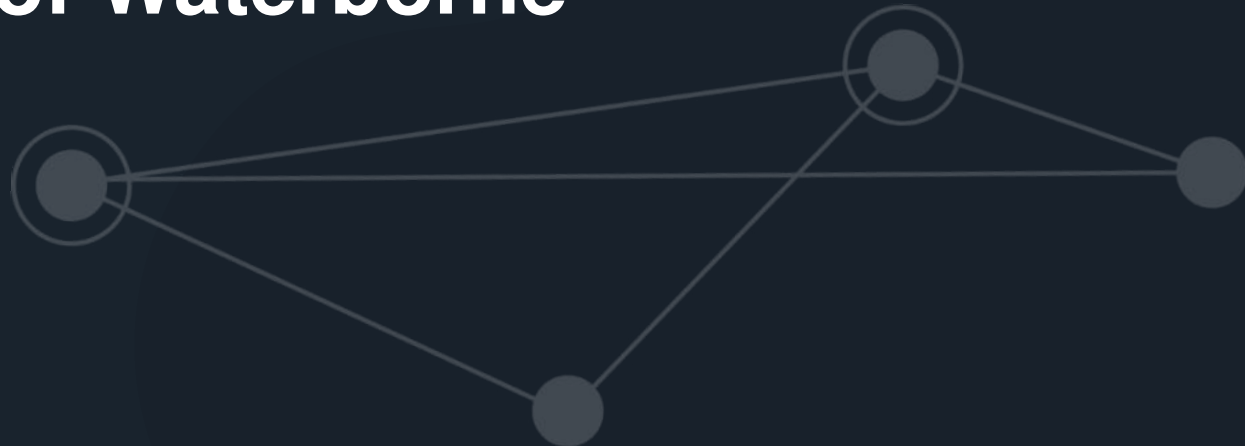




**Advancion**

PAINTS AND COATINGS

# Leveraging the Use of Alkanolamine Additives During Pigment Grinding to Improve the Performance of Waterborne Coatings



# Multifunctional ANGUS Solutions for Reducing VOC across Multiple Applications

## Architectural Decorative Paints

AEPD™ VOX 1000 as a multifunctional wetting agent for no-VOC formulations

## Solvent-borne Alkyd Paints

Replacement of solvents by up to 20%wt replaced by water or NIPAR S-10™

## Waterborne Direct-To-Metal (DTM) Coatings

ANGUS amino alcohols enable the development of high-performance alternatives to solvent-based coatings

## Non-VOC Organic Pigment Dispersions

ANGUS multifunctional additives enhance stability and dispersion performance in no-emission tinting systems

## Waterborne Pigment Slurries

ANGUS amino alcohols enable higher solid content (e.g., higher TiO<sub>2</sub> loading), reducing overall CO<sub>2</sub> footprint of products

## Indoor Air Quality Improvement

TRIS AMINO™ Crystals provide high-efficiency scavenging of VOC pollutants such as formaldehyde in deco paints and air filtration media.

# Summary

The use of Advancion ingredients such as AMP-95™ in waterborne organic pigment dispersions:

- Enables a significant **increase of the solid content** of pigment, while **decreasing the amount of conventional dispersing agent**.
- **Increases the storage stability** of waterborne dispersions.
- **Reduces the mechanic effort** during grinding.
- Supports the **optimization of organic pigment dosage**



# Products for Paints, Coatings and Inks

## For Water-based Systems

### Amino Alcohols

AMP-95™  
AEPD™ VOX 1000  
DMAMP-80™  
TRIS AMINO™ Crystals  
DMMOPA™ - **NEW!**

*Multifunctionality*  
*Pigment Dispersion*  
*Neutralization*  
*pH Buffering*  
*Corrosion Control*  
*Preservative Synergy*  
*Formaldehyde Scavenging*  
*Color Acceptance*  
*Solvency*

### Carbodiimides

ZOLDINE™ XL-29SE

*Cross-Linking*

## For Solvent-based Systems

### Nitroparaffin Solvents

NIPAR™ S-10  
NIKANE™ MS 3000  
NIKANE™ MS 5000  
AVANTANE™ PA 4000  
FLEXITANE™ CA 6000

*Solubilization*  
*Controlled Drying*  
*Substrate Wetting*  
*Pigment Dispersion*

### Oxazoline Surfactants

ALKATERGE™ E  
ALKATERGE™ T

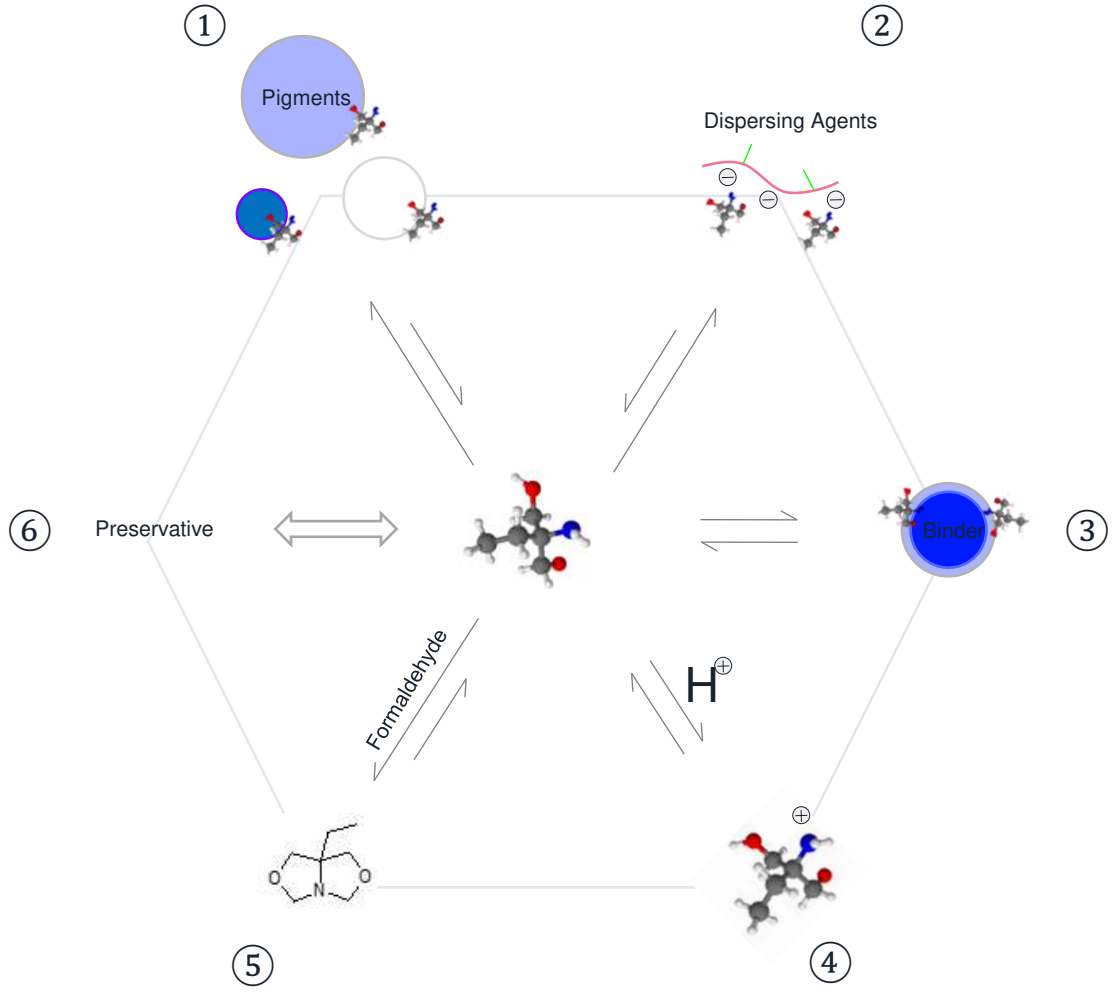
*Emulsification*  
*Pigment Dispersion*  
*Corrosion Control*

