East and Africa

SpecialtyPolymers.Americas@solvay.com | Americas

SpecialtyPolymers.Asia@solvay.com | Asia Pacific