

## Comparison of High Solvating Plasticizers in Silylated Polyurethane (SPUR) Formulations

### Purpose

Determination of how well Valtris Benzyl Phthalates and Non-phthalates work in Silylated Polyurethane formulations.

### Samples Evaluated

- Santicizer® 160
- Santicizer® 261A
- Santicizer® 278
- Santicizer® Platinum P-1400
- Santicizer® Platinum P-1700
- Santicizer® Platinum G-2000
- Benzoate
- Alkyl Sulfonic Ester

### Formulation

Description	Amount (phr)
SPUR Prepolymer	22.9
Plasticizer	18.4
Silquest A-171	0.4
CaCO <sub>3</sub>	55.1
UV Absorber	0.2
UV Absorber	0.2
Silica	2.3
Silquest A-1120	0.5
Catalyst	0.1

### Testing

- Viscosity
- Shear Recovery
- Cure Through
- Shore Hardness
- Water Sensitivity
- Tensile and Elongation



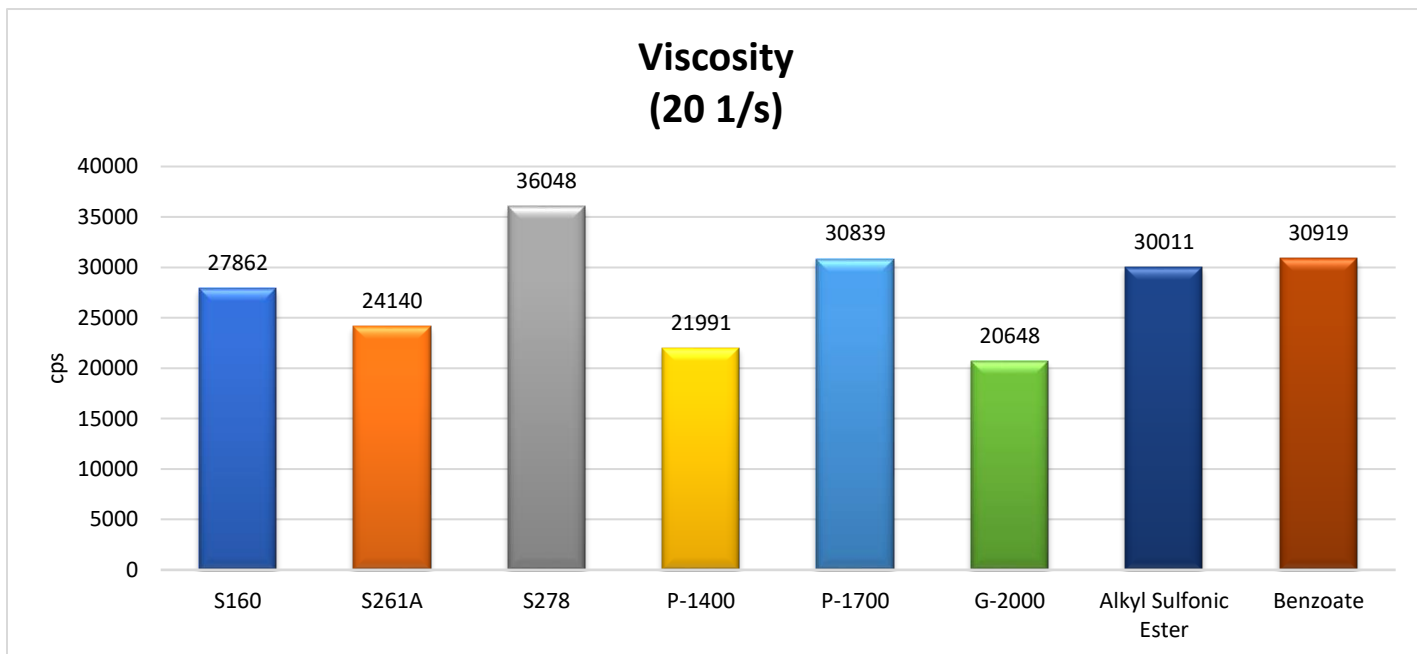
- Loop Exudation

### Executive Summary

All Valtris Benzyl Phthalates (Santicizer® 160, 261A, 278) and Non-Phthalates (Santicizer® Platinum P-1400, P-1700 and Santicizer® Platinum G-2000) work well in SPUR applications. The structural differences in the molecules make them suitable for a range of different properties.