### Oxazolidine Additives

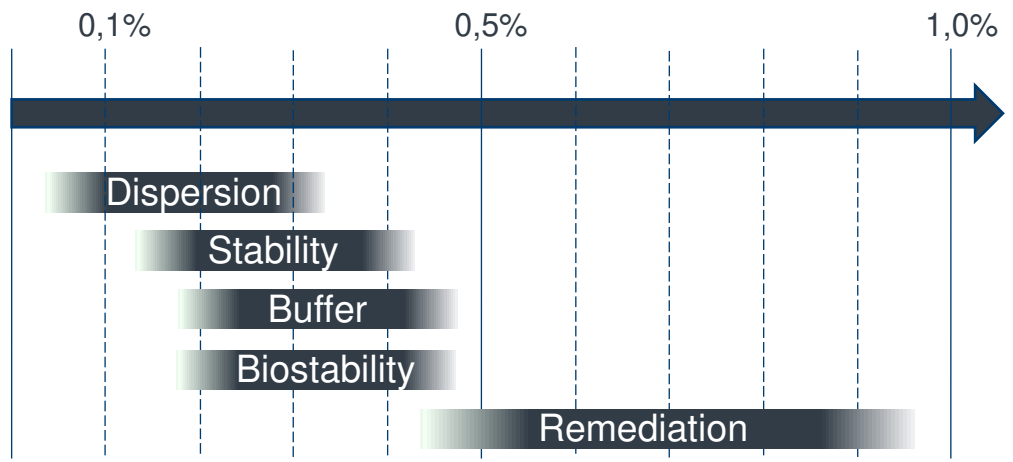
ZOLDINE™ MS-PLUS

*Moisture Scavenging*

# Maximizing Multifunctional Performance

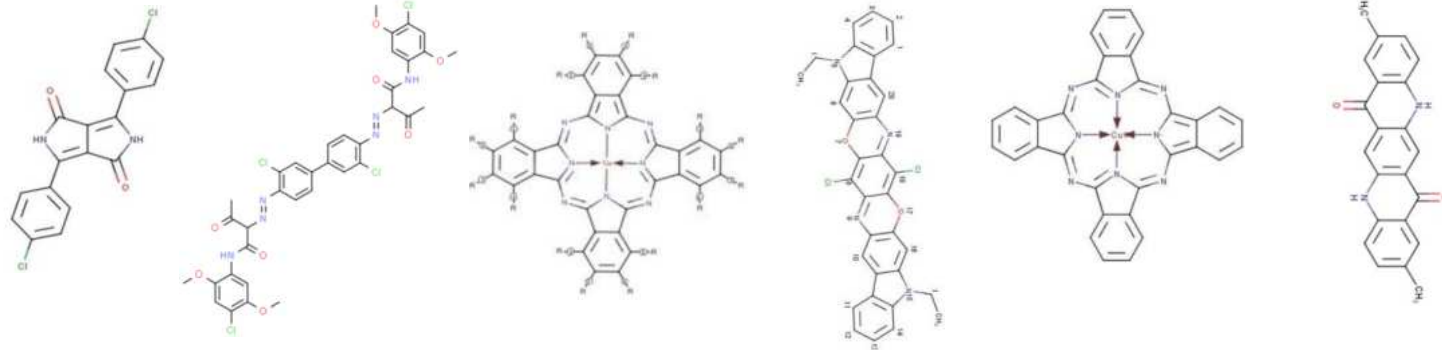


Effect	Cause	Dispersion	Let Down
Dispersion	①②	X	
Stability	①②③④	X	X
Buffer	④		X
Remediation	⑤		X
Biostability	⑥	X	X



# Overview of Organic Pigments Evaluated

Pigment CAS No. CI	PR 254 84632-65-5 56110	PY 83 5567-15-7 21108	PG 7 1328-53-6 74260	PV 23 21247-95-3 51319	PB 15:3 147-14-8 74160	PR 122 980-26-7 73915
Chemical class	Diketopyrrolo- pyrrole	Diarylide	Phtalocyanine	Dioxazine	Phtalocyanine	Quinacridone
<i>Density</i>	1,55	1,51	2,05	1,49	1,61	4,45
<i>Oil absorption (mL/100g)</i>	51	66	50	78	54	65
<i>specific surface (m<sup>2</sup>/g)</i>	16	21	40	80	52	77

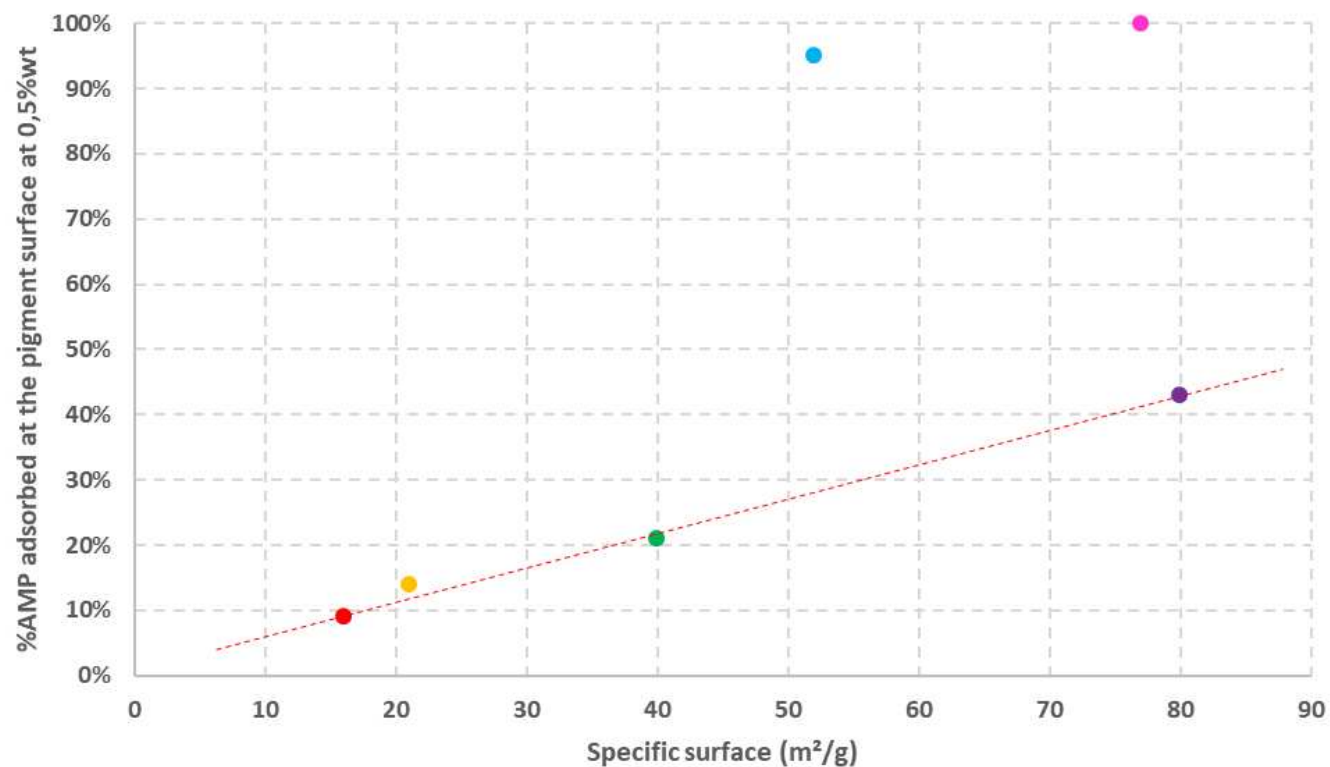


# Evaluation of the Interaction Between AMP and Organic Pigments

Pigment CAS No. CI	PR 254 84632-65-5 56110	PY 83 5567-15-7 21108	PG 7 1328-53-6 74260	PV 23 21247-95-3 51319	PB 15:3 147-14-8 74160	PR 122 980-26-7 73915
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# Adsorption and Specific Surface

