VALTRIS SPECIALTY CHEMICALS

FORMULATING TIPS SHEET

Comparison of High Solvating Plasticizers in Silyl-terminated Polyether Formulations

Purpose

Determination of how well Valtris Benzyl Phthalates and Non-phthalates work in Silyl-terminated Polyether 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)
MS Polymer S303H	100
Plasticizer	55
V1515	120
TiO2	20
Fumed Silica	2
Irganox 1010	1
UV Stabilizer	1
VTMO	3
DiButyl Tin Ketonate	3

Testing

- Viscosity
- Tack Time
- Cure Through
- Shore Hardness
- Water Sensitivity
- Tensile and Elongation

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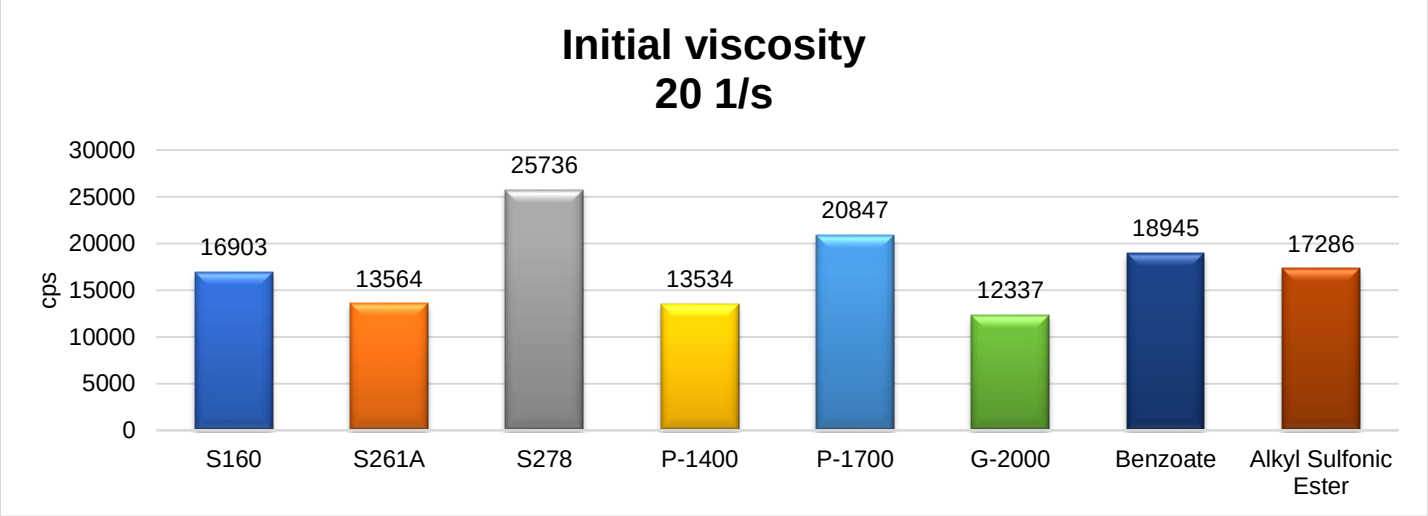
- Exudation – Loop and SPEW

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 MS Polymer applications. The structural differences in the molecules make them suitable for a range of different properties.

