

vercet ™

# POLYOLS

FOR POLYURETHANES

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# CREATING PERFORMANCE THROUGH CHEMISTRY

Building upon decades spent advancing materials chemistry innovation, NatureWorks offers solutions based on lactides and lactide intermediates that help innovators within the coatings, adhesives, sealants, and elastomers (C.A.S.E.), toner and surfactant industries realize:



Significant, measurable product performance benefits



Move through the R&D process more efficiently and with minimal risk

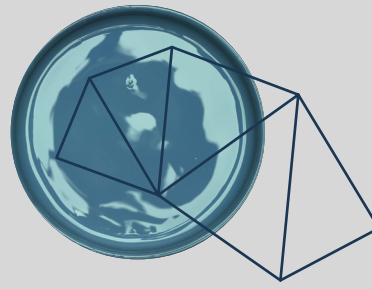


Decrease systems costs via an optimized supply chain

## POLYOLS FOR POLYURETHANES CUSTOM SOLUTIONS FOR COATINGS & ADHESIVES

Using Vercet polyester polyols for polyurethanes enables unique properties including excellent grease and oil resistance for both adhesive and coating applications.

COATINGS		ADHESIVES	
SUBSTRATES	MARKETS	SUBSTRATES	MARKETS
Wood Metal Cements Ceramics	Furniture Flooring Architecture Decorative	Wood Wood Laminates Metal Mixed Substrates	Furniture Flooring Nonwovens / Hygiene Foams Electronics Packaging: Rigid & Flexible
PERFORMANCE BENEFITS		PERFORMANCE BENEFITS	
Excellent oil, grease, and solvent resistance High hardness polyurethanes Controlled functionality Controlled viscosity (hydroxyl values 12-112 mg-KOH/g) Low haze Solvent-borne & hot melt coatings		Tailored open times and work-life Excellent solvent resistance Solvent-borne & hot melt adhesives Renewably-sourced building block	



We achieve this by coupling tunable Vercet™ lactide-based chemistries with the knowledge of scientists and engineers who understand how to dial in the full capabilities of this versatile product line.



## PROPERTIES

### VERCET POLYOLS

Grade	Tg [°C]	f	Viscosity @ 100°C [Pa*s]	OHV <sup>1</sup> [mg-KOH/g]
P1025X	15	1	1.2	25
P2040X	32	2	3.7	40
P2025X	40	2	11.3	25
P2140X	22	2	1.8	41
P2125X	30	2	7.5	25
P3025X	40	3	19.1	29

1. OHV – Hydroxyl Value as determined by ASTM E1899

### POLYURETHANES FORMULATED WITH VERCET POLYOLS

Polyurethane with Polyol	Wt% - Polyol / MDI 1 1,2 PG	Polyol OHV <sup>1</sup> [mg-KOH/g]	Gel Time [sec] 120°C	Hardness <sup>2</sup> [Shore A / D]	Tg/Tm <sup>3</sup>	Resiliency <sup>4</sup>	Water Pickup <sup>5</sup>
P2040X	85.3 / 12.5 / 0.8	32	160	86 / 72	Tg 48-52°C	22	0.9%
P2140X	84.8 / 13.6 / 0.9	32	190	84 / 71	Tg 47-50°C	17	1.0%
Control (Based on AA-HDO)	86.6 / 11.6 / 0.8	29	60	70 / 33	Tm peak 55°C	23	0.6%