Slurry of organic pigments in water with 0,5%wt / OPwt of AMP

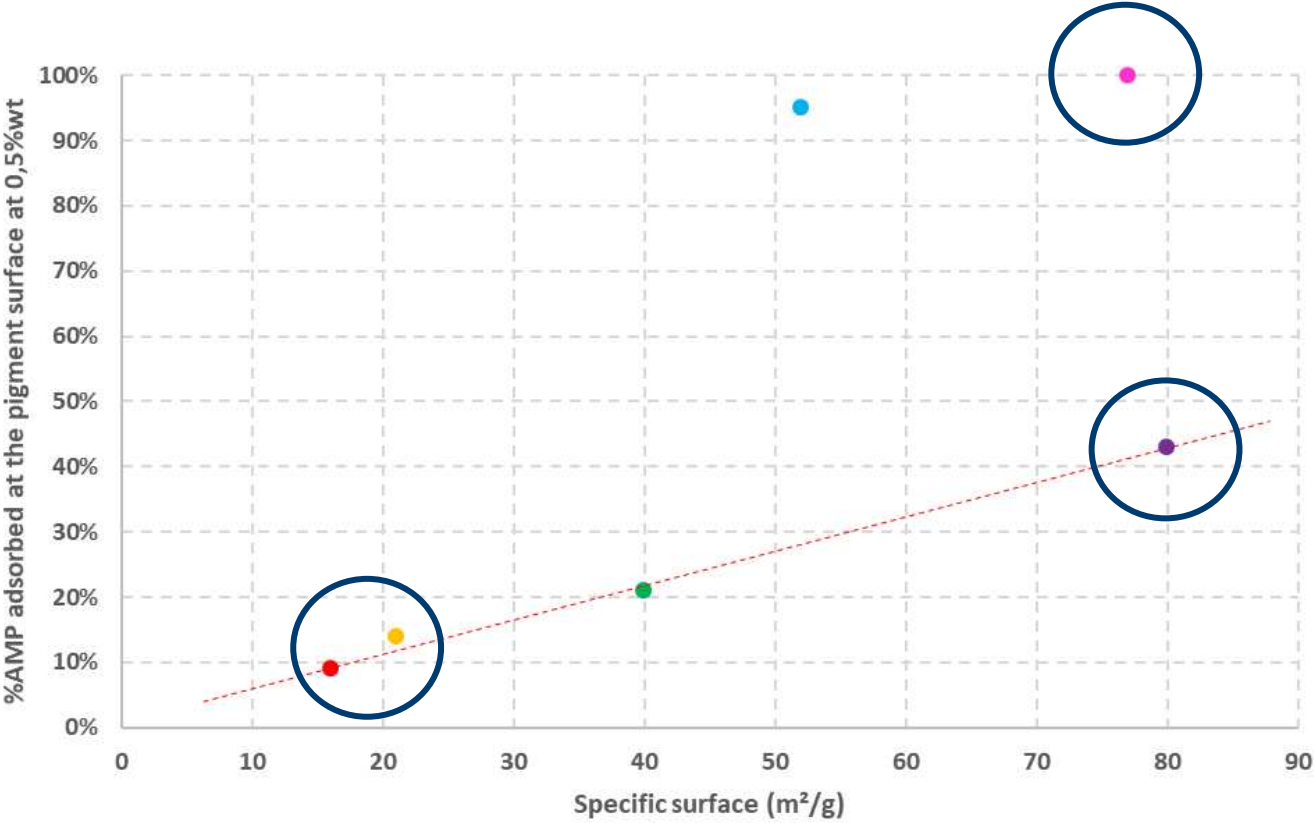


Linear correlation between Specific surface and adsorption, excepted for PB 15:3 and PR122



Pigment	PR 254	PY 83	PG 7	PV 23	PB 15:3	PR 122
CAS No.	84632-65-5	5567-15-7	1328-53-6	21247-95-3	147-14-8	980-26-7
CI	56110	21108	74260	51319	74160	73915
Chemical class	Diketopyrrolo-pyrrole	Diarylide	Phtalocyanine	Dioxazine	Phtalocyanine	Quinacridone
Density	1,55	1,51	2,05	1,49	1,61	4,45
Oil absorption (mL/100g)	51	66	50	78	54	65
specific surface (m <sup>2</sup> /g)	16	21	40	80	52	77

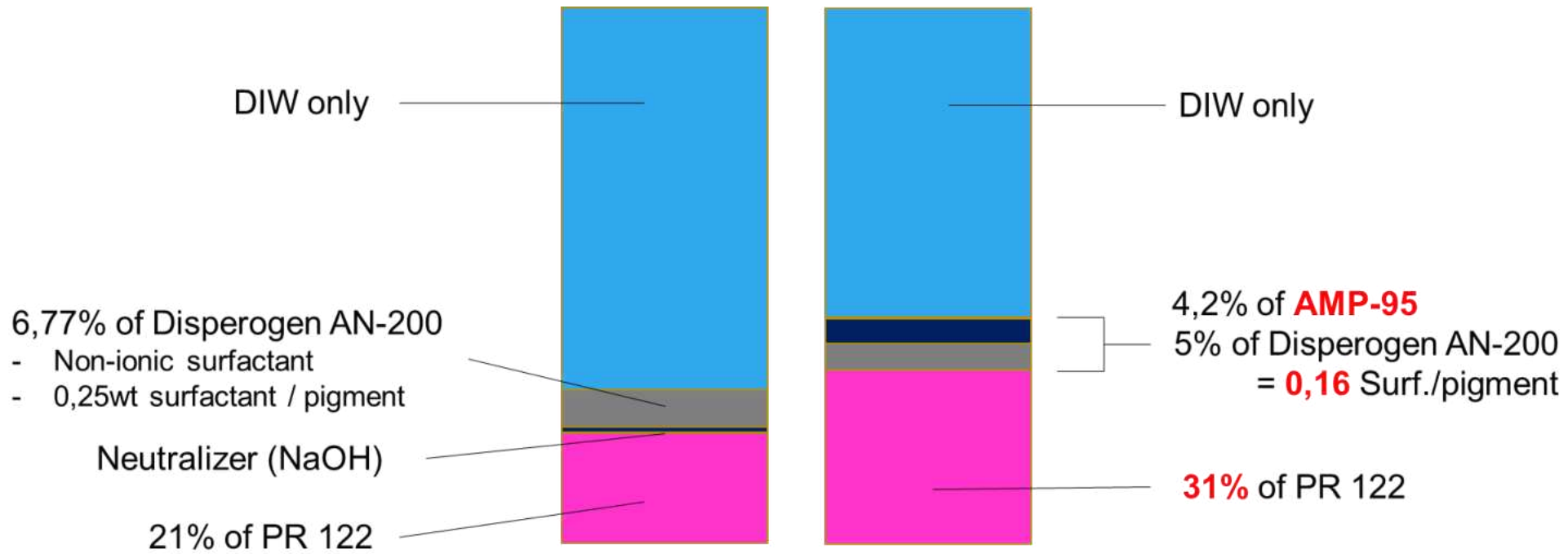
# Selection of 4 pigments for the grinding process