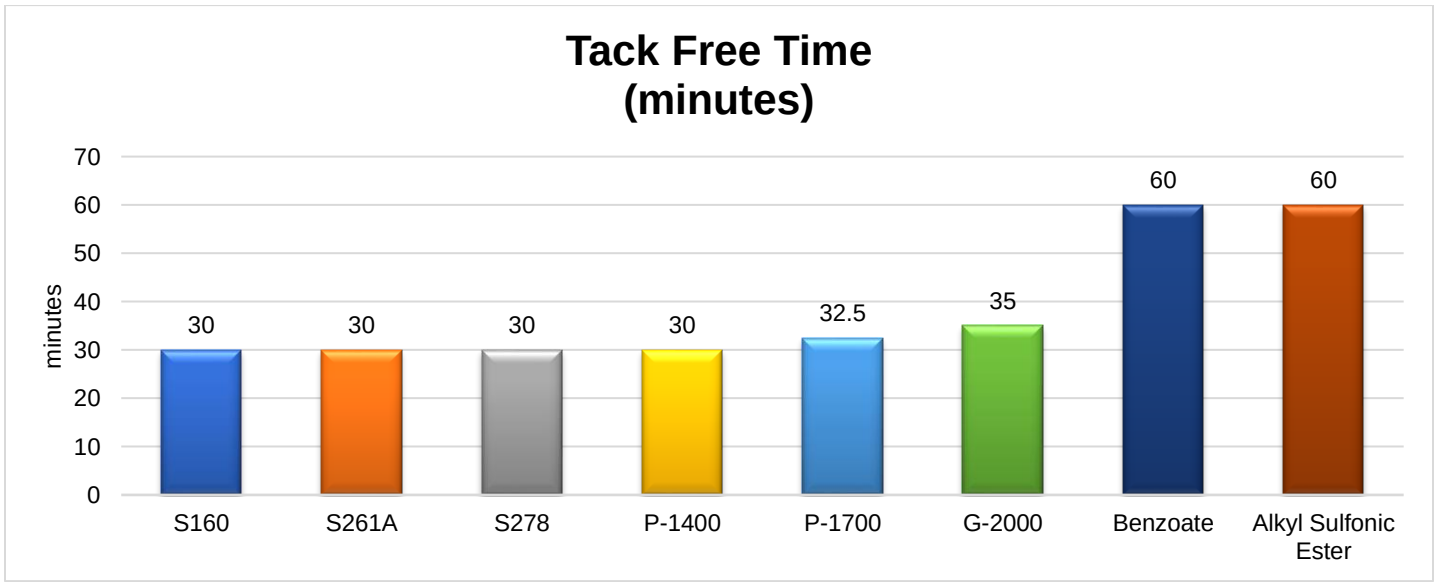
Plastisol Testing

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® G-2000 show the lowest initial viscosity.

Tack Time was tested to determine how quickly the material is tack free to touch in minutes. Material was applied in forms at ¼ in. thickness.



