

## Elevance Unify® 270 Coalescing Agent

### Product Description

Elevance Unify® 270 is a high-performing coalescing agent for waterborne coatings and is designed as a lower VOC replacement to high-VOC coalescing agents. This high-performing coalescing agent lowers VOC emissions while maintaining film performance, offering formulators increased flexibility during reformulation. With its unique molecular structure — a medium chain length unsaturated alkyl ester — Elevance Unify® 270 is creating new performance possibilities as a coalescing agent in waterborne paints and coatings. It has a bio-content of 75 percent.

Coalescing agents are a key component in a paint formula that enable good film formation. They soften the resin particles in the paint, by lowering its Tg and allowing the particles to more effectively flow together after the water has evaporated from the applied film. Traditional coalescing agents evaporate after the film has properly formed creating substantial VOC emissions. Zero VOC coalescing agents stay in the film often adversely impacting film properties such as block and scrub resistance. Elevance Unify® 270 is a semi-volatile material which has exceptional efficiency as a coalescing agent across a wide range of resins. This increased efficiency, likely a result of its unsaturation, combined with its semi-volatility can enable formulators to reduce a paint's VOC by up to 50% compared to the leading high VOC coalescing agent on the market.

Elevance Unify® 270 creates good quality films while lowering the paint's VOC up to 50 percent compared to 2,2,4-trimethyl-1,3 pentanediol monoisobutyrate (TMB)<sup>1</sup>. Elevance Unify® 270 has shown 40 percent higher efficiencies in some formulations indicating lower coalescent loadings could be achieved. In addition, formulations using Elevance Unify® 270 frequently show improved open times compared to TMB.

Applications for Elevance Unify® 270 include a broad range of waterborne coatings such as architectural, industrial and special purpose coatings.

#### Features

- 50 percent VOC reduction<sup>1</sup>
- Good film qualities
- Excellent efficiency
- De-foaming action
- Better open times
- Bio-based
- Good scrub resistance

#### Benefits

- Increased formulation flexibility – lowering VOC without sacrificing film quality
- Reduced coalescent loadings
- Decreased use of de-foaming additives
- Improved paint usability
- Lower carbon footprint

## Elevance Unify® 270 Coalescing Agent

### Chemical and Physical Properties

Chemical & Physical Analysis	Typical Value	Method	Chemical & Physical Analysis	Typical Value	Method
Molecular Weight	212.32 g/mol	Calc	Density (20°C)	0.882 g/mL	--
Chemical Formula	C <sub>13</sub> H <sub>24</sub> O <sub>2</sub>	Formula	Wt/Vol (20°C)	7.36 lb/gal	--
Appearance	Clear liquid	Visual	Viscosity 20°C	3.45 mm <sup>2</sup> /sec	OECD114
Color (Pt-Co)	≤ 10	ASTM D5386	Solubility	0.00105 g/L	OECD105
Boiling Point	267°C	OECD103	Octanol/Water Part Coef	5.85-5.96 Log Pow	OECD117
Freezing Point	-36°C	ASTM D97	Hansen Solubility δ <sub>D</sub>	16.5 MPa <sup>1/2</sup>	Calc
Flash Point	127°C	ASTM D93	Hansen Solubility δ <sub>P</sub>	4.6 MPa <sup>1/2</sup>	Calc
Surface Tension @ 20°C	29.7 dyne/cm	ISO304	Hansen Solubility δ <sub>H</sub>	7.4 MPa <sup>1/2</sup>	Calc
Acid Number	≤ 5 mg KOH/g	AOCS Cd 3d-63	VOC (US EPA Method 24) <sup>b</sup>	0.495 g/g	ASTM D2369-95