**PR254, PY83, PV23, and PR122** have been selected in order to cover a wide range of AMP adsorption.

# Optimized Experimental Protocol

# Formulation Selection



Formulation in water only

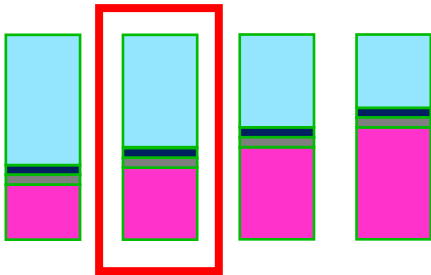
50% replacement of conventional dispersing agent with AMP  
Side-by-side comparison with the same viscosity  
=> Optimization of the solid content

# Optimizing the Waterborne Dispersion with AMP

## Organic pigment grinding

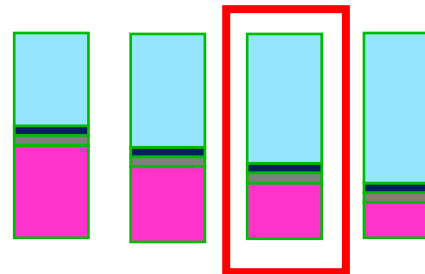
Optimization of the **%SC<sub>g</sub>** during grinding (similar particle size distribution and viscosity)

**Pigment / dispersant ratio is constant.**



## Dilution of the waterborne dispersion

Optimization of the final **%SC<sub>f</sub>** (equivalent viscosity)



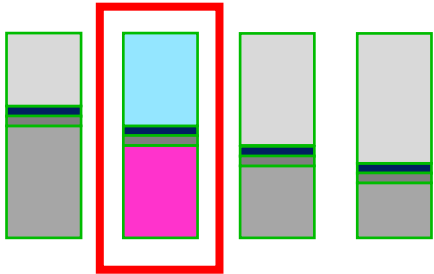
## Commercial paint tinting

Tinting of 9 commercial white paints with the **same %wt** of PR 122



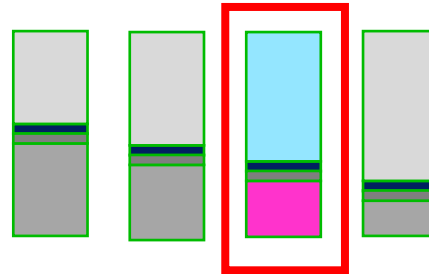
# Optimizing the Waterborne Dispersion with AMP

## Organic pigment grinding



High viscosity does not allow experimental evaluations

## Dilution of the WB dispersion



Initial and 4W@45°C performance:

- Particulate size distribution
- Viscosity
- pH

## Commercial paint tinting



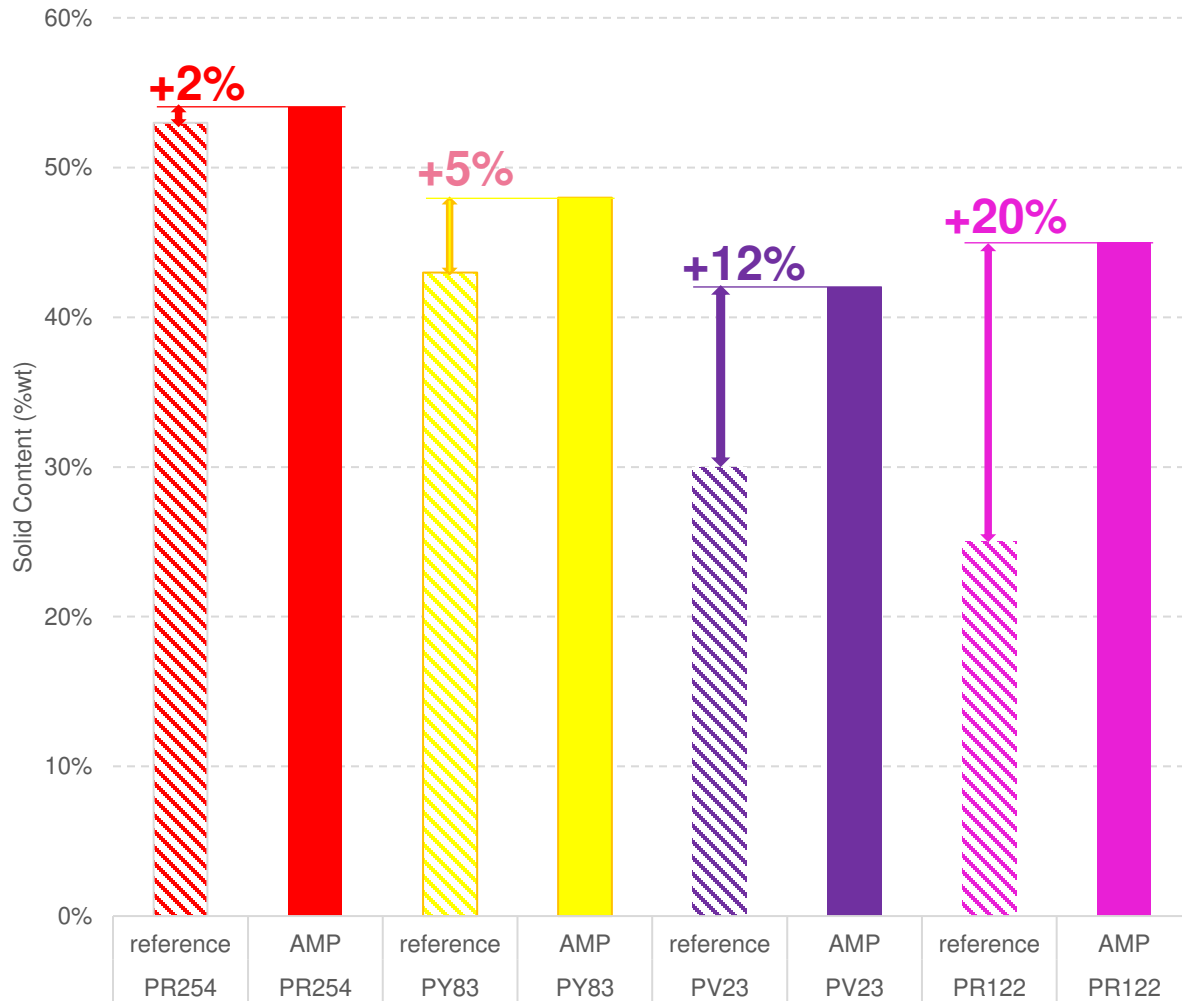
Initial and 4W@45°C performance:

