

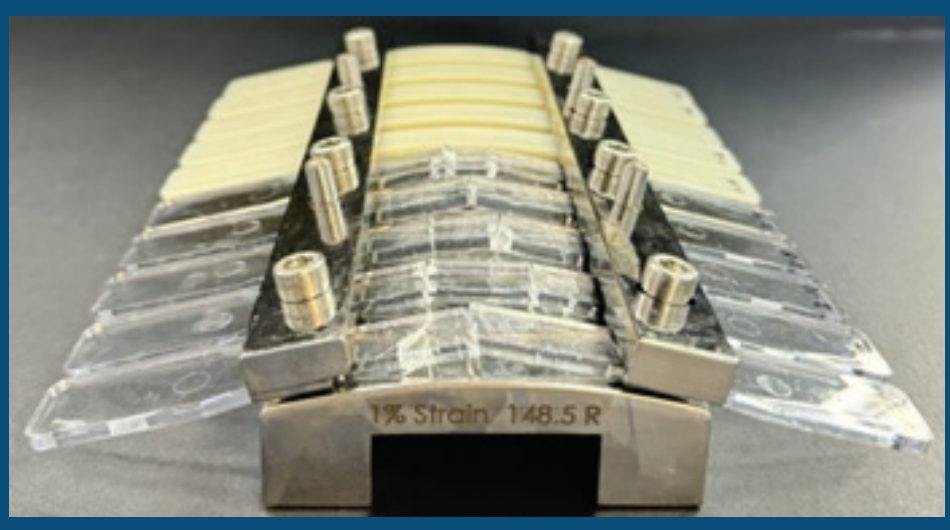


CHEMICAL RESISTANCE TESTING OF RESINS IN HOSPITAL SETTINGS

In the demanding environment of healthcare facilities, materials must be exceptionally durable and resistant to harsh chemicals used for the prevention of healthcare-acquired infections. By understanding the performance of these materials when exposed to various disinfectants and cleaning agents, instrument designers can select appropriate materials that will contribute to the creation of more durable devices.

Understanding Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents

ASTM D543 Standard Practices for Evaluating the Resistance of Plastics to Chemical Reagents is a standardized test method designed to evaluate plastic materials, ensuring they can withstand chemical exposure without degradation or discoloration. To assess the chemical resistance of Americhem's engineered compounds to healthcare disinfectants, injection-molded tensile bars were exposed to ten common healthcare cleaning agents for 72 hours under mechanical stress (1% strain) and at a constant temperature of 23 ± 2°C. After exposure, the specimens were evaluated for changes in mechanical properties (tensile strength) and appearance (color, gloss, surface texture).



Key factors that can accelerate polymer degradation include:

- Disinfectant concentration and pH
- Duration and frequency of exposure
- Elevated Temperatures
- Mechanical stress
- UV Exposure



Figure 1: Front: Example of catastrophic cracking and Rear: Example of acceptable performance after 72-hour chemical with a saturated non-woven wipe.

Chemically Resistant Polymers for Hospital Settings

The following polymers have been tested for resistance to common hospital disinfectants, including those containing hydrogen peroxide, quaternary ammonium compounds, isopropyl alcohol, acetic acid, and sodium hypochlorite.

ColorRx® Designation

At Americhem, the ColorRx® designation signifies a line of pre-colored compounds and masterbatches specifically designed for medical applications that include the following:

- Meets stringent requirements for biocompatibility and performance in healthcare settings
- ColorRx® materials have locked formulations, meaning the composition remains constant over time
- Manufactured in ISO 13485 and cGMP compliant facilities
- Include a robust process change management system and notice of change protocols

High-Performance Engineering Thermoplastics

Polyphenylsulfone (PPSU), Polyetherimide (PEI), Polysulfone (PSU), and Polyphthalamide (PPA) are all high-performance polymers with excellent properties, making them suitable for demanding applications in the medical and healthcare industries. However, they have distinct characteristics that should be considered for specific applications.

Engineering Thermoplastics

Polycarbonate (PC), Acrylonitrile Butadiene Styrene (ABS), Polybutylene Terephthalate (PBT), and Polyamide (PA) or Nylon belong to the class of engineering thermoplastics that offer superior mechanical, thermal, and electrical properties when compared to commodity plastics like polyethylene and polypropylene.

Polyolefins

Polypropylene (PP) offers excellent resistance to a wide range of chemicals, particularly non-polar solvents, acids, and bases at room temperature. Its resistance to aqueous solutions, salts, and many organic solvents make it suitable for a variety of applications. However, PP is susceptible to attack by strong oxidizing agents and has limited resistance to some hydrocarbons and chlorinated solvents. Polypropylene's lower cost and ease of processing make it a favorable choice for high-volume applications where high strength, high-temperature performance, or extreme impact resistance of an engineering resin is not required.

Flexible Elastomers

When considering chemical resistance to common hospital disinfectants, TPVs (Thermoplastic Vulcanizates) generally offer superior performance compared to standard TPEs (Thermoplastic Elastomers). While TPEs may exhibit adequate resistance to some dilute aqueous disinfectant solutions, they tend to have limitations with strong oxidizing agents (like high concentrations of hydrogen peroxide or sodium hypochlorite), strong acids, and certain solvents. However, TPVs are engineered for enhanced chemical resistance, making them more resilient to a broader range of disinfectants, including many acids, bases, and even some oxidizing agents.

TPEs (Thermoplastic Elastomers) are generally preferred over TPVs (Thermoplastic Vulcanizates) when flexibility and elasticity are paramount. TPEs are generally easier to mold, have lower processing temperatures and better melt flow. Cost considerations also favor TPEs, as they are typically more economical than TPVs.



