Coatings Trends & Technologies SUMMIT

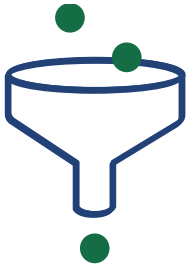
Paradigm-Shifting Work Yields Surprising New Formulation Options

DyStar®

ASSUMPTIONS FROM INDUSTRY INTERVIEWS & EXPERIENCE

Semi-Gloss Paints

For semi-gloss paints, Organically Modified Silicone (OMS) defoamers are predominant.



The dosage rate for defoamer is usually kept to a minimum, 0.2 - 0.3% on total formula weight, to prevent film defects, such as craters, fish-eyes, and pinholes.

Semi-gloss architectural paints are applied via airless spray, brush, or roller

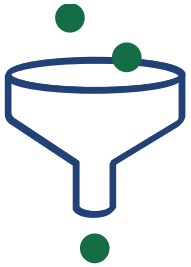
- *Airless spray is the preferred method by contractors*

ASSUMPTIONS FROM INDUSTRY INTERVIEWS & EXPERIENCE

Satin Paints

For satin architectural paints, Organically Modified Silicone (OMS) or Mineral Oils are most common.

- *However, mineral oils are often dismissed due to perceived gloss loss or undesirable film characteristics.*



The dosage rate for defoamer is usually kept to a minimum, 0.5 - 0.8% on total formula weight, to prevent film defects, such as craters, fish-eyes, and pinholes.

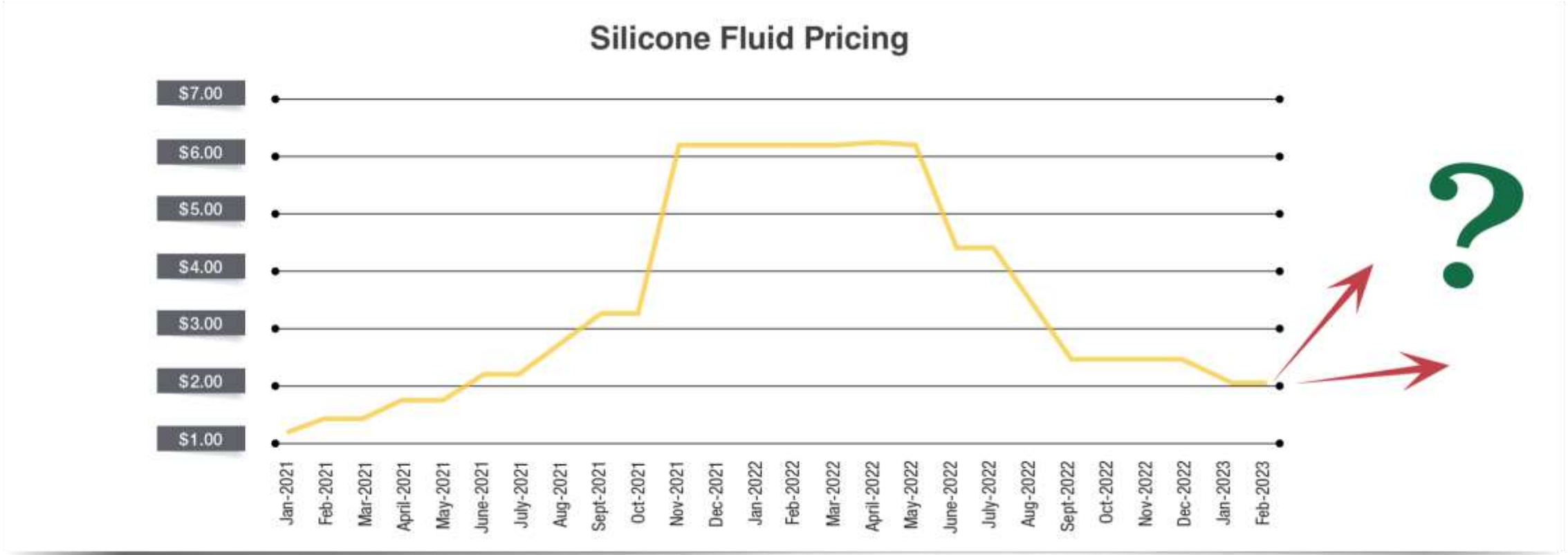
Satin architectural paints are applied via airless spray, HVLP spray, brush, or roller.