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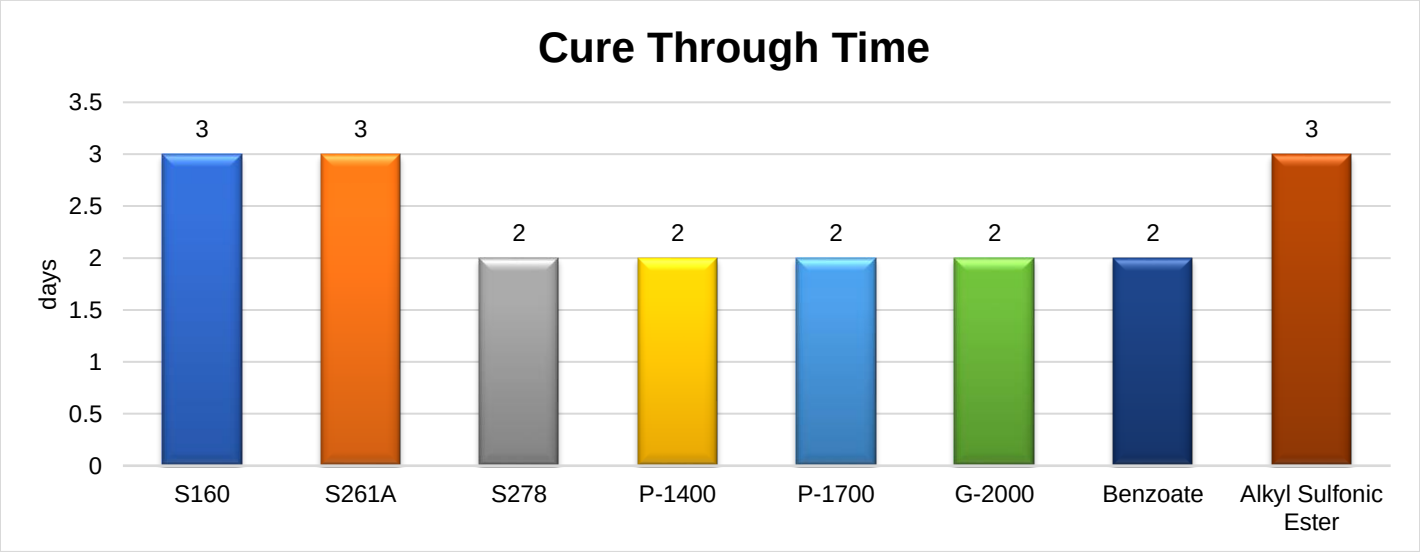
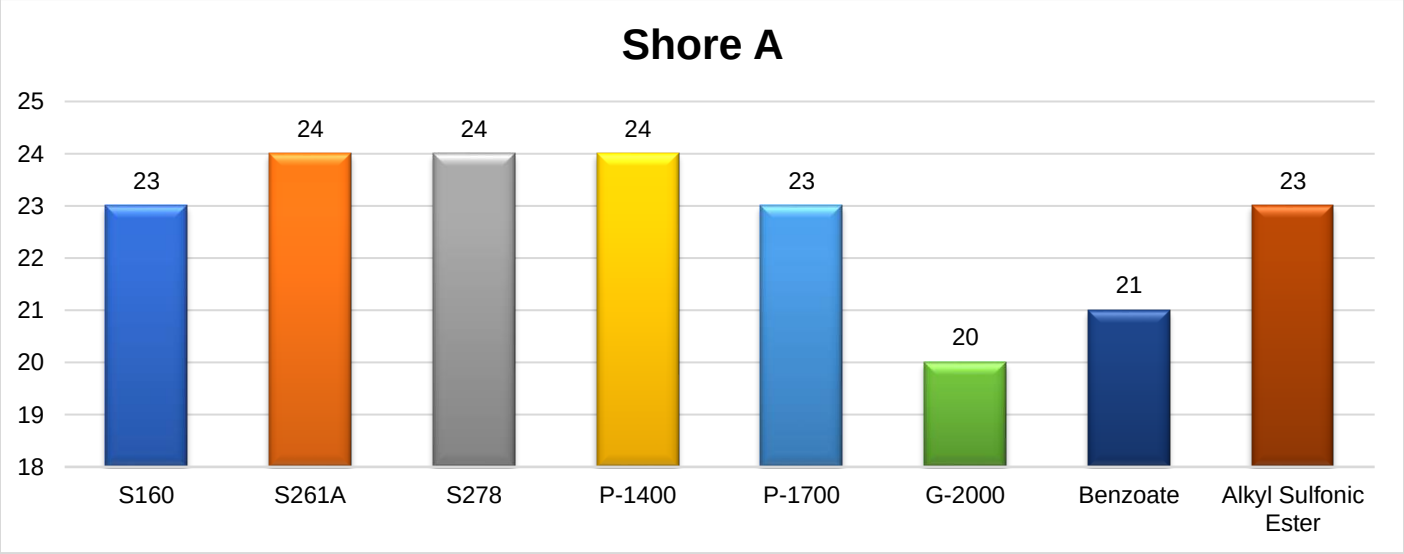
All Valtris products show fast tack free time when compared to the Benzoate and Alkyl Sulfonic Ester.