### Elevance Unify® 270 Coalescing Performance

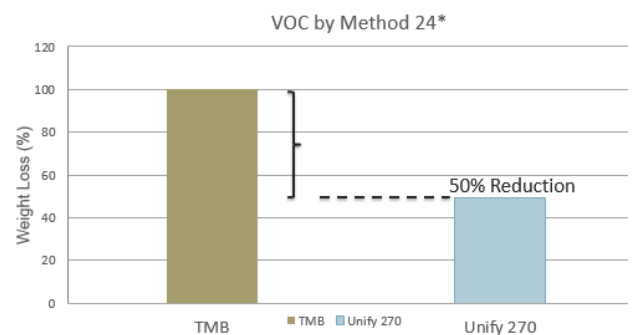
Elevance Unify® 270 exhibited excellent film formation performance compared to TMB at equal loadings in a water-borne acrylic resin formulation (Rhoplex SG-30). At loadings of 1 percent Elevance Unify® 270 passed the low temperature film formation test and showed lower minimum film formation performance compared to TMB. Comparable viscosity and color acceptance was achieved, with less than a 5 percent reduction in scrub resistance performance. In addition Elevance Unify® 270 has shown de-foaming performance and extended open time in acrylic formulations.

### VOC Performance

Elevance Unify® 270 has a VOC profile that is approximately 50 percent lower than TMB by Method 24, as a result of its higher boiling point (267°C) compared to TMB (254°C). The VOC content of neat Elevance Unify® 270 is about 0.495 g/g VOC. In addition, Elevance Unify® 270 can often be used at lower loadings than other coalescing agents, which helps to further reduce the VOC contribution in a formulation. Elevance Unify® 270 offers formulators increased formulation flexibility for lowering VOC emissions and optimizing their formula as needed while maintaining film performance.

Coating Performance:  
Acrylic Resin: SG-30 Formulation

Properties	Unify 270	TMB
Coalescent Loading	1%	1%
% of Resin Solids	2.25%	2.25%
LTF 4.5 F	Pass	Pass
MFFT, C	-1.41	2.35
Viscosity (KU)	110	106
Viscosity (KU) 30 days	115	118
Color Acceptance	Pass	Pass
Scrub Cycles	990	1060

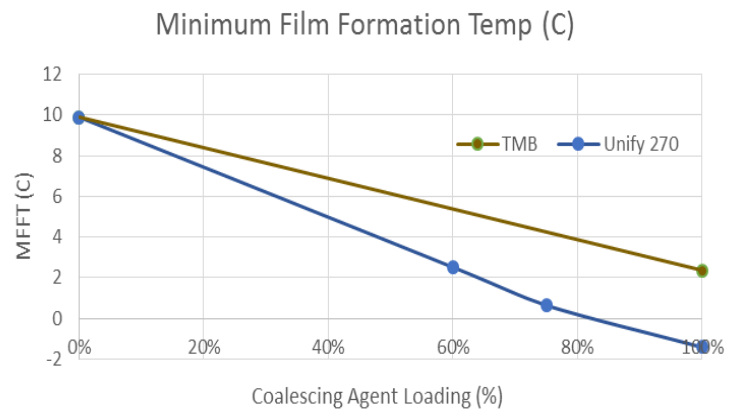


## Elevance Unify® 270 Coalescing Agent

### Film Formation Efficiency

Elevance Unify® 270 is a very good film forming agent. The minimum film forming temperatures for Elevance Unify® 270 at various loadings were compared to TMB in a Rhoplex SG-30 Acrylic resin formulation. This loading study reveals that the loading for Elevance Unify® 270 can be reduced by 40 percent compared to TMB while maintaining the same minimum film formation temperature of about 2.4°C.

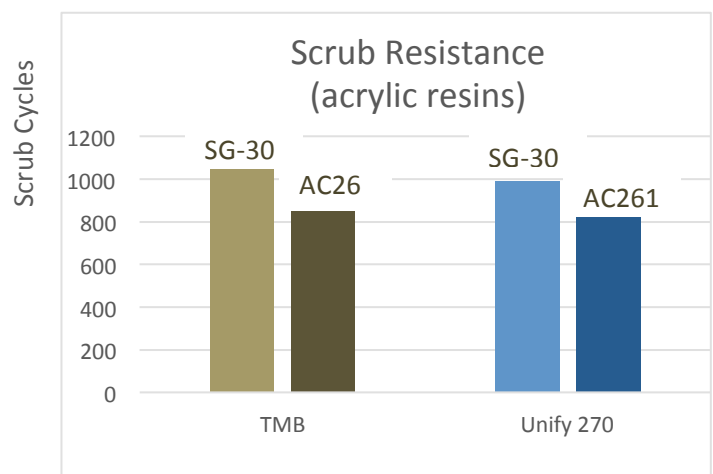
These studies suggest Elevance Unify® 270 is significantly more efficient than TMB allowing for reduced loadings without impacting film formation properties.