1. OHV – Hydroxyl Value as determined by ASTM E1899

2. Hardness as determined by ASTM 2240

3. DSC mid-point, 20°C/min, 2nd heat

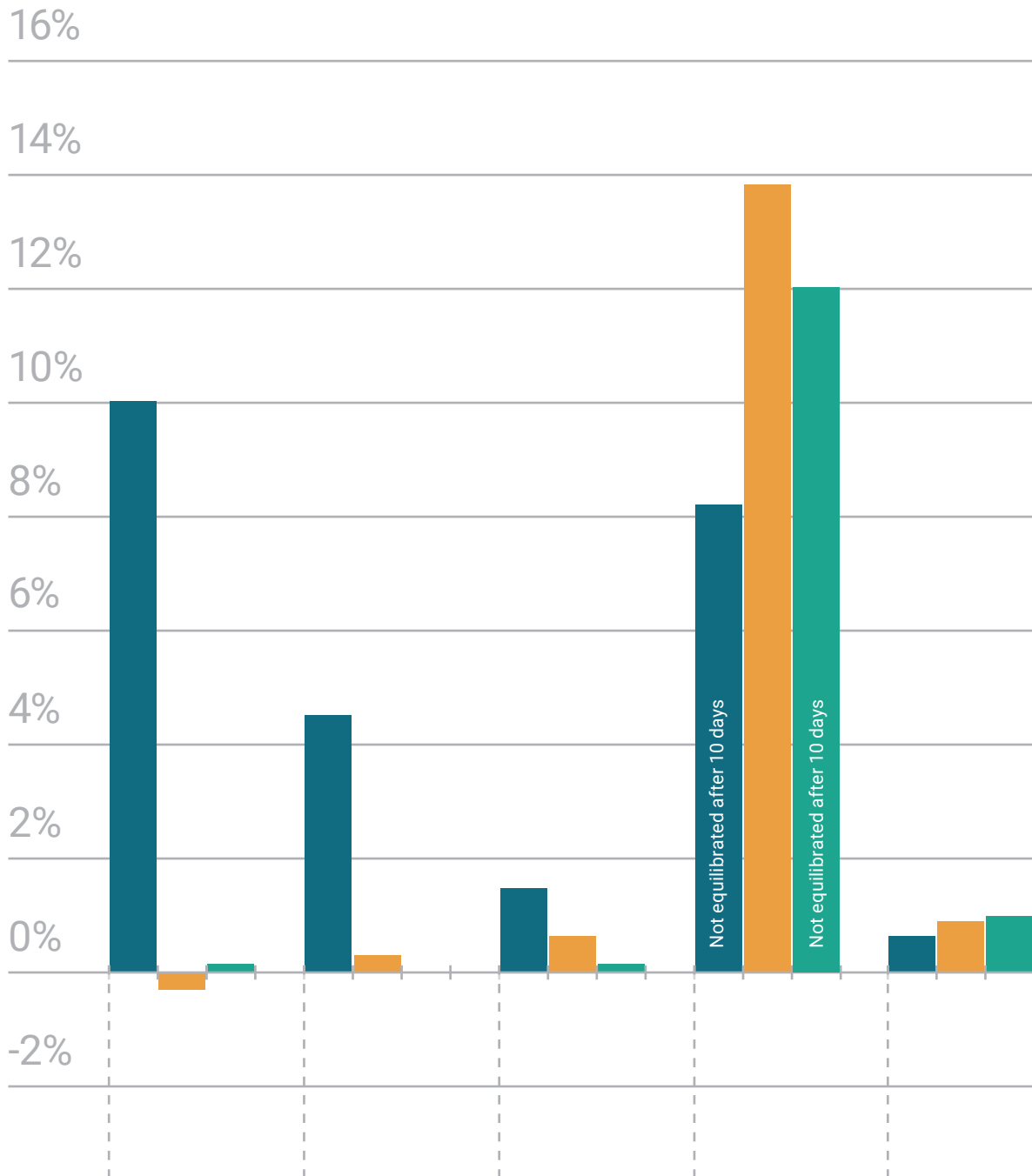
4. Resiliency as determined by ASTM D2632