- *Airless spray or HVLP is the preferred method by contractors*
- *DIY – brush or roll*

SILICONE MARKET VOLATILITY

We are dealing with the same situation…

- *Silicone raw materials are highly sensitive to shocks given current supply/demand balance*
- *Overall industrial output, solar, and China energy policy has major impact on the supply*
- *Pricing is a big concern, but even worse, availability can be terrible during shocks*



DyStar®

Coatings Trends & Technologies SUMMIT

QUESTION:

Are Organically Modified Silicones really the best?

Design of Experiment

- *Utilize up-to-date "modern" paint formulas (low VOC, etc.)*
- *Screen multiple defoamers based on likely utility*
- *Deep dive comparisons to industry benchmarks*
  - *Competitor A - Polysiloxane & Hydrophobic Solids in Polyglycol*
  - *Competitor B - Polyether Siloxane*
  - *Competitor C - Hyperbranched Polymer with OMS*

	RAW MATERIALS	QTY (gms)	QTY (Kg)
PIGMENT GRIND	Water	9.00	90.00
	Stabilizer	0.10	1.00
	Dispersant	0.25	2.50
	Wetting Aid	0.15	1.50
	Defoamer	0.14	1.40
	Thickener	1.10	11.00
	Buffer	0.10	1.00
	Thixotropic Additive	0.50	5.00
	Titanium Dioxide	23.10	231.00
	Water	1.90	19.00
PRE-LET DOWN	Acrylic Emulsion	46.30	463.00
	Water	4.50	45.00
	Propylene Glycol	0.90	9.00
LET DOWN	Coalescent	1.55	15.50
	Defoamer	0.11	1.10
	Water	2.00	20.00
	Rheology Modifier	2.00	20.00
	Thickener (HEUR)	1.00	10.00
	pH Adjusting Additive	0.10	1.00
	In-Can Preservative	0.10	1.00
	Dry Film Preservative	0.30	3.00
	Water	4.80	48.00
	Total	**100**	**1,000.00**

DyStar®

SEMI-GLOSS WHITE BASE:

Coatings Trends & Technologies SUMMIT

DyStar®

Coatings Trends & Technologies SUMMIT

SEMI-GLOSS PAINT PROPERTIES:

TYPICAL PROPERTIES	
% Solids (by weight)	50.00
% Solids (by volume)	36.00
% PVC	21.00
pH range	8.50 - 9.50
WPG (lbs/gal)	10.50 - 10.75
Specific Gravity (g/cm^3)	1.25 - 1.28
% Gloss (60°)	60 - 68

DRAWDOWN RESULTS – 3 MIL DRY

PROPERTY	COMPETITOR A	COMPETITOR B	COMPETITOR C	DYSTAR SG-A	DYSTAR SG-B	DYSTAR SG-C
"Base" Chemistry	OMS	OMS	OMS	OMS	Polyol	Mineral Oil
Film Appearance (Dry)	5	5	5	5	5	5
60° Gloss (60 - 68)	65	65	64	62	61	65

- *(OMS) - Organically Modified Silicone*
- *Appearance Scale - 0 = Extreme Foam*
  5 = No Foam