### Plastisol Testing

Viscosity was tested on a TA Discovery HR-2 Rheometer at 20 1/s at 25 °C.

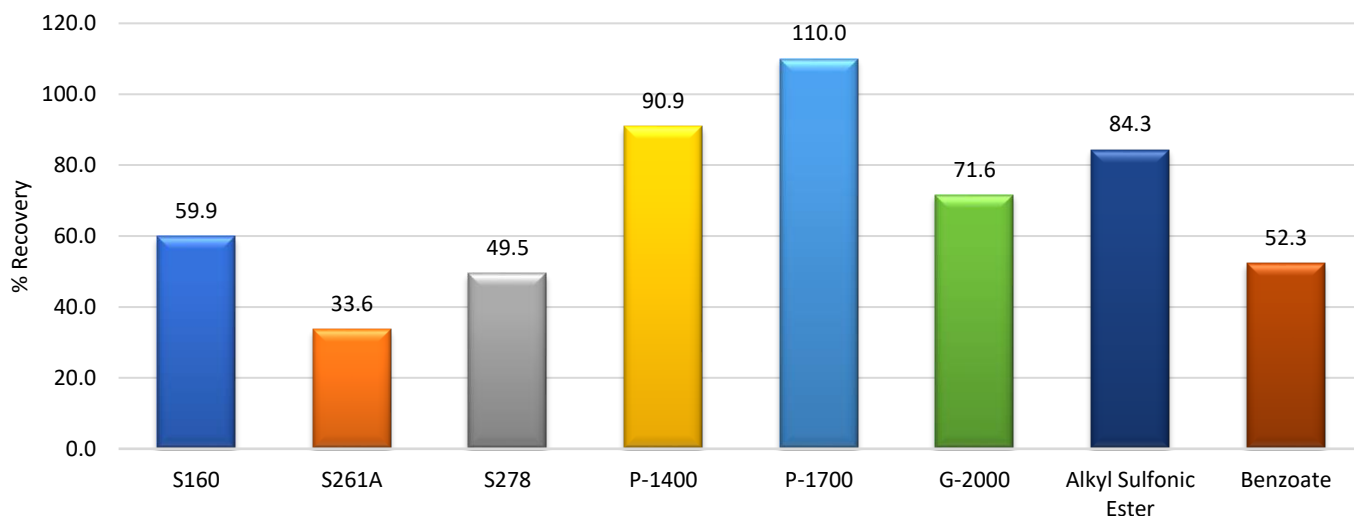


The Santicizer® 261A, Santicizer® Platinum P-1400, and Santicizer® Platinum G-2000 show the lowest initial viscosity.

Shear Recovery is used as a way to determine how well a sealant rebounds after being dispensed from a tube or caulk gun. In this application, we also used a TA Discovery HR-2 Rheometer, we kept the temperature at 25°C, initial shear rate was 0.1 1/s for 3 minutes, 50 1/s for 30 seconds, followed by 0.1 1/s for another 3 minutes. We looked at the % Recovery of the sealant, or how well it rebounded to its initial viscosity reading at 0.1 1/s.