5. Immersion testing, 8 days at 25°C

MEASURABLE PERFORMANCE

# VERCET-BASED POLYURETHANE SOLVENT RESISTANCE: 10 DAY SWELL VALUES

WT% SOLVENT PICK-UP

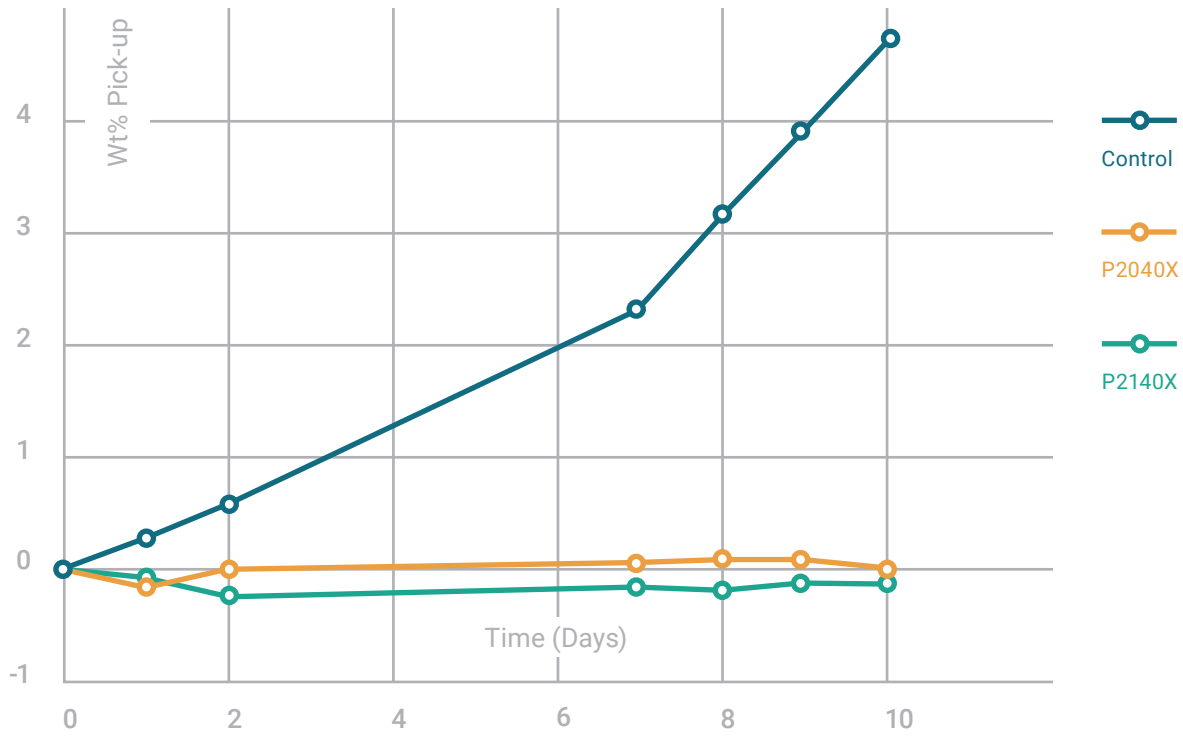


	IRM 903 OIL	CANOLA OIL	N-HEXANE	ETHANOL	WATER
<b>CONTROL</b>	10.00%	4.50%	1.50%	8.10%	0.60%
<b>P2040X</b>	-0.20%	0.20%	0.60%	13.90%	0.90%
<b>P2140X</b>	0.10%	0.00%	0.10%	12.00%	1.00%

