EFFECT OF CLEANERS AND DISINFECTANTS ON STRESS CRAZING INITIATION

APPENDIX 19A

Compound	Duration of Loading	Effect on Acrylic Plastic
#1 Permatix Plastic Cleaner Part No. 403D	4 hrs.	No crazing*
#2 Plastishine Polish	4 hrs.	No crazing*
#3 Tend Cleaner	4 hrs.	No crazing*
#4 General Plastics Static Stop	4 hrs.	No crazing*
#5 Tend Plastic Cleaner Anti-Static	1 hr. 15 mins.	Crazing-mild*
#6 Everbrite w/Teflon	4 hrs.	No crazing*
#7 Quartet Re-Mark-able	1 hr.	Crazing-moderate*
#8 Glassene Glass cleaner	1 hr.	Crazing-moderate*
#9 Tend Plastic Cleaner and Polish	5 hrs.	No crazing*
#10 Novus Plastic Polish #1	6 hrs.	No crazing*
#11 Simple Green	6 hrs.	No crazing*
#12 Citra Solv	6 hrs.	No crazing*
#13 Goo Gone	3 hrs.	Crazing @
#14 Ivory detergent	6 hrs.	No crazing*
#15 Opti Clear	6 hrs.	No crazing*
#16 IPS Weld-On 57-A Cleaner	1 hr.	Deep Crazing*
#17 Devcon Cleaner/Conditioner	1 hr.	Catastrophic failure*

Notes:
Test Conditions:
Specimens: 2 x 22 x 0.25 inch annealed Plexiglas G® UVT (MIL-P-5425)
Loading: Three point, dead weight
Temperature: * = 60°F, α = 75°F, @ = 100°F
Stress: 2000 psi flexural stress at point of cleaner application

Compound	Duration of Loading	Effect on Acrylic Plastic
#18 Mask-Off	12 hrs.	No crazing*
#19 Windex	12 hrs.	No crazing*
#20 Formby Cleaning fluid	12 hrs.	No crazing*
#21 Chlorothene Nu Degreaser	20 min.	Catastrophic failure*
#22 Ethyl Alcohol	30 min. 30 min.	Catastrophic fracture @ Severe stress cracking α
#23 Methyl Alcohol	30 min.	Severe cracking @
#24 Isopropyl Alcohol	30 min.	Severe crazing @
#25 Vandalex (spot remover)	30 min.	Catastrophic fracture α
#26 Repcon (spot remover)	60 min.	Mild crazing α
#27 Mask-Off (masking paper remover)	60 min. 240 min.	No crazing @ Very Light crazing @
#28 WD-40 oil	1200 min.	No crazing α
#29 CRC-2-26	1200 min.	No crazing α
#30 Dow Corning HiVac (grease)	600 min.	No crazing α
#31 Parker-O-Lube (Barium base grease)	180 min.	No crazing α
#32 APPIEZON Type H (grease)	600 min.	No crazing α
#33 DuPont Krytox	120 min.	No crazing α
#34 CIDEX 7	720 min.	No crazing α
#35 CIDEX PLUS	60 min. 720 min.	No crazing α Very light crazing α
#36 Lysol Spray (alcohol solution)	30 min.	Very severe cracking @
#37 Lysol 1:100 (water solution)	300 min.	No crazing @
#38 Amphyl spray (alcohol solution)	30 min.	Very severe cracking @
#39 Amphyl 1:128 (water solution)	300 min.	No crazing @
#40 Virotech spray (alcohol solution)	30 min.	Very severe cracking @
#41 Staphene spray (alcohol solution)	30 min.	Light stress cracking @

Compound	Duration of Loading	Effect on Acrylic Plastic
#42 Chlorothene spray (alcohol spray)	30 min.	Light stress cracking @
#43 Windex	720 min.	Very light crazing @
#44 Vesphine	240 min.	Very light crazing @
#45 Micro-Quat FS	240 min.	Very light crazing @
#46 Tergisyl 1:100 (water solution)	300 min.	No crazing @
#47 Sani-Bactol 1:100 (water solution)	300 min.	No crazing @
#48 O-Syl 1:128 (water solution)	270 min.	No crazing @
#49 SaniJet spray	270 min.	No crazing @
#50 Diesel fuel	270 min.	No crazing @
#51 Adesol 20 1:1000 (water solution)	720 min.	No crazing α
#52 Sodium hypochloride 1:1000 (water solution)	720 min.	No crazing α
#53 RADIAC (full strength)	240 min.	No crazing α
#54 RADIAC 1:20 (water solution)	240 min.	No crazing α

NOTES:
1. The ambient temperatures at which the tests were performed varied from 60°–100°F resulting in some variation in test results as at higher temperatures crazing appears sooner.
2. All test specimens were under 2000 psi sustained flexure stress.
3. Sixty minutes without initiation of crazing is considered to be the lower threshold of acceptance for compounds. Where feasible, one should select compounds that require ≥ 240 minutes to initiate crazing.