### Scrub Resistance

Elevance Unify® 270 exhibited good scrub resistance in several acrylic resin formulations. The scrub performance for formulations using TMB and Elevance Unify® 270 were compared in two different acrylic systems (SG-30 and AC261). Elevance Unify® 270 exhibited scrub performance within 5 percent of the scrub performance observed with TMB in both systems.

Scrub resistance testing was performed following ASTM D2486. Leneta standard scrub panels with untinted paint formulations were prepared using a 7 mil Bird bar. The panels dried in air for seven days before testing. The panels were attached to a Gardner Abrasion tester using a specified brush. The brush and scrub media were replaced every 400 cycles. The tests were run until breakthrough at the shim was reached.



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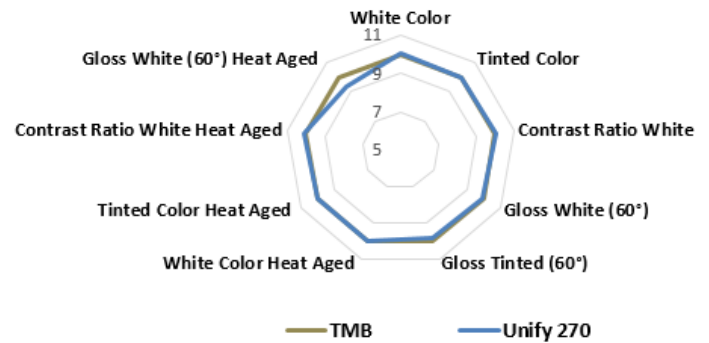
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## Elevance Unify<sup>®</sup> 270 Coalescing Agent

### Film Color/Gloss Quality and Stability

As seen in the following spider chart and color comparison table, a semi-gloss acrylic resin (SG-30) made with Elevance Unify<sup>®</sup> 270 shows very good color, gloss, and hide performance compared to a formulation made with TMB. In addition, color, gloss, and hide performance was not significantly impacted after heat aging for 30 days at 50°C. Color rub-up tests performed on heat aged, tinted samples showed no color development issues. These color and gloss results suggest that Elevance Unify<sup>®</sup> 270 can replace TMB without significant color acceptance or gloss changes.

### Architectural Coating - Rhoplex SG-30 Acrylic Latex



### White and Tinted Color and Gloss Performance

Coalescent	Film Thickness	White Gloss 20/60	White L.a.b. Color	Contrast Ratio	Conclusion
TMB, White	8 mil	31.6/67.7	L +95.79 / a -1.07 / b +0.50	97.12	Pass
Unify 270, White	8 mil	29.9/67.3	L +96.10 / a -1.08 / b +0.75	98.07	Pass
TMB, Tinted	8 mil	38.5/72.1	L +91.98 / a +1.36 / b +14.51	No Change	Pass
Unify 270, Tinted	8 mil	35.4/71.0	L +91.97 / a +1.40 / b +14.57	No Change	Pass

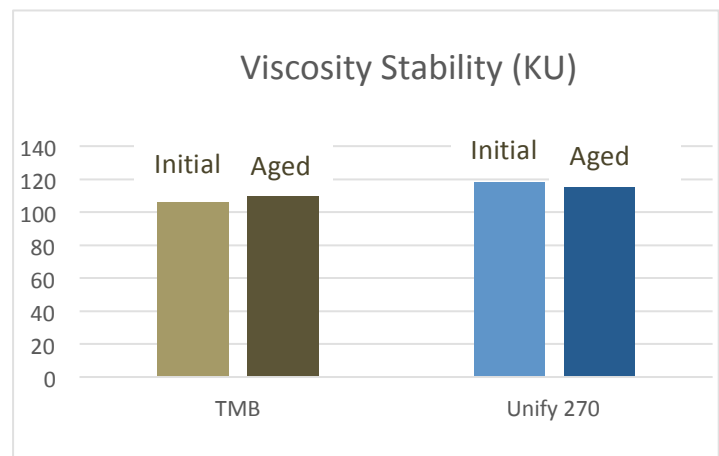
White and tinted formulations were tested fresh after 24 hrs or after heat aging for 30 days at 50°C on 8 mil thick films. Tinted paints were made with PAN no VOC Yellow Oxide colorant. As the tinted samples started to dry, a color rub-up test was performed on them.