Americhem Engineered Compounds Chemical Resistance

	Americhem Trade Name	Material Type	Applications	Clorox Healthcare® VersaSure®	All Purpose Virex® Disinfectant Cleaner	PDI Super Sani-Cloth®	PDI Sani-HyPerCide®	Clorox Healthcare® Hydrogen Peroxide	Metrex Cavi-Wipes™ HP	Diversey Oxivir® 1	Metrex Cavi-Wipes™ Bleach	PDI Sani-Cloth® Bleach	Clorox Healthcare® Bleach
High-Performance Engineering Thermoplastics	PPSU-2000RX	PPSU	Suitable for thin wall applications requiring high temperature stability and humidity resistance	●	●	●	●	●	●	●	●	●	●
	PEI-0900RX	PEI	High temperature stability with strength and stiffness suitable for metal replacement	●	●	●	●	●			●	●	●
	PSU-1000RX	PSU	Oxidation and hydrolysis resistant with high temperature stability	●	▲	●	●	●	x	x	●	●	●
	NY3-1030GFRX	Glass Filled PPA	Glass reinforced; high heat resistance, good chemical resistance & excellent dimensional stability	●			●		▲		●	●	●
Engineering Thermoplastics	POM2-0800RX	POM	Typically used for internal mechanical components requiring low friction & high wear resistance or short-term use where frequent disinfection is not required.	●	●	●	●	●	●	●	●	●	●
	PBT-3000RX	PBT	Good electrical insulation and a balance of chemical resistance, dimensional stability, and sterilizability.	●	●	●	●	●	●	●	●	●	●
	NY5-1000RX	PA12	Balanced impact resistance and flexibility, chemical resistance, and sterilizability	●	●	●	●	●	●	●	●	●	●
	PC-2000RX	PC	High impact resistance, optical clarity, and sterilizability where chemical resistance is less important	x	x	●	●	●	▲	x	●	●	●
	ABS-0600RX	ABS	Ideal for housings, enclosures, and handles where aesthetics and colorability are important but chemical exposure is minimal	▲	x	▲	●	x	x	x	●	●	●
Polyolefins	PP1-2000LMRX	PP	Suitable for thin-walled parts and complex geometries requiring good chemical resistance and ease of processing	●	●	●	●	●	●	●	●	●	●
	PP1-1200RX	PP	Suitable for parts needing greater toughness and durability, where flowability is less critical	●	●	●	●	●	●	●	●	●	●
Flexible Elastomers	TPEV7500-65ARX	TPV based copolymer	Seals and Gaskets, soft-touch grips, and tubing where flexibility, good compression resistance and chemical resistance are important	●	●	●	●	●	●	●	●	●	●
	TPES5500-60ARX	TPE copolymer	Over-molded soft-touch grips on substrates like PC, ABS, PC/ABS, PC/PETG, and PC/PBT where ease of processing is more important than chemical resistance	▲	▲	▲	▲	▲	▲	▲	▲	▲	▲

ASTM D543 72-hour wet patch exposure under 1% strain ● > 80% Tensile Retention ▲ 60- 80% Tensile Retention x < 60% Tensile Retention with acceptable visual aesthetics

Common Hospital Disinfectants

Disinfectant Name	Active Ingredient(s)	CAS-No	%	pH Range
Clorox Healthcare® VersaSure®	Ethylene glycol monohexyl ether	112-25-4	1 - 5	10.5
	Quaternary ammonium compounds, benzyl-C12-18-alkyldimethyl, chlorides	68391-01-5	0.25	
	Quaternary ammonium compounds, C12-14-alkyl[(ethylphenyl)methyl]dimethyl, chlorides	85409-23-0	0.25	
Diversey All Purpose Virex® Disinfectant Cleaner	2-(2-butoxyethoxy)ethanol	112-34-5	5 - 10	>11
	Tetrasodium salt of EDTA	64-02-8	1 - 5	
	Quaternary ammonium compounds, C12-18-alkyl[(ethylphenyl)methyl]dimethyl, chlorides	68956-79-6	> 0.1 - < 1	
	Quaternary ammonium compounds, benzyl-C12-18-alkyldimethyl, chlorides	68391-01-5	> 0.1 - < 1	
PDI Super Sani-Cloth®	Isopropyl alcohol	67-63-0	50 - 60	6.25 - 8.5
	Quaternary ammonium compounds, C12-18-alkyl[(ethylphenyl)methyl]dimethyl, chlorides	68956-79-6	0.25	
	Quaternary ammonium compounds, benzyl-C12-18-alkyldimethyl, chlorides	68391-01-5	0.25	
PDI Sani-HyPerCide®	Acetic acid	64-19-7	10 - 20	3.5 - 5.5
	Hydrogen peroxide	7722-84-1	4.04	
Clorox Healthcare® Hydrogen Peroxide	Hydrogen peroxide	7722-84-1	1.4	2 - 3
Metrex CaviWipes™ HP	Hydrogen peroxide		< 1	>2
Diversey Oxivir® 1	Benzyl alcohol	100-51-6	1 - 5	1.7 - 2.5
	Diversey Oxivir® 1	7722-84-1	0.5	
Metrex CaviWipes™ Bleach	Sodium Hypochlorite	7681-52-9	< 1.5	10.4
PDI Sani-Cloth® Bleach	Sodium Hypochlorite	7681-52-9	0.63	9.8 - 13.25
Clorox Healthcare® Bleach	Sodium Hypochlorite	7681-52-9	0.55	12.0 - 12.4

Careful selection of materials is important, and it is crucial to understand that the data contained within this brochure is intended as a guide. Final part testing under actual use conditions is essential to validate material performance and ensure suitability for specific applications.

Quaternary ammonium
Peroxide
Bleach (sodium hypochlorite)