EFFECT OF CHEMICALS ON CAST ACRYLIC

APPENDIX 19C

GENERAL

This compilation gives an indication of the chemical resistance of clear, uncolored, cast, unstressed acrylic as judged by visual observation of small samples (4 in x 1/2 in x 1/4 in) immersed in various liquids at 68°F and in some instances at 140°F. The following symbols have been used in this compilation:

S	=	Satisfactory (no effect, except possibly staining)
A	=	Some attack by, or absorption of, the liquid (slight crazing or swelling of the acrylic may have occurred but the material has retained most of its strength).
U	=	Unsatisfactory (the acrylic has decomposed, dissolved, swollen, lost strength, etc.)

Note:

Tests on the resistance of unstressed acrylic to chemical attack are difficult to interpret because plastic materials may be attacked in several ways, and, in addition, the conditions of exposure may have an important bearing on the result. Presence of residual or active stresses, in particular, will accelerate significantly the deterioration of acrylic at any temperature.

Reference: Acrylite Bulletin No. 306, 1963.

Chemical	Concentration	Resistance at 68°F	Resistance at 140°F	Time of Exposure	Notes
Acetaldehyde	100%	U	U		
Acetic acid	10%	S		over 1 year	
	100%	U		1 day	Badly swollen
	glacial	U		3 days	Dissolved
Acetic anhydride		A			
Acetone	100%	U		1 day	Dissolved
Acetonitrile		U			
Acetophenone		U		28 days	Crazed and swollen and dissolved
Alcohol, allyl		U		1 day	Crazed and dissolved
amyl		U			
benzyl		U			
n-butyl		U		over 1 year	Crazing and disintegrating
ethyl	10%	A		over 1 year	Slight attack
	50%	A		over 1 year	Slight attack
	100%	U		1 year	Slight attack, swollen & softened
isopropyl	10%	A		over 1 year	Crazing
	50%	A		over 1 year	Crazing
	100%	A		over 1 year	Cloudy and slight attack

Figure 19C.1
Compatibility of chemicals with cast acrylic non-crosslinked UVT and UVA.

Chemical	Concentration	Resistance at 68°F	Resistance at 140°F	Time of Exposure	Notes
methyl	10%	A		over 1 year	Slight attack
	50%	A		168 days	Swollen
	100%	U		168 days	Swollen and increased 20% in weight
Aluminum potassium sulphate	Saturated solution	S		over 1 year	
Ammonia	0.880 solution	S	A		
	Liquid	U	U		
Ammonium chloride	Saturated solution	S		over 1 year	
Amyl acetate		U		28 days	Crazed and dissolved
Aniline		U		7 days	Crazed and dissolved
Anthracene	Solution in paraffin	S		over 1 year	
Benzaldehyde		U		7 days	Dissolved
Benzene		U		1 day	Dissolved
Benzoyl chloride		U		7 days	Dissolved
n-Butyric acid	Concentrated	U		7 days	Dissolved
Butyl acetate		U		10 days	Dissolved
Butyraldehyde		U		7 days	Dissolved
Butyl acetyl ricinoleate		A	A	over 1 year	Slight attack at edges.
n-Butyl chloride		U		7 days	Dissolved
Butyl stearate		A		over 1 year	Slight attack on crazing
Calcium chloride	Saturated solution	S		over 1 year	Slight attack on edges

Figure 19C.1 (Continued)

Chemical	Concentration	Resistance at 68°F	Resistance at 140°F	Time of Exposure	Notes
Carbon di-sulphide		U		84 days	Crazed, softened and swollen
Carbon tetrachloride		U		84 days	Crazed, dissolving
Chlorine	2% in water	A		over 1 year	Crazing and surface attack
Chloroform		U		1 day	Dissolved
Chromic acid	10% Saturated solution	S (over 1 year) U	A		Staining, Dissolves slowly
Citric acid	Saturated solution	S (over 1 year)	S (6 mos.)		
meta-Cresol		U		7 days	Crazed and dissolved
Cyclohexane		U		over 1 year	No attack up to 168 days. Dissolved after 2 years.
Cyclohexanol		U	U	7 days	Dissolved and swollen
Cyclohexanone		U	U	7 days	Dissolved and swollen
Cyclohexene		U		84 days	Swollen and crazed
Decahydro-naphthalene (Decalin)		U		7 days	Crazed and softened
Di-alkylphthalate		A	U	over 1 year	Slight disintegration
Di-butyl phthalate		A (over 1 year)			Surface crazed
			U (8 days)		Dissolved

Figure 19C.1 (Continued)