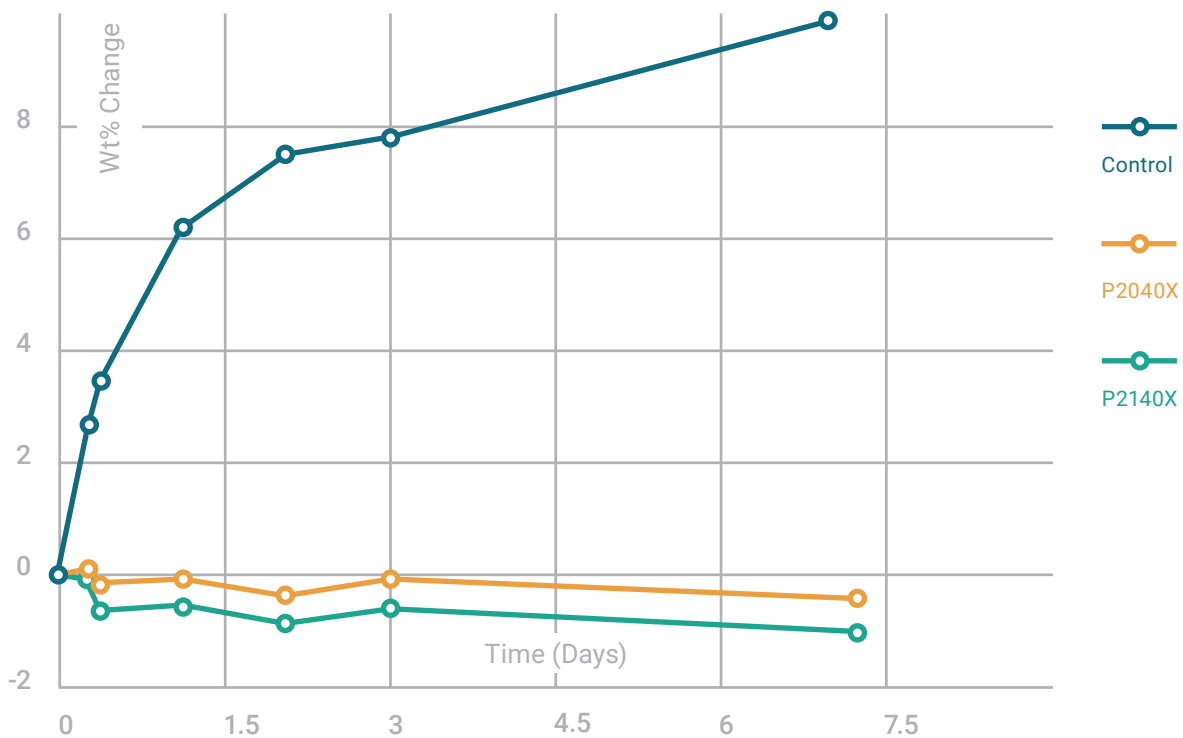
Wt% data collected 68°C

# HOT OIL SWELL SHOWS EXCELLENT OIL RESISTANCE

**WT% CANOLA OIL PICK-UP 68°C**

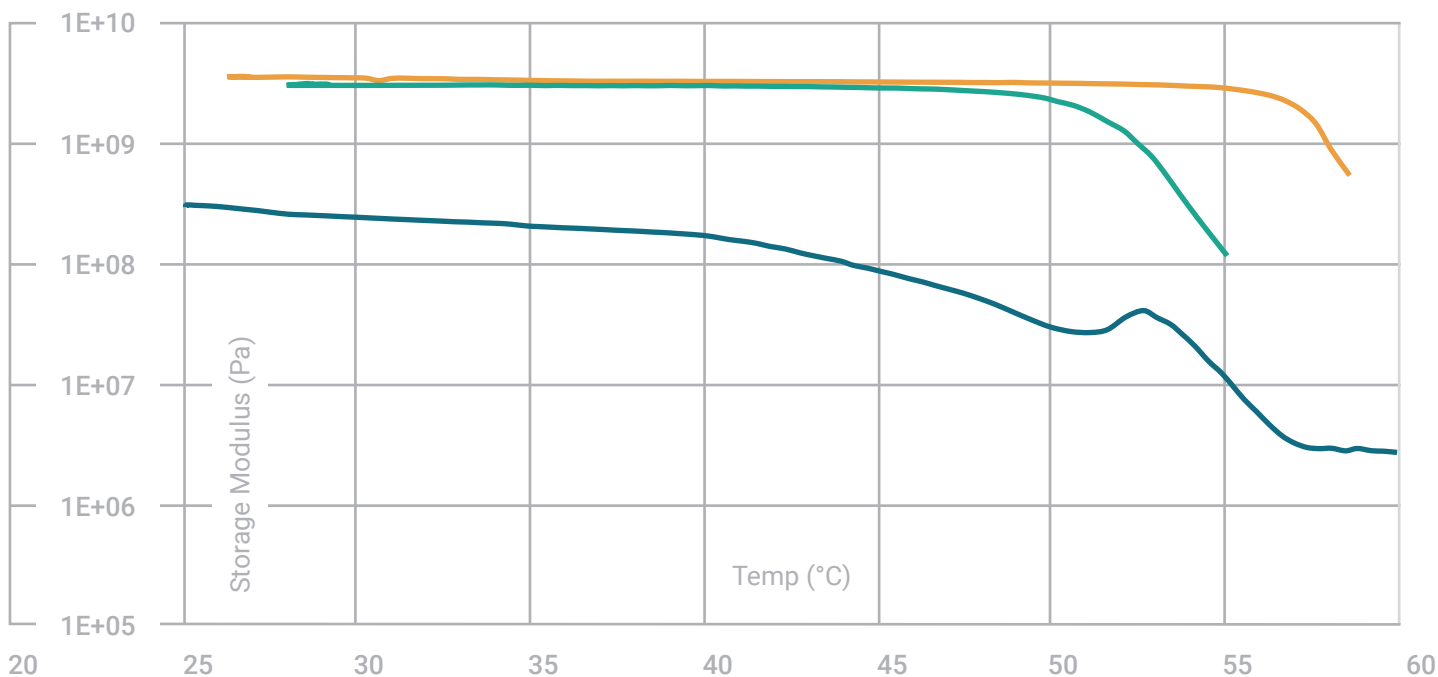


**WT% IRM 903 OIL PICK-UP 68°C**



## MEASURABLE PERFORMANCE

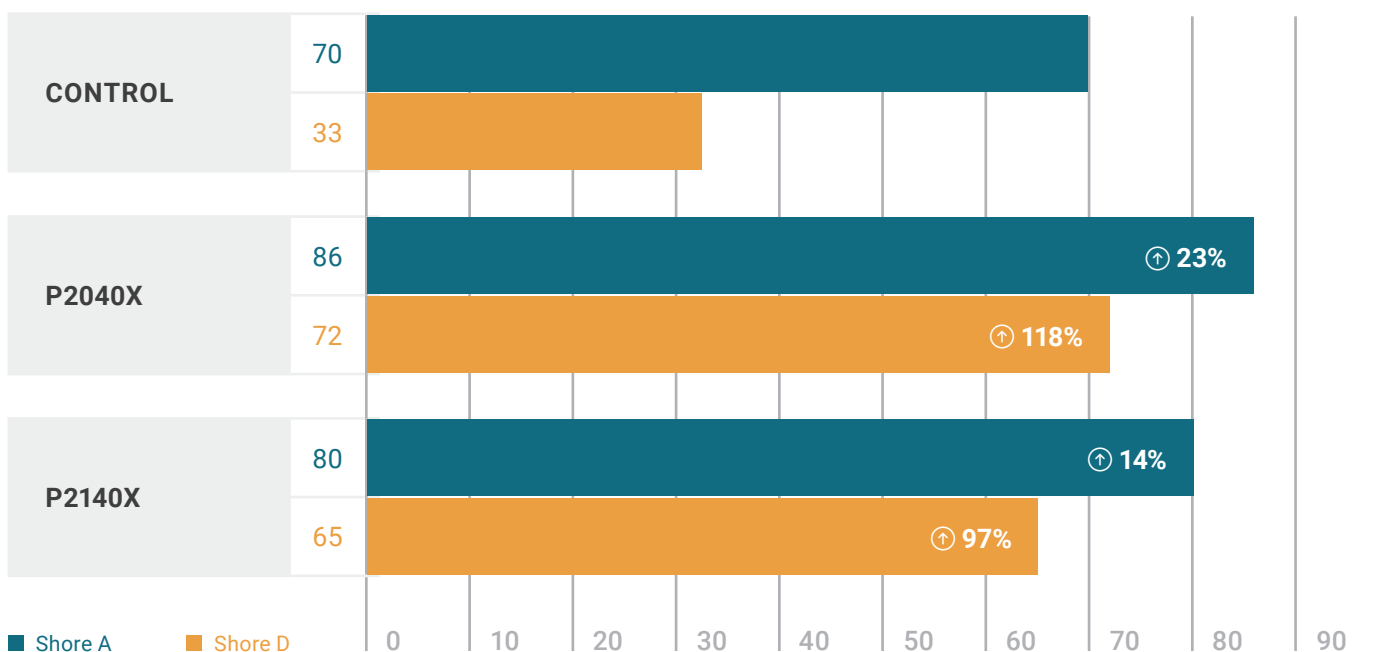
# HIGHER MODULUS, INCREASED STABILITY WITH TEMPERATURE



	Tg (°C, DSC)	Tg (°C, DMA)	E' (MPa, 30°C)	E' (MPa, 35°C)	E' (MPa, 45°C)	E' (MPa, 50°C)
<b>CONTROL</b>	41-44 Tm (onset)		24	21	8.8	3.0
<b>P2040X</b>	49-52	56	350	331	321	315
<b>P2140X</b>	47-50	52	300	300	286	221

ASTM Method D790. 3 point bend fixture heated 3°C per minute.