DRAWDOWN RESULTS – 3 MIL DRY

NO DEFOAMER

COMPETITOR A

COMPETITOR B

DYSTAR SG-A

DYSTAR SG-B

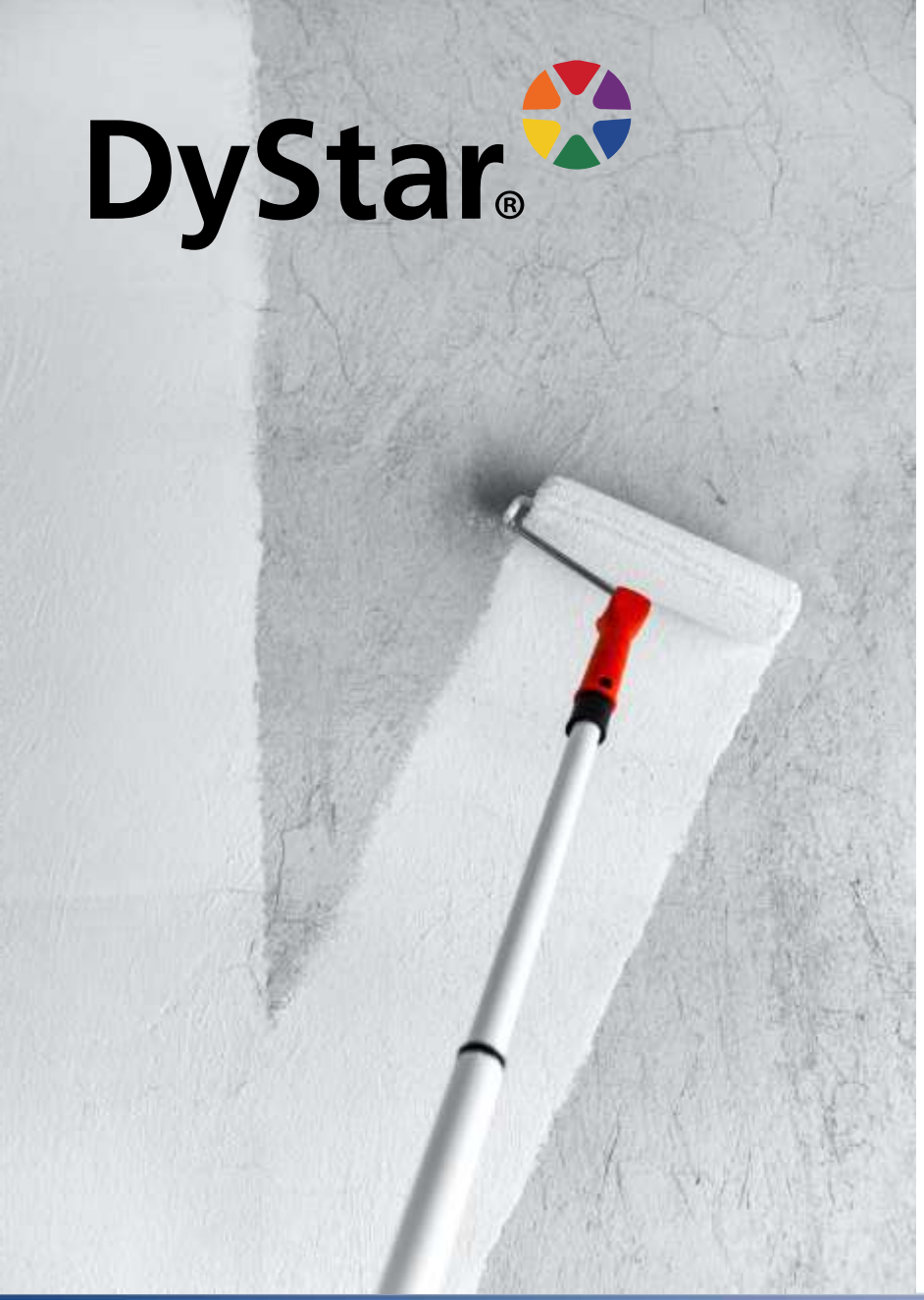
DYSTAR SG-C

AIRLESS SPRAY RESULTS – 5 MIL DRY

PROPERTY	COMPETITOR A	COMPETITOR B	COMPETITOR C	DYSTAR SG-A	DYSTAR SG-B	DYSTAR SG-C
"Base" Chemistry	OMS	OMS	OMS	OMS	Polyol	Mineral Oil
Film Appearance (Dry)	3.5	3.5	5	5	5	5
60° Gloss (60 - 68)	65	65	64	62	61	65