Chemical	Concentration	Resistance at 68°F	Resistance at 140°F	Time of Exposure	Notes
Di-nonyl phthalate		A	A	over 1 year	Slight disintegration
Di-octyl phthalate		A	A	over 1 year	Slight disintegration
Di-alkyl sebacate		A	A	over 1 year	Slight disintegration
Di-butyl sebacate		A	A	over 1 year	Slight crazing and disintegration
Di-octyl sebacate		A	A	over 1 year	Slight disintegration
Di-ethyl ether		U		168 days	Soft and swollen
Petroleum ether 100-120		S		over 1 year	Slight crazing
Ethylene di-bromide		U		1 day	Dissolved
Ethylene glycol		S		over 1 year	
Ethylene di-chloride		U		1 day	Dissolved
Ethyl acetate		U		3 days	Dissolved
Epichlorhydrin		U		1 day	Dissolved
Ferric chloride	10% aq.	S		1 year	
Formaldehyde	40% aq.	S		over 1 year	
Formic acid	10%	S (over 1 year)	U (168 days)		
	90%	U		7 days	
Glycerine		S		over 1 year	
Hexane		S		168 days	Very slight crazing

Figure 19C.1 (Continued)

Chemical	Concentration	Resistance at 68°F	Resistance at 140°F	Time of Exposure	Notes
Hydrochloric acid	0%	S	S	168 days	Slight crazing
	Concentrated	S	S	168 days	Slight crazing
Hydrocyanic acid		U		1 day	Dissolved
Hydrofluoric acid	Concentrated	U		1 day	Swollen and soft
Hydrogen peroxide	10 vol.	S			
	90%	U			
Lactic acid		S		over 1 year	Slight crazing
Lanolin		S		over 1 year	
Mercury		S		over 1 year	
Methylamine		S		over 1 year	
Methyl benzoate		U		7 days	Dissolved
Methyl cyclohexanol		U		7 days	Crazed after a few hours
Methylene dichloride		U		1 day	Dissolved
Methyl naphthalene		U (84 days)	U (1 day)		Dissolved
Methyl salicylate		U		7 days	Dissolved
Monochlorobenzene		U		7 days	Dissolved
Naptha		U		168 days	Soft and crazed
Naphthalene	Crystals	A		28 days	
	Saturated solution in paraffin	A		28 days	
Nitric acid	10%	S (over 1 year)	S (168 days)		
	100%	U		24 hours	Swollen

Figure 19C.1 (Continued)

Chemical	Concentration	Resistance at 68°F	Resistance at 140°F	Time of Exposure	Notes
Nitrobenzene		U		7 days	Dissolved and crazed
n-Octane		A		168 days	Slight crazing
100-octane aviation fuel		A		168 days	Slight crazing
Transformer Oil		S		over 1 year	Staining
Diesel Oil		S		over 1 year	Clouding of surface
Olive Oil		S		over 1 year	Slight crazing
Oxalic acid	Saturated solution	S (over 1 year)	S (168 days)		
Paraffin, medicinal		S		over 1 year	
Perchloro-ethylene		U		over 1 year	Crazed badly
Phenol		U		7 days	Dissolved
Phosphoric acid	10%	S (over 1 year)	S (168 days)		
	95%	U		7 days	Badly crazed
Piperidine		U		1 day	
Potassium chlorate	Saturated solution	S		over 1 year	
dichromate	10%	S		over 1 year	Stained slightly
hydroxide	Saturated solution	S	S	168 days	
Potassium permanganate	0.1 N solution	S		over 1 year	Heavy staining
Polypropylene adipate		S	A	over 1 year	Slight attack
laurate		S	A	over 1 year	Slight attack
sebacate		S	A	over 1 year	

Figure 19C.1 (Continued)

Chemical	Concentration	Resistance at 68°F	Resistance at 140°F	Time of Exposure	Notes
Sebacic acid		S		over 1 year	
Sodium carbonate	Saturated solution	S (over 1 year)	S (168 days)		
Sodium chlorate	Saturated solution	S		over 1 year	
Sodium hydroxide	Saturated solution	S (over 1 year)	S (168 days)		
Sodium hypochlorite	10% chlorine	S		over 1 year	
Sodium thiosulphate	40%	S		over 1 year	
Sulphuric acid	10%	S (over 1 year)	S (168 days)		
	30%	S	S	1 year	Slight attack at edge; crazing
Tartaric acid	98%	U	U	1 day	Swollen
	Saturated solution	S (over 1 year)	S (168 days)	1 day	
Tetrahydro furan		U		1 day	Dissolved
Tetrahydro naphthalene (Tetralin)		U		after 168 days	Soft and crazed
		U		after 1 year	Surfaces dissolved
Toluene		U		7 days	Dissolved
Trichloroethane		U		1 day	Dissolved
Trichloroethylene		U		1 day	Dissolved
Tricresyl phosphate		U (over 1 year)	U (28 days)		Crazing and attacked surface
Tri-xylenyl phosphate		U (over year)	U (28 days)		
Water		S		over 1 year	
White spirit		S		over 1 year	Slight crazing
Xylene		U		7 days	Dissolved

Figure 19C.1 (Continued)