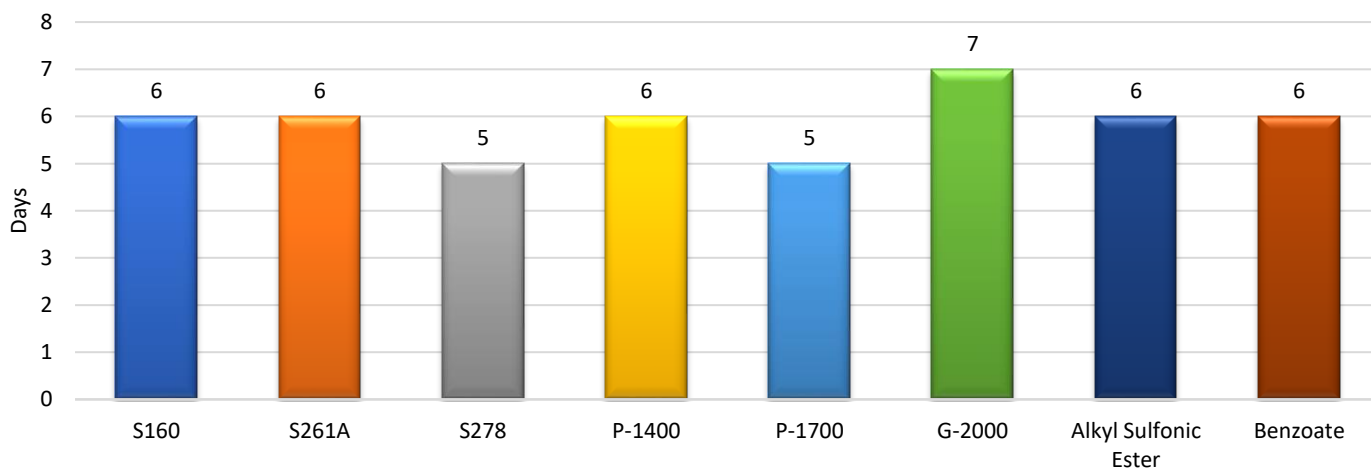
### Shear Recovery



In SPUR polymer systems Shear Recovery makes a difference depending on the plasticizer being used. Santicizer® Platinum P1400 and P1700 have the best recovery, meaning the viscosity rebounded to >90% the initial viscosity.

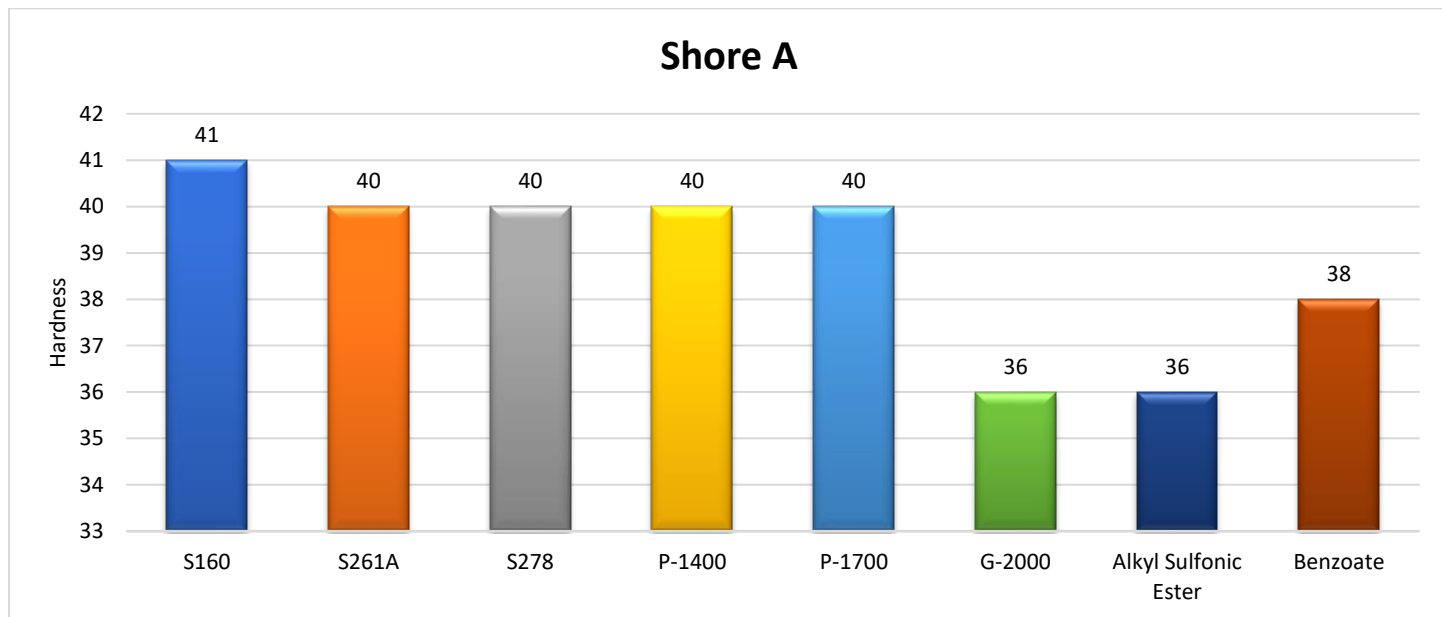
Cure Through - Material was applied in ¼ in. thickness. Samples were cut daily to determine how long it takes the product to cure all the way through. Data was determined in days.