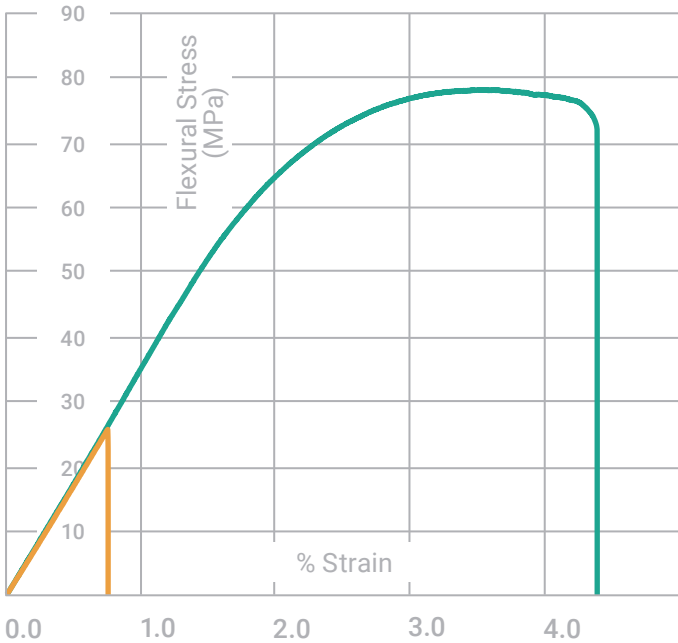
## EXCELLENT HARDNESS AT LOW MDI CONTENT



# HYDROLYSIS RESISTANCE

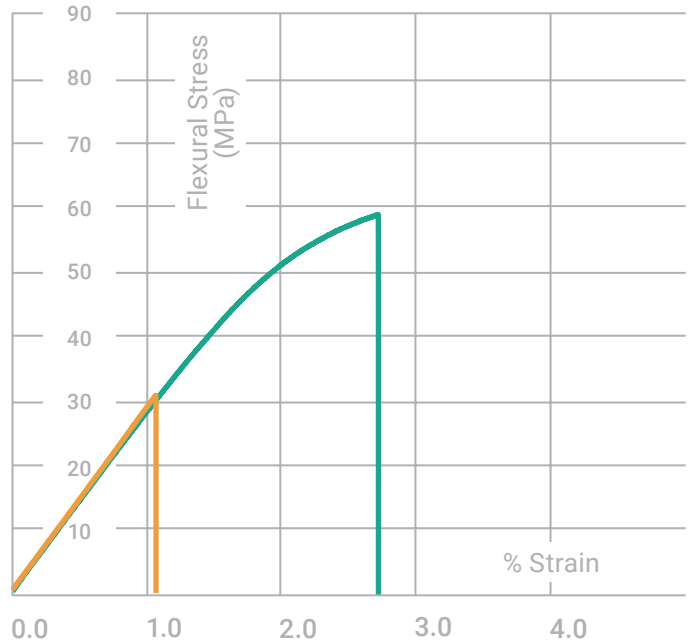
No significant change to mechanical properties after humidity exposure.