- Particulate size distribution
- Viscosity
- pH
- Colorimetric tests

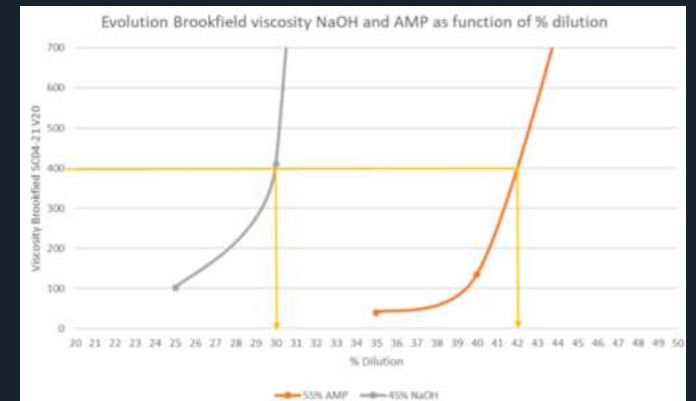
# Comparison of 4 Pigments

PV23 PR122 PR254 PY83

# Optimizing Solid Content

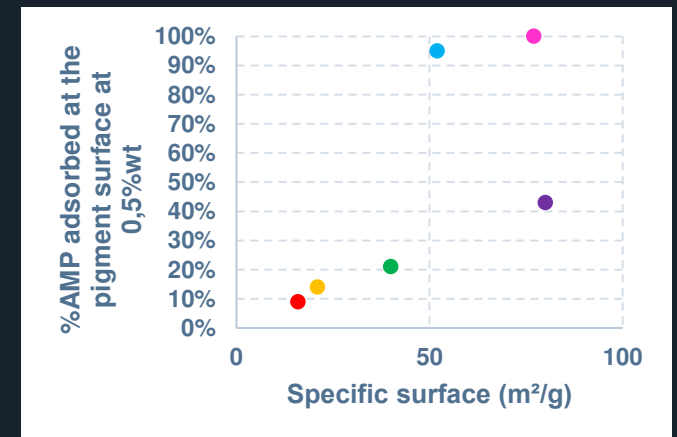


When using AMP to replace 50% of the conventional dispersing agent (Disperogen AN200), the solid content of the dispersion can be increased for an equivalent viscosity



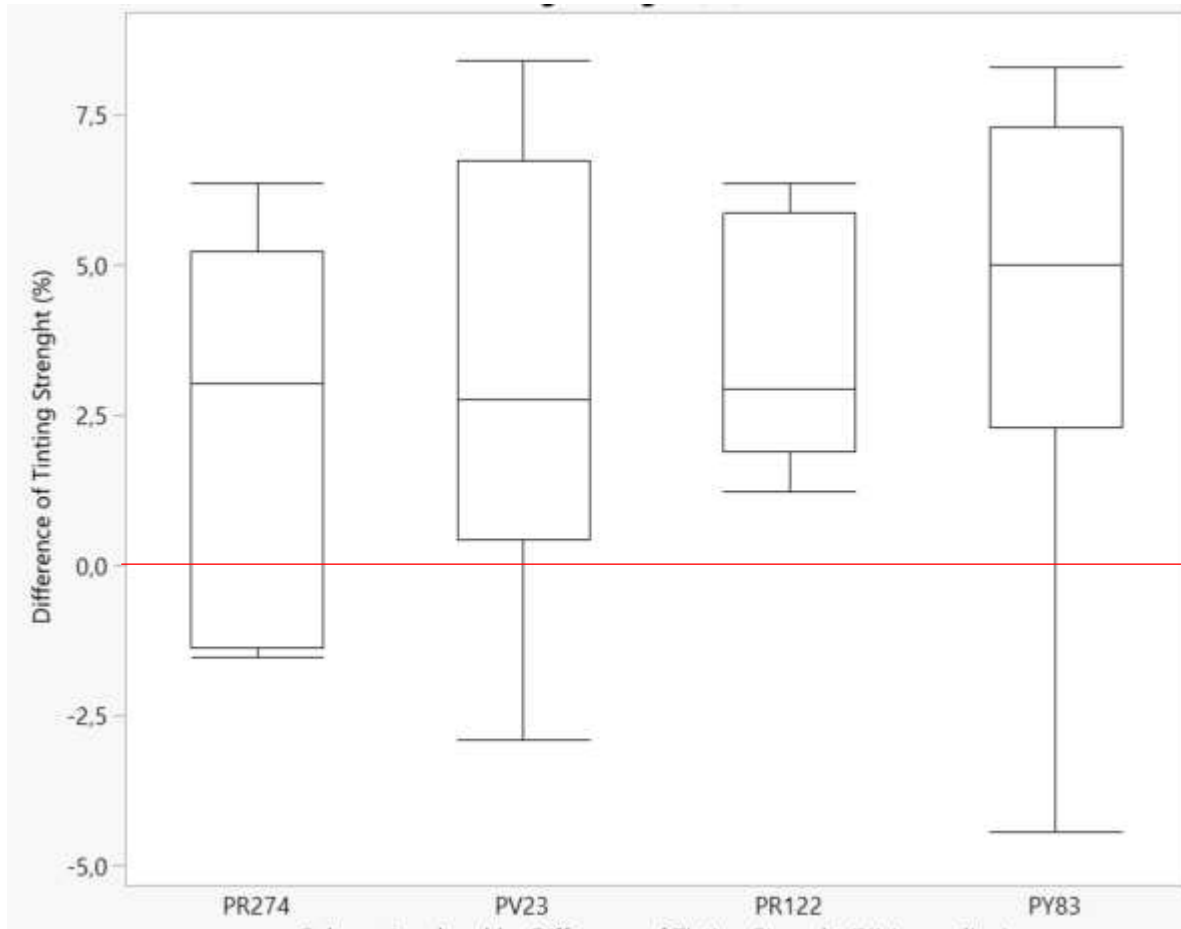
# Optimizing Solid Content

**Solid correlation between the adsorption of AMP at the pigment surface and the improvement of the solid content during the grinding (or the drop of viscosity).**



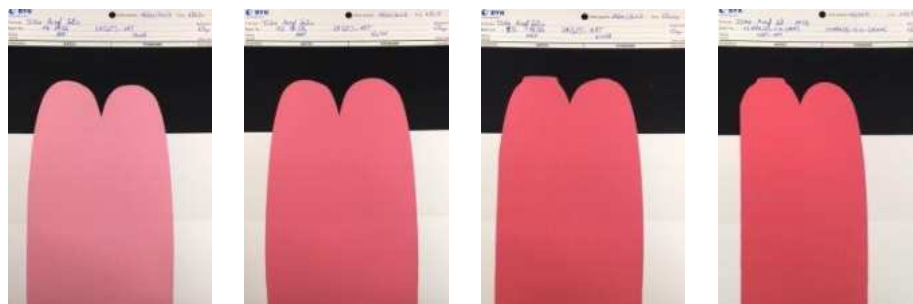
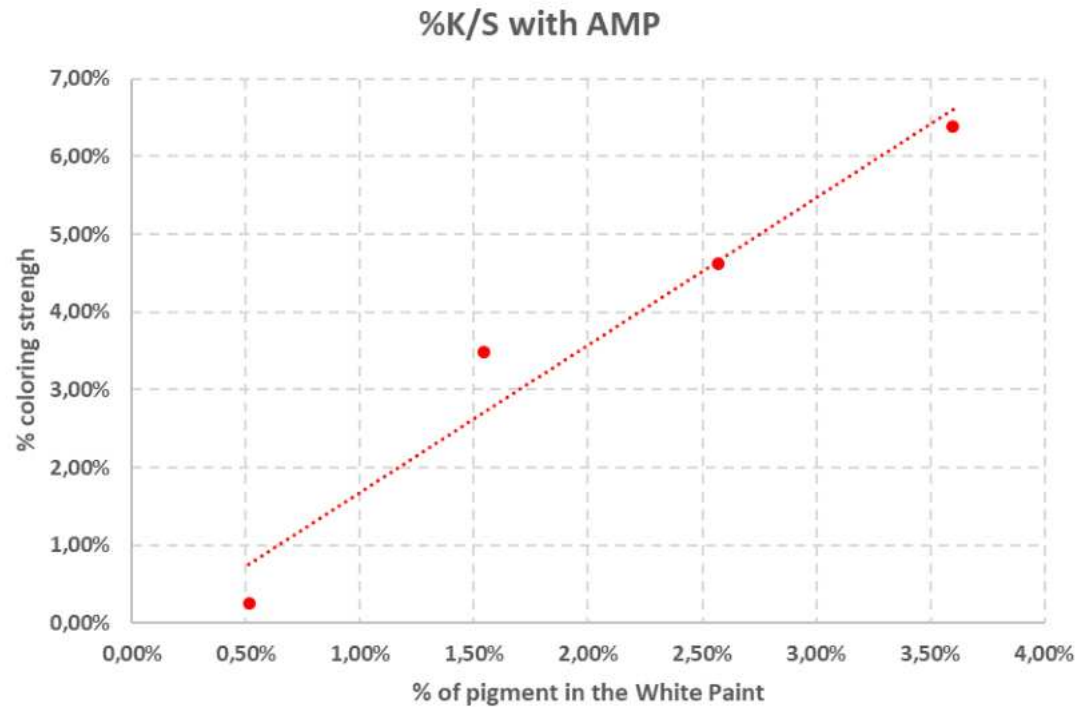