### Cure Through Time (days)



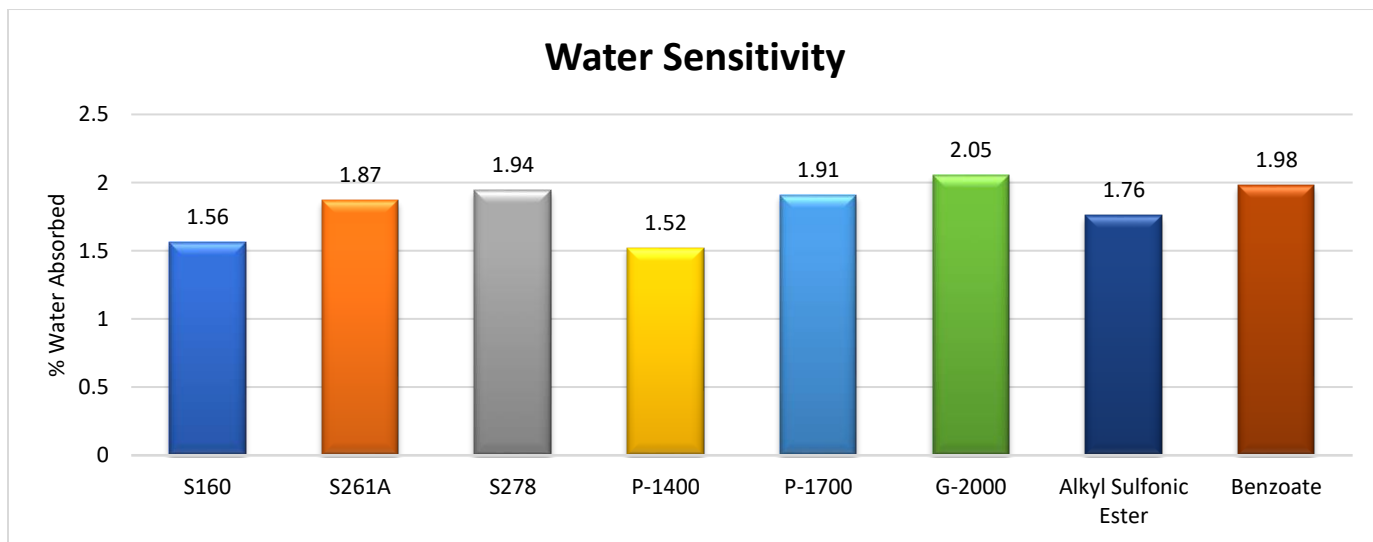
The Valtris Santicizer® 278 and Santicizer® Platinum P1700 shows to have quicker cure through time than the Santicizer® 160, 261A, P1400, Alkyl Sulfonic Ester and the benzoate.

Hardness - Material was applied in 1/8 in. thickness.