Color was measured using an X-Rite color spectrophotometer following ASTM D2244 (Color) and ASTM 2805 (Contrast Ratio). Gloss was measured at 20° and 60° angles following ASTM 523. Readings were taken on white and tinted (PAN non-VOC, yellow oxide) films.

### Viscosity and Stability

Elevance Unify<sup>®</sup> 270 exhibited a similar viscosity profile in acrylic resin formulations (SG-30) using TMB at similar loadings and these formulations expressed similar viscosity changes over time after heat aging.

Viscosity was measured by ASTM D562 Krebs Viscosity. The initial viscosities using Elevance Unify<sup>®</sup> 270 were slightly higher than the viscosities observed with TMB at 110 KU vs. 106 KU respectively. Formulated paints were then heat aged at 50°C over 30 days. The heat aged viscosities, measured at 25°C, were 115 KU and 118 KU respectively.



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## Elevance Unify® 270 Coalescing Agent

### Formula Guide

The SG-30 Acrylic paint formulations used in this technical bulletin were prepared using the following formula. This formula is for the 100 percent TMB paint formulation. Elevance Unify® 270 formula followed the same approach. A master grind of the pigment dispersion was used to minimize any variations. After all of the letdowns were made the paint formulations were allowed to acclimate for 24-48 hours in a 25°C stability chamber before any test was done. This allowed the product to come to the proper temperature for viscosity measurement and to de-air from processing.

### References and Testing Methods

1. VOC Measurement – Method 24, which involves determining the total volatiles by ASTM D2369-95, density by ASTM D1475, and the water percentage by ASTM D4107 Karl Fischer
2. Scrub Resistance – ASTM D2486, which entails preparing films on Leneta standard scrub panel using a 7 mil Bird Bar; Panels dried for seven days before testing; Panels were scrubbed using a Gardner Abrasion tester with a specified scrub brush and media; Tests are run until breakthrough at the scrim
3. Viscosity – ASTM D562 Krebs Viscosity
4. Gloss – ASTM 523
5. Color – ASTM D2244
6. Contrast Ratio – ASTM D2805

Rhoplex SG-30 Semi-gloss Formula (1.0% coalescing agent formulation)		
Ingredient	Formulation	X3.2 (Made)
Add the water to the clean vessel then add the next four ingredients under low speed - use a dispersion blade		
Water	66.8	213.76
Proxel GXL	1.5	4.8
Tamol 1124	4.2	13.44
CF 10/ CO 630	2	6.4
BYK 022	0.8	2.4
Add the next two ingredients slowly and increase the blade speed to maintain a vortex - increase speed to 1500-2000 RPMs		
ASP-170	30	96
TiO2 - R900	230	736
Use a small amount of additional water if needed - scrape sides of container - check for dispersion after 10 minutes ---5.5-6H		
Additional Water		
Adjust PH to 9-9.5 with		
AMP-95		
Use to adjust paste viscosity to prevent settling		
TR-117		

Ingredient	Formulation	3 Quarts (Made)
In the thin-down tank add the resin and then add the next four ingredients under low speed agitation.		
SG 30	510	1530
Water	253.88	761.64
Coalescing Agent	11.5	34.5
Propylene Glycol	31.5	94.5
BYK O24	2	6
Use the following to adjust viscosity, ICI viscosity and PH. Add the Rheotech materials to the vortex - allow 30 minutes after addition before checking viscosity.		
AMP-95	3	9
Rheotech 2800	15	45
Rheotech 2800	0	0
<b>Viscosity</b>	<b>102 @ 23 C</b>	