# Overview of Tinting Strength



# Illustration of Pigment Savings with AMP / PR254

Waterborne organic pigment dispersion with AMP



# Summary

The use of Advancion ingredients such as AMP-95™ in waterborne organic pigment dispersions:

- Enables a significant **increase of the solid content** of pigment, while **decreasing the amount of conventional dispersing agent**.
- **Increases the storage stability** of waterborne dispersions.
- **Reduces the mechanic effort** during grinding.
- Supports the **optimization of organic pigment dosage**



# Advancion Technical Contact

## **Romain Severac, PhD**

Global Technical Director – Paints & Coatings

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**E** [rseverac@advancionsciences.com](mailto:rseverac@advancionsciences.com)

**O** +33 1 34 233 171

**M** +33 6 74 196 498

**Samples, Technical literature, and more at  
[advancionsciences.com](http://advancionsciences.com)**



# Illustration of the Experimental Protocol

# Control Versus 50% Replacement with AMP-95











Formulation	22YFPR254-01	22YFPR254-02	22YFPR254-03	22YFPR254-04	22YFPR254-05
P/D	4.38	4.38	4.38	4.38	4.38
Pigment	45	50	55	60	65
Dispersogen AN 200	6.43	7.14	7.86	8.57	9.29
<b>AMP95</b>	5.41	6.02	6.62	7.22	7.82
Sol NaOH 25%					
Agitan DF 6681	0.3	0.3	0.3	0.3	0.3
Water	42.86	32.17	30.23	23.91	17.59
<b>Total</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>

Formulation	22YFPR254-06	22YFPR254-07	22YFPR254-08	22YFPR254-09	22YFPR254-10
P/D	4.38	4.38	4.38	4.38	4.38
Pigment	45.00	50.00	55.00	60.00	65.00
Dispersogen AN 200	12.84	14.27	15.70	17.12	
AMP95					
<b>Sol NaOH 25%</b>	9.71	10.80	11.88	12.96	
Agitan DF 6681	0.30	0.30	0.30	0.30	0.30
Water	32.15	24.63	17.12	9.62	
<b>Total</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>	<b>100.00</b>

- Replacement of 50% dispersant (AN200) with AMP compared with the guideline formulation
- Same level of dispersant as the guideline formulation – Same molar quantity as AMP

# Visual Aspect After Grinding

	22YFPR254-01	22YFPR254-02	22YFPR254-03	22YFPR254-04	22YFPR254-05
Solid content (%)	45	50	55	60	65
Grinding temperature (°C)	32.1	37	38.2	65.1	55.3
Visual aspect	very Fluid	Fluid	Fluid	Paste	Solid
Picture					
Grinding Viscosity SC04-21(cP)	142.5	405	585	Not possible	Not possible
Grinding Particle size (nm)	380	380	380		
	22YFPR254-06	22YFPR254-07	22YFPR254-08	22YFPR254-09	22YFPR254-05
Solid content (%)	45	50	55	60	65
Grinding temperature (°C)	33	36.5	56	30.5	70
Visual aspect	very Fluid	Fluid	Paste	Paste	Solid
Picture					
Grinding Viscosity SC04-21(cP)	342.5	892.5	Not possible	Not possible	Not possible
Grinding Particle size (nm)	380	380			

Dilution of the WB dispersion		Organic pigment grinding										
		NaOH					AMP-95					
		%SC grinding					%SC grinding					
		45%	50%	55%	60%	65%	45%	50%	55%	60%	65%	
%SC WB dispersion	65%				Paste						Paste	
60%				Paste	Paste				Paste	477		
55%			Paste	312	332			585	232	237		
50%		892	170	155	182		405		115	125		
45%	342		95	92	90	142			65	60		
40%			47	47	52				35	32		
35%			27	27	32				15	17		

- All **viscosities** with the 50 / 50 AMP / Disperogen AN-200 blend are **much more fluid**
- The significant impact of AMP does not allow to compare grinding or dispersion at the same viscosity (i.e., with a similar shear rate during grinding)

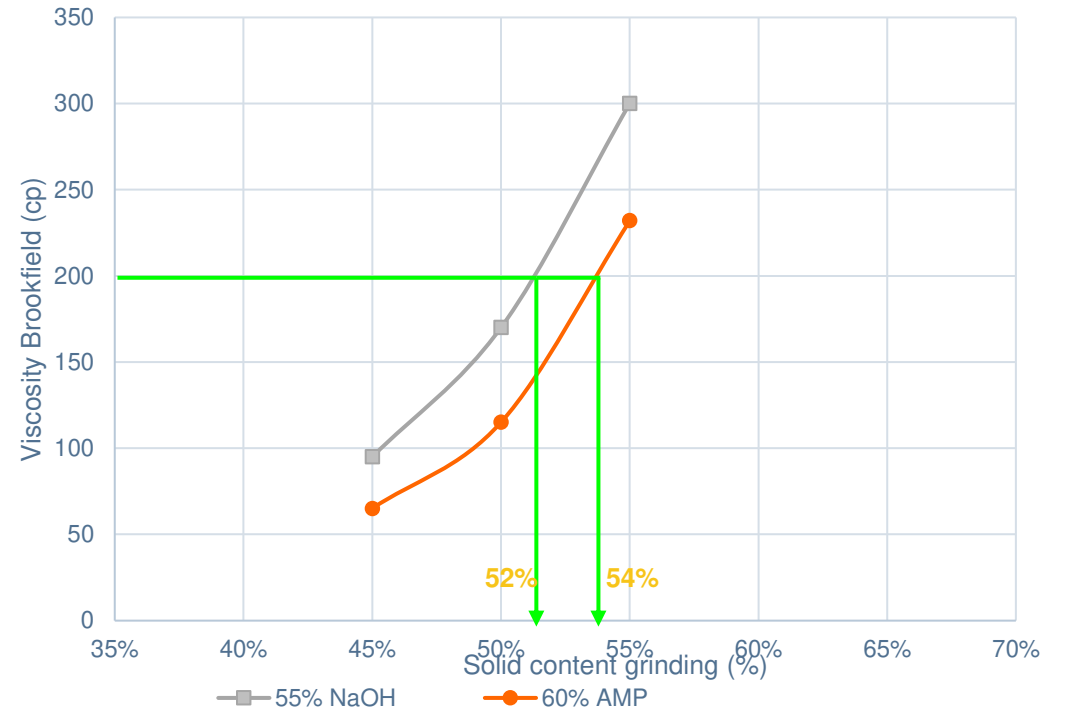


# Comparison of Tinting Strength

To select the solid content during grinding, the aspect and the viscosity are monitored (55% with NaOH and 60% AMP). The selected **optimum solid content** for the dilution is set up to reach a similar final viscosity for the slurry.