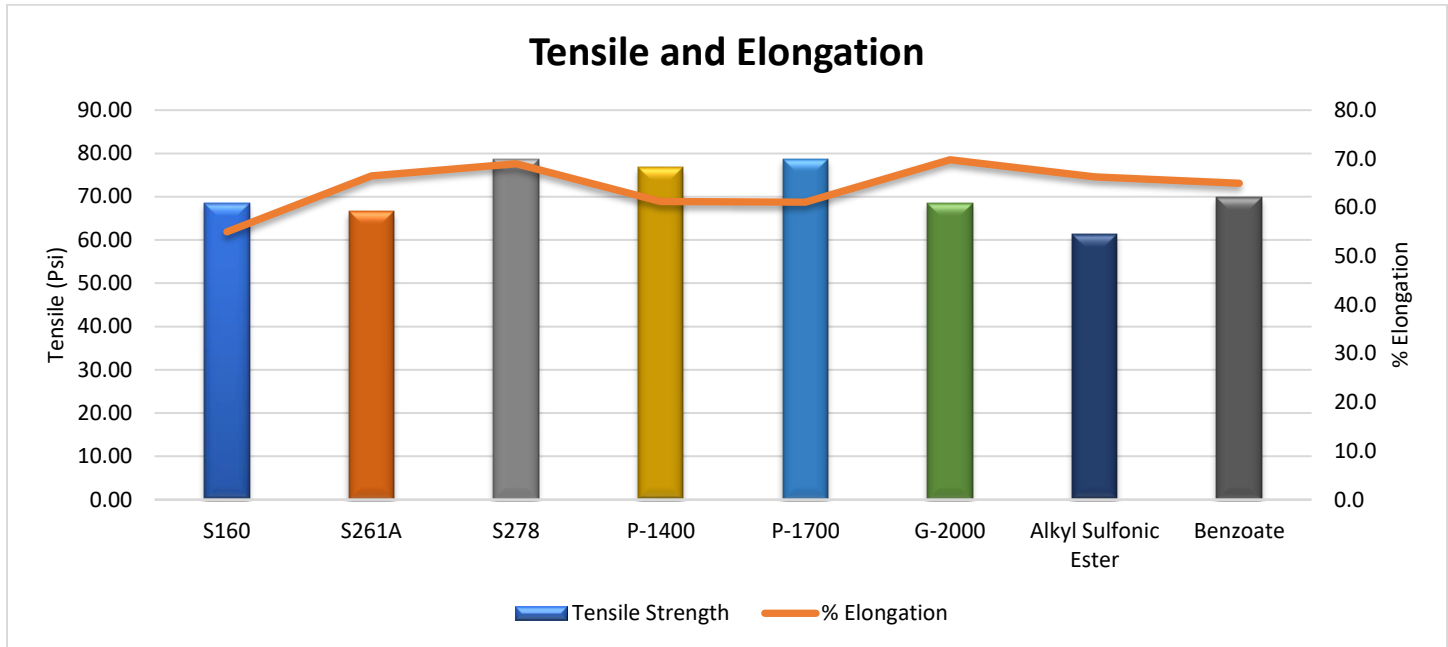
All samples showed similar hardness values except for the Santicizer® Platinum G-2000, Alkyl Sulfonic Ester, and benzoate which showed slightly better efficiency.

Water Sensitivity - Material was applied in forms at 1/8 in. thickness. Circular discs were cut out of the samples and weighed. They were then suspended in DI water at 50 °C for 24 hrs. Samples were then dried and weighed to determine how much water was absorbed into the sample.



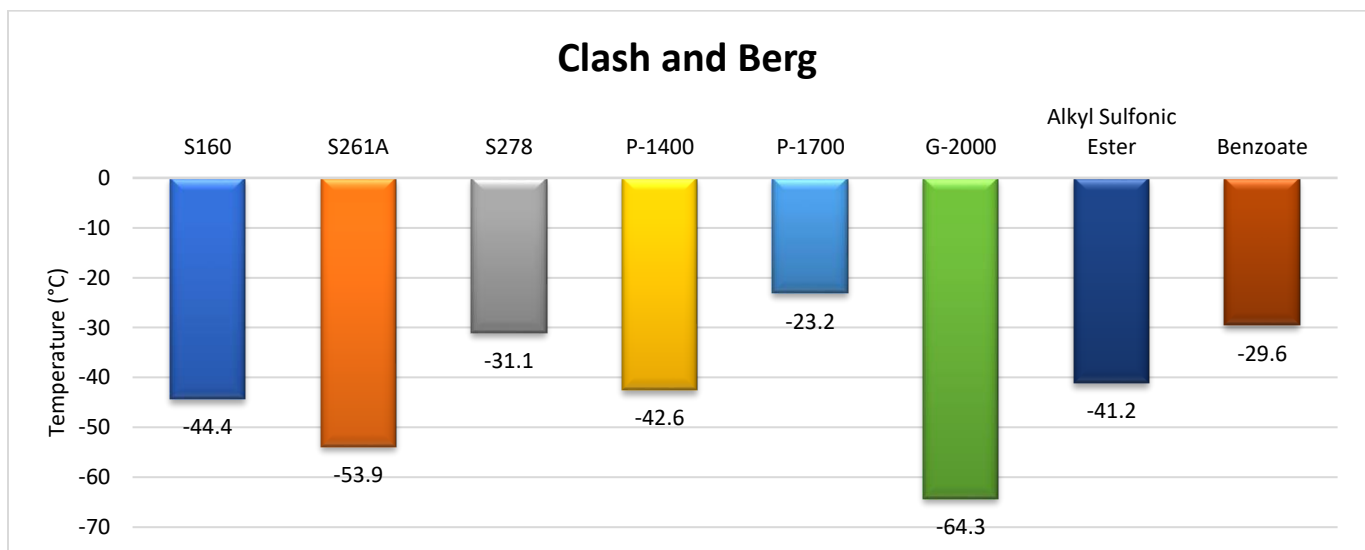
Santicizer® 160 and Santicizer® Platinum P-1400 have the lowest % water absorption numbers, reading lower than 1.6%.