**POLYURETHANES FLEXURAL PROPERTIES INITIAL**



— P2040X — P2140X

**POLYURETHANES FLEXURAL PROPERTIES 7 DAYS HYDROLYSIS, 95% RH**

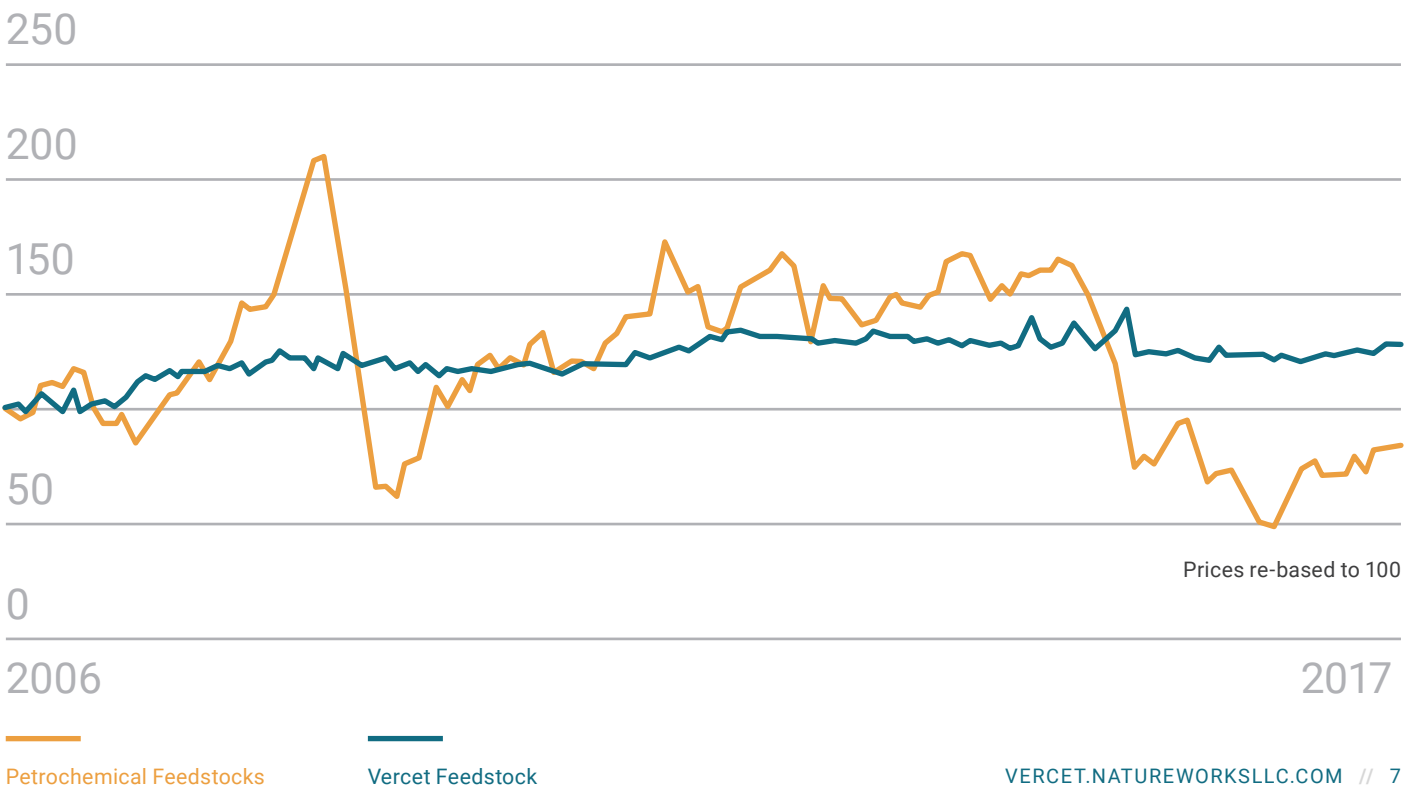


— P2040X — P2140X

## BENIGN BY DESIGN

# REDUCING VOLATILITY IN PRICING THROUGH ALTERNATIVE FEEDSTOCKS

Renewably-sourced Vercet lactide-based products bring sensible, elegant, and cost-effective solutions based squarely on the principles of green chemistry to supply chains that, until now, were coupled with traditional fossil-petroleum solutions and their inherent price volatility.



— Petrochemical Feedstocks

— Vercet Feedstock



## HOW CAN WE HELP YOU?

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To learn more about Vercet custom solutions, please contact a member of our Performance Chemicals team.

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