		NaOH					AMP-95				
		%SC grinding					%SC grinding				
		45%	50%	55%	60%	65%	45%	50%	55%	60%	65%
%SC WB dispersion	65%					Paste					Paste
	60%				Paste	Paste				Paste	477
	55%			Paste	312	332			585	232	237
	50%		892	170	155	182		405		115	125
	45%	342		95	92	90	142			65	60
	40%			47	47	52				35	32
	35%			27	27	32				15	17

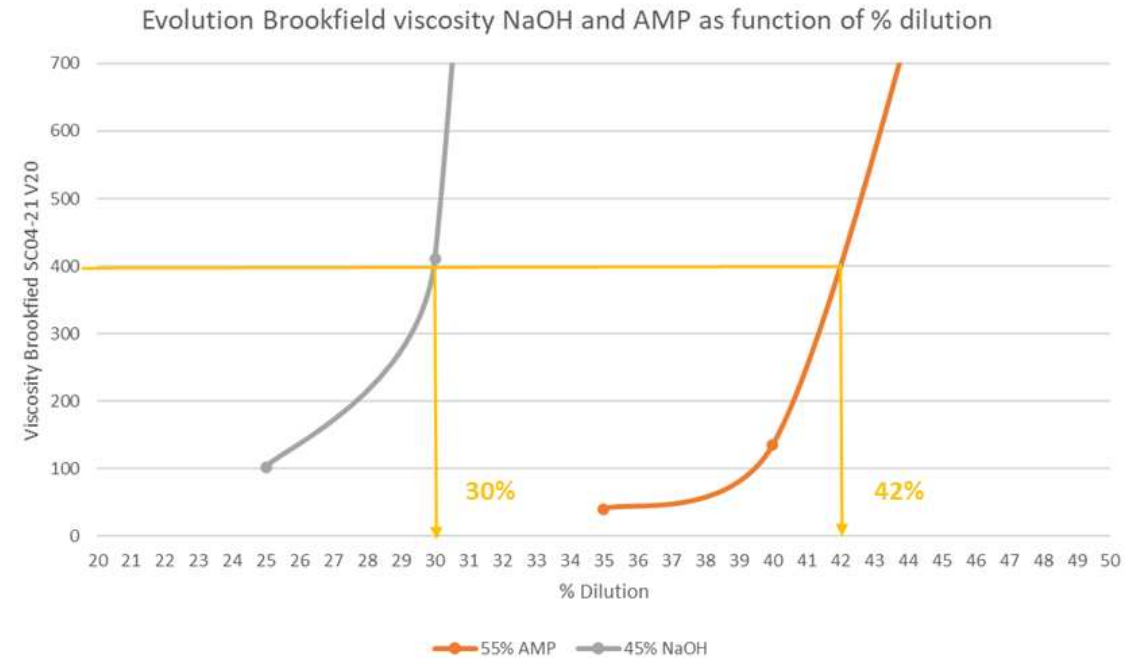


# Comparison of Tinting Strength

To select the solid content during grinding, the aspect and the viscosity are monitored (45% with NaOH and 55% AMP). The selected solid content for the dilution is set up to reach a similar final viscosity for the slurry.

22YFPV23-07	22YFPV23-08	22YFPV23-09	22YFPV23-10	22YFPV23-01	22YFPV23-02	22YFPV23-03	22YFPV23-04	22YFPV23-05	22YFPV23-06
35	40	45	50	35	40	45	50	55	60
30.7 Fluid	35.6 Fluid-paste	65.4 Paste	30.5 Paste	30.8 very Fluid	30.8 very Fluid	32.4 very Fluid	35.4 Fluid-paste	70.6 Paste	36.7 Paste-Solid
620 250	Not possible 200	Not possible Not possible	Not possible Not possible	25 220	72.5 200	250 180	3913 170	Not possible Not possible	Not possible Not possible

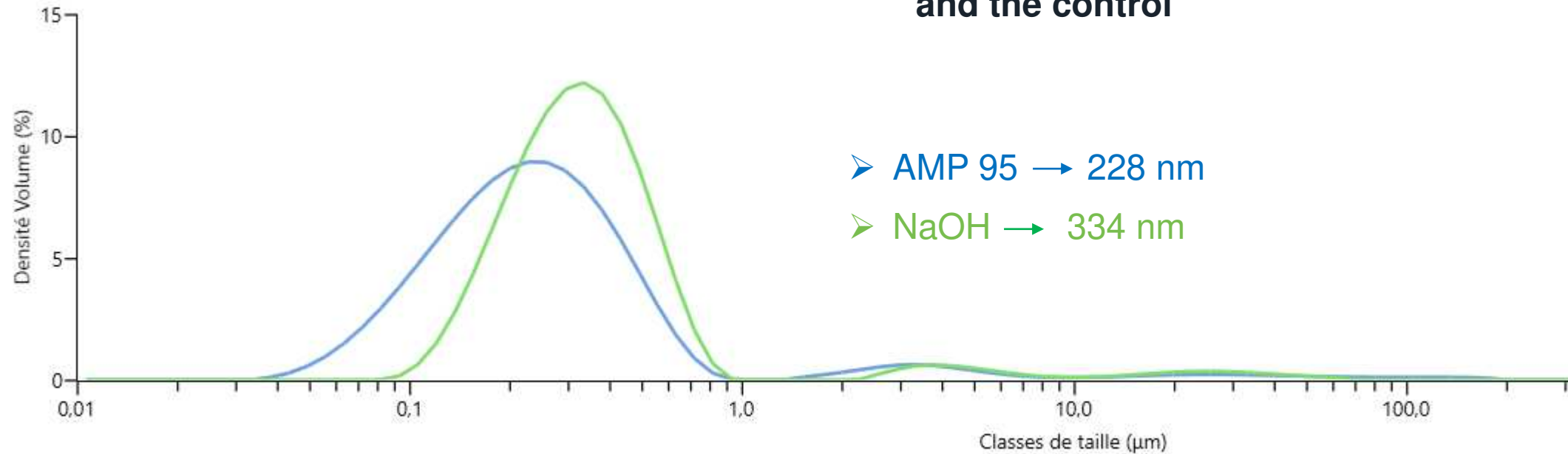
		NaOH				AMP-95							
		%SC grinding				%SC grinding							
		35%	40%	45%	50%	35%	40%	45%	50%	55%	60%		
%SC WB dispersion	60%											Paste	
	55%											Paste	Paste
	50%				Paste				3913	Paste	Paste	Paste	
	45%			Paste	Paste			250		922	742		
	40%		Paste	Paste	Paste		72			135	92		
	35%	620	535	4850	1160	25				40	35		
	30%		175	410	342						12		
	25%		45	102	62								