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.



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

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



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

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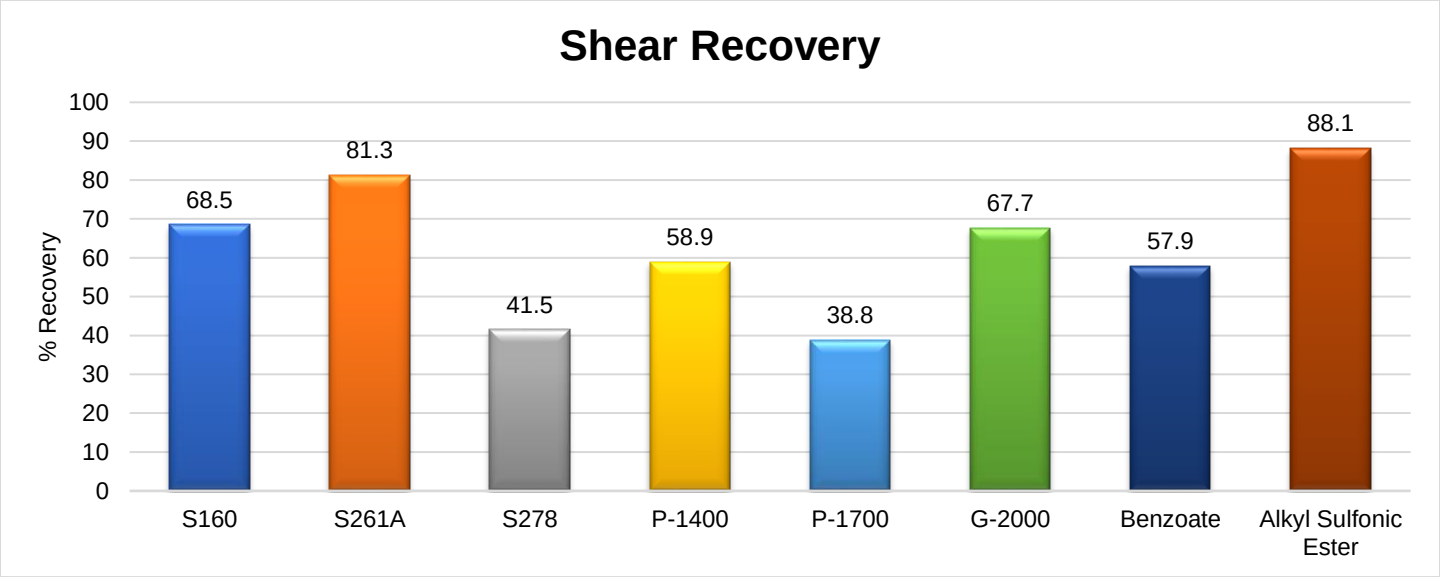
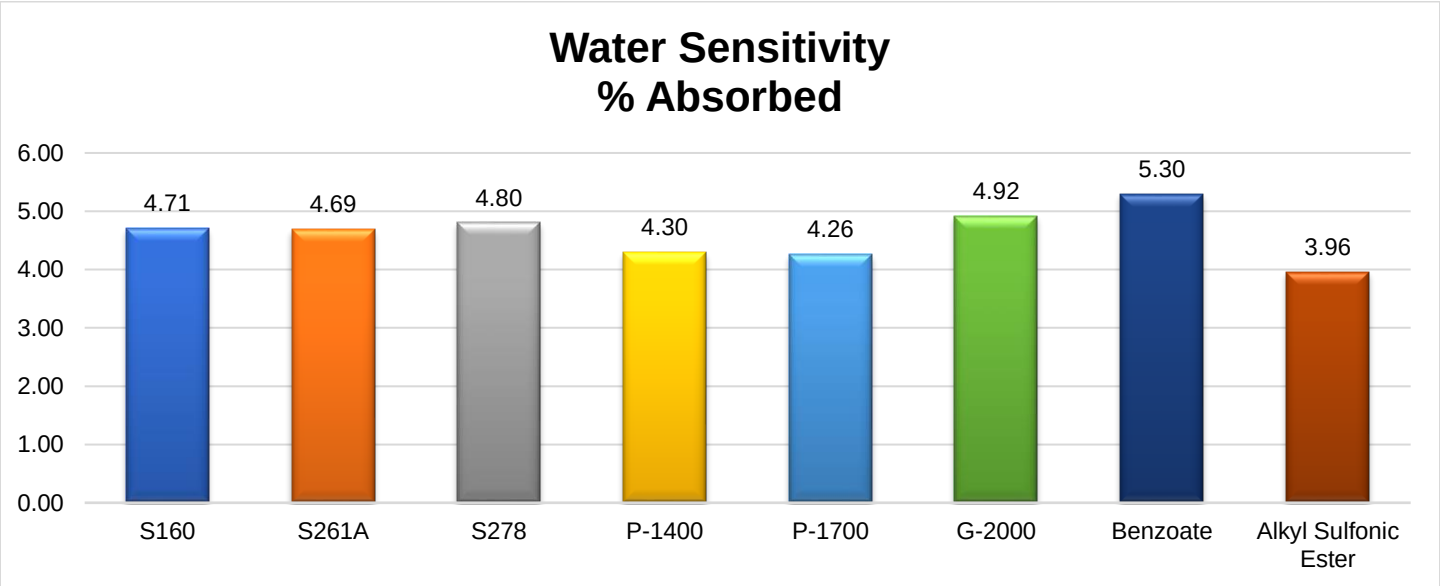
Shear Recovery is used as a way to determine how well a sealant rebounds after being dispensed from a tube or caulk gun. In this application, we also used a TA Discovery HR-2 Rheometer, we kept the temperature at 25°C, initial shear rate was 0.1 1/s for 3 minutes, 50 1/s for 30 seconds, followed by 0.1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



In MS polymer systems Shear Recovery makes a difference depending on the plasticizer being used. Santicizer® 261A and Alkyl Sulfonic Ester have the best recovery, meaning the viscosity rebounded to >80% the initial viscosity.

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.