- *(OMS) - Organically Modified Silicone*
- *Appearance Scale - 0 = Extreme Foam*
  5 = No Foam

DyStar®



	RAW MATERIALS	QTY (gms)	QTY (Kg)
PIGMENT GRIND	Water	14.00	140.00
	Stabilizer	0.10	1.00
	Dispersant	0.60	6.00
	Wetting Aid	0.45	4.50
	Defoamer	0.30	3.00
	Thickener	0.20	2.00
	Buffer	0.10	1.00
	Thixotropic Additive	0.30	3.00
	Titanium Dioxide	20.00	200.00
	Extender Pigment	5.50	55.00
	Water	4.20	42.00
LET DOWN	Acrylic Emulsion	42.20	422.00
	Water	2.00	20.00
	Opacifier	2.30	23.00
	Propylene Glycol	1.80	18.00
	Coalescent	1.25	12.50
	Defoamer	0.45	4.50
	Thickener (HEUR)	0.80	8.00
	Thickener (HEUR)	0.05	0.50
	In-Can Preservative	0.15	1.50
	Dry Film Preservative	0.30	3.00
	Water	2.95	29.50
	Total	**100**	**1,000.00**

SATIN WHITE BASE:

Coatings Trends & Technologies SUMMIT

DyStar®

Coatings Trends & Technologies SUMMIT

SATIN WHITE BASE:

TYPICAL PROPERTIES	
% Solids (by weight)	53.00
% Solids (by volume)	39.00
% PVC	26.00
pH range	8.50 - 9.50
WPG (lbs/gal)	10.73
Specific Gravity (g/cm^3)	1.282
% Gloss (60°)	15 - 20

DRAWDOWN RESULTS – 3 MIL DRY

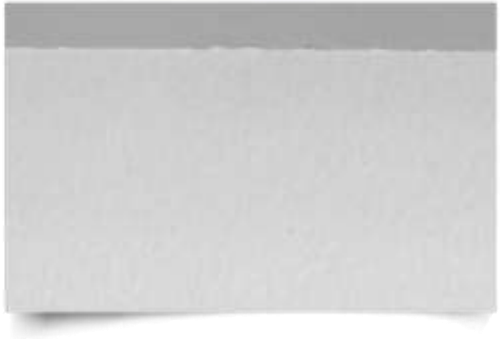
PROPERTY	COMPETITOR A	COMPETITOR B	COMPETITOR C	COMPETITOR D	DYSTAR A	DYSTAR B	DYSTAR C
Chemistry	Mineral Oil	Mineral Oil	OMS	OMS	Mineral Oil	Mineral Oil	Synthetic Polyol
Weight/Gal (initial)	10.538	10.616	10.584	10.578	10.611	10.626	10.625
Weight/Gal (24 hours)	10.578	10.612	10.598	10.598	10.609	10.626	10.634
Film Appearance (Wet)	Moderate Foam	Moderate Foam	Moderate Foam	Moderate Foam	No Foam	Foamy	No Foam
Film Appearance (Dry)	No Foam	No Foam	No Foam	No Foam	No Foam	No Foam	No Foam
60° Gloss	19.3	19.9	20.7	21.1	17.4	19.3	17.3
60° Gloss (after 4 weeks, 50°C)	21.2	21	22.7	22.1	19.3	20.8	17.8