Tensile and Elongation was completed on a Instron Tensile Tester. Material was applied in forms at ¼ in. thickness and then cut for testing.



All samples have similar tensile and elongation results.

Cold Temperature Flexibility - Material was applied in 1/8 in. thickness, cured and then run on a TA Discovery HR-2 Rheometer to determine Clash and Berg, or Cold Temperature Flex.



**Cold Temperature Flexibility:** Santicizer® 261A and Santicizer® Platinum G-2000 have the best cold temperature flexibility, while the Santicizer® 160, Santicizer® Platinum P-1400, and Alkyl Sulfonic Ester are comparable.

**Loop Exudation** looks at samples under tension and compression. Material was applied in forms at 1/8 in. thickness and then cut to test for loop exudation. The sample was bent into a loop and monitored for 1 day and 7 days to look for plasticizer migration.

	<b>Loop Exudation</b>	
	<b>1 day</b>	<b>7 days</b>
Santicizer® 160	0	0
Santicizer® 261A	0	0
Santicizer® 278	0	0
Santicizer® Platinum P-1400	0	0
Santicizer® Platinum P-1700	0	0
Santicizer® Platinum G-2000	0	0
Alkyl Sulfonic Ester	0	0
Benzoate	0	0

0 – no exudation

1 – slight exudation

2 – moderate exudation

3 – severe exudation

After 1 and 7 days, all samples showed no concerns for plasticizer exudation.

## Conclusions

- All Valtris Benzyl Phthalates (Santicizer® 160, 261A, 278) and Non-Phthalates (Santicizer® Platinum P-1400, P-1700 and Santicizer® G-2000) work well in SPUR Polymer applications
- Initial viscosity: Santicizer® Platinum G-2000, Santicizer® Platinum P-1400, and Santicizer® 261A show lowest initial viscosity. All other samples have similar viscosity results
- Shear Recovery: Santicizer® Platinum P-1700 has the best shear recovery. The Santicizer® Platinum P-1700 recovered at a higher viscosity than its initial viscosity, giving it a >100% recovery. The benzyl phthalates do not perform well for shear recovery in this polymer system.
- Cure Through: Santicizer® 278 and Santicizer® Platinum P-1700 have the fastest cure through at 5 days. All other samples have cure through at 6 days time except for the Santicizer® Platinum G-2000 that took 7 days to cure.
- Shore A Hardness: Santicizer® Platinum G-2000 and Alkyl Sulfonic Ester are the most efficient in this application. With durometer hardness readings of below 40.
- Water Sensitivity: Santicizer® 160 and Santicizer® Platinum P-1400 have the lowest % water absorption numbers, reading lower than 1.6%.
- Tensile and Elongation: All other samples are comparable.



- Cold Temperature Flexibility: Santicizer® 261A and Santicizer® Platinum G-2000 have the best cold temperature flexibility, while the Santicizer® 160, Santicizer® Platinum P-1400, and Alkyl Sulfonic Ester are comparable.
- Exudation: All samples showed no concerns with exudation

### Valtris Overview

Valtris is a global leader in specialty chemical additives and precursors, offering innovative solutions and products to customers around the world. With strong technical expertise and best-in-class formulation capabilities, we develop products that provide essential performance properties to plastics, coatings, adhesives and sealants, pharmaceuticals, flavor and fragrance, and personal care products. For more than 75 years, we have served as a trusted partner for customers by providing exceptional service and high-quality products. [www.valtris.com](http://www.valtris.com)