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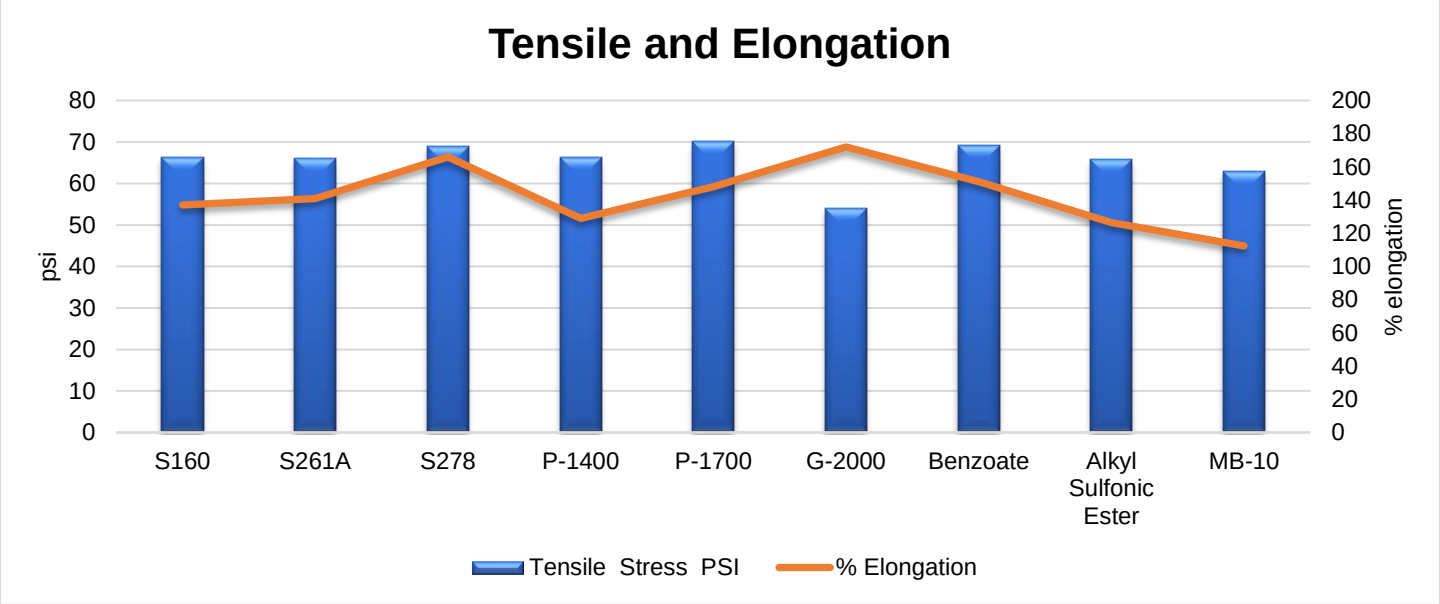
All samples show similar results for % water absorbed, except the benzoate which is slightly worse than the rest of the samples tested.

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 except for the Santicizer® Platinum G-2000.

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.

	Loop Exudation	
	1 day	**7 days**
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
Benzoate	0	0
Alkyl Sulfonic Ester	0	0
Santicizer®160	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.

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SPEW exudation looks at high temperature and humidity. Material was applied in forms at 1/8 in. thickness and then cut to test for SPEW exudation. The samples were hung over a beaker of water and placed in an oven at 70 °C for four weeks. Samples were evaluated by touch every week to look for tackiness. Tackiness is an indicator that plasticizer is exuding from the sample.

	SPEW Exudation			
	1 week	**2 weeks**	**3 weeks**	**4 weeks**
Santicizer®160	no tack	no tack	no tack	no tack
Santicizer®261A	no tack	no tack	no tack	no tack
Santicizer®278	no tack	no tack	no tack	no tack
Santicizer® Platinum P-1400	no tack	no tack	no tack	no tack
Santicizer® Platinum P-1700	no tack	no tack	no tack	no tack
Santicizer® Platinum G-2000	no tack	no tack	no tack	no tack
Benzoate	no tack	no tack	slight tack	slight tack
Alkyl Sulfonic Ester	no tack	no tack	slight tack	slight tack
Santicizer®160	no tack	no tack	no tack	no tack

None (no tack)
Slight (tacky)
Moderate (greasy)
Heavy (wet)

Results show after week 3 that the benzoate and Alkyl Sulfonic Ester show slight tackiness which is an indicator that some exudation is occurring at elevated temperature and humidity.

Conclusions

- 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 MS Polymer applications. There were no detriments to the testing that was completed.
- They are comparable in viscosity, tack free time, cure through, shore hardness, tensile and elongation, water sensitivity, and Loop and SPEW exudation.
- The benzoate and Alkyl Sulfonic Ester also performs well, but may have limitations in water sensitivity (benzoate) and SPEW exudation (benzoate and Alkyl Sulfonic Ester).

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

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