» *(OMS) - Organically Modified Silicone*

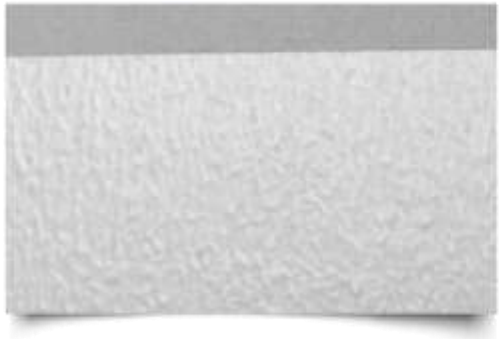
ROLLOUT RESULTS – 3 MIL DRY

COMPETITOR A

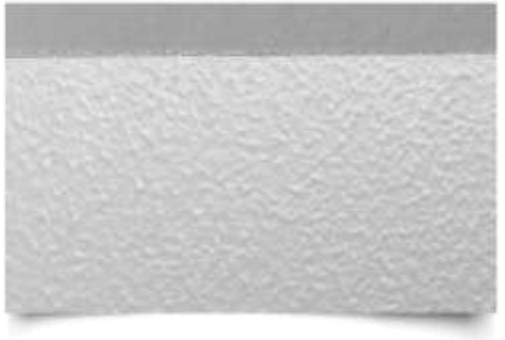
COMPETITOR B



COMPETITOR C



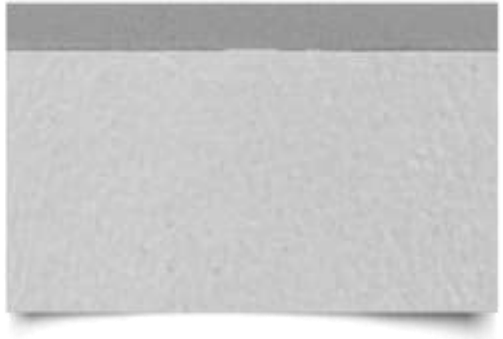
COMPETITOR D



DYSTAR - A

DYSTAR - B

DYSTAR - C



SPRAY (HVLP) RESULTS – TWO COATS:

PROPERTY	COMPETITOR A	COMPETITOR B	COMPETITOR C	COMPETITOR D	DYSTAR A	DYSTAR B	DYSTAR C
Chemistry	Mineral Oil	Mineral Oil	OMS	OMS	Mineral Oil	Mineral Oil	Synthetic Polyol
Film Appearance (Wet)	Slight Foam	Slight Foam	Moderate Foam	Moderate Foam	No Foam	Slight Foam	No Foam
Film Appearance (Dry)	Slight Foam	Very Slight Foam	Moderate Foam	Moderate Foam	No Foam	Slight Foam	No Foam
60° Gloss	16.5	17	16.6	17.4	15.3	15	17

» *(OMS) - Organically Modified Silicone*

DyStar®

Coatings Trends & Technologies SUMMIT

CONCLUSIONS:

Semi-Gloss

Several promising non-OMS alternatives were identified.

- *Synthetic Polyol*
- *Self-emulsifying non-ionic Mineral Oil*

Satin

Novel non-OMS, non-Mineral Oil alternative identified.

- *Synthetic Polyol*

Both competitive and in-house mineral oil types debunk gloss loss assumptions.

CONCLUSIONS:

Both Semi-Gloss & Satin

› *Wet Films occasionally have fine foam traces (all defoamer types)*

› *Dry Films appear clean, smooth and devoid of craters, pin holes or fish-eyes*

› *No negative performance tradeoffs*

› *Could lead to meaningful raw material cost advantages and security of supply*

PLEASE CONTACT US WITH ANY QUESTIONS:

Bryan Haltom
Performance Chemicals Business Manager
Industrial Colorants & Additives
haltom.bryan@dystar.com
+1 980 257 2288

Steve Crast
Performance Chemicals R&D Manager
Industrial Colorants & Additives
crast.steven@dystar.com
+1 704 561 3073

DyStar®