# Waterborne Dispersion of PR 122: Grinding

## Measurement of Average Particle Size

**Significant decrease of particle size between AMP and the control**



➤ AMP 95 → 228 nm

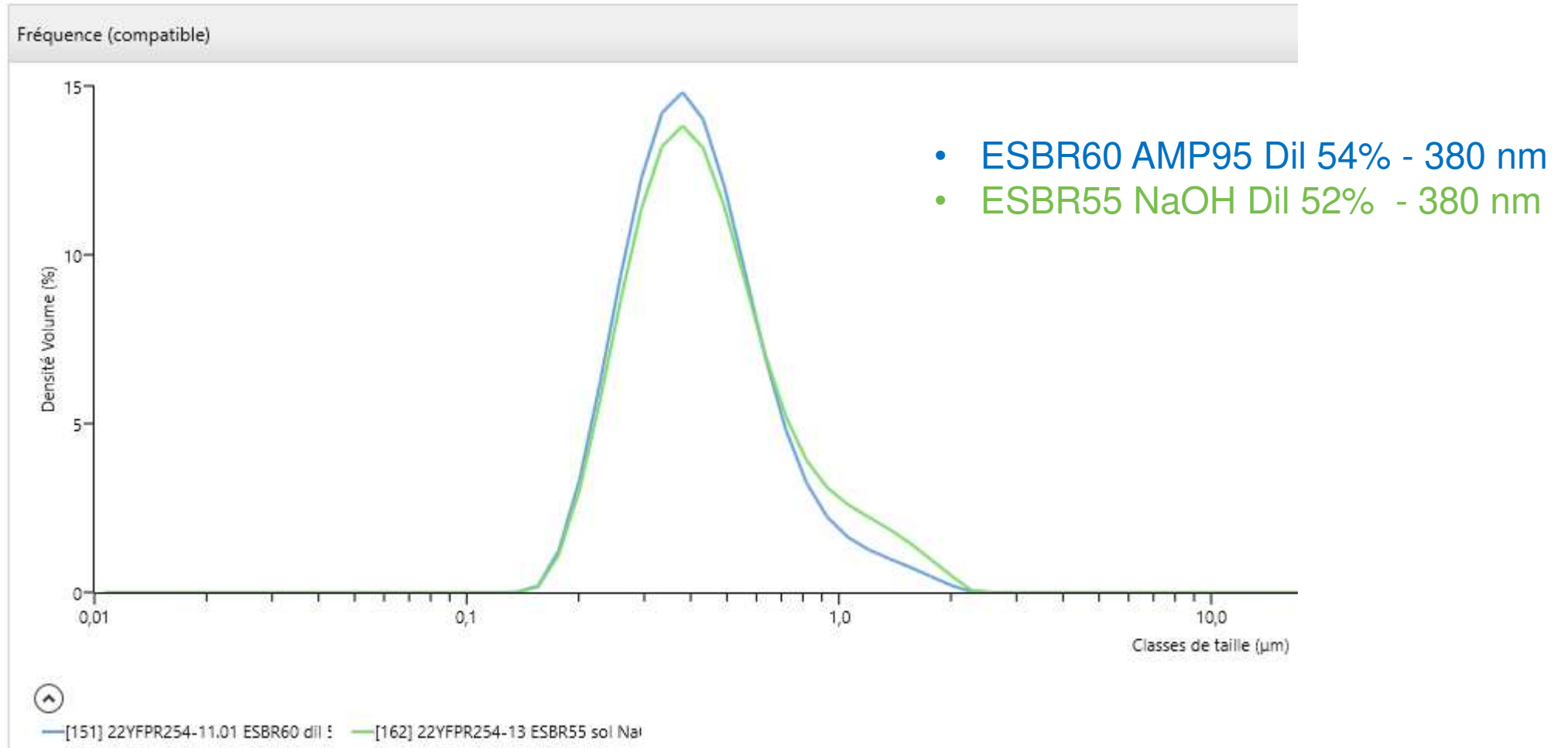
➤ NaOH → 334 nm



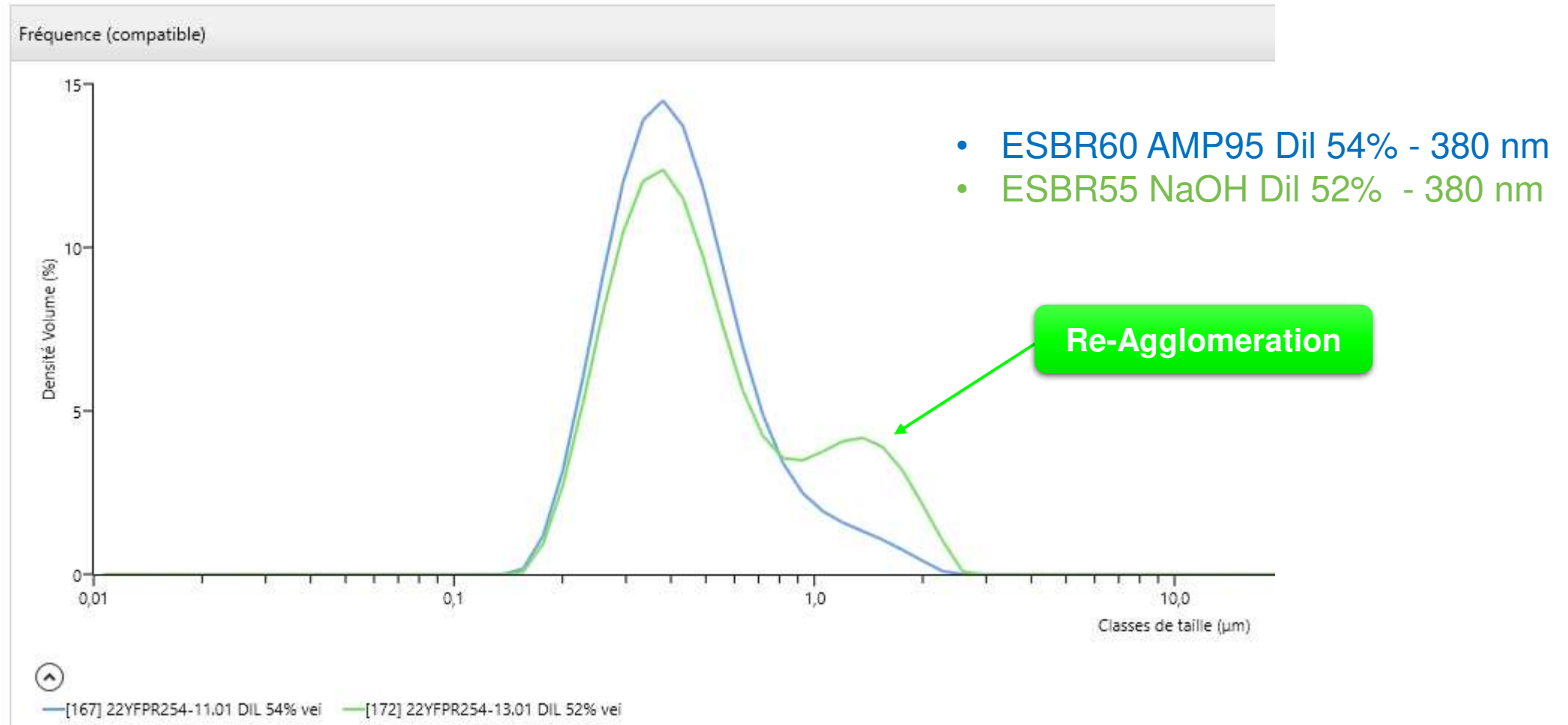
		Organic pigment grinding							
		NaOH				AMP-95			
		%SC grinding				%SC grinding			
		40%	45%	50%	55%	40%	45%	50%	55%
Dilution of the WB dispersion	%SC WB dispersion	50%			<i>paste</i>				140
	45%			<i>paste</i>	<i>paste</i>			150	140
	40%		240	210	240		200	140	140
	35%	270	210	240	220	200	200	140	140
	30%	290	220	200	260	200	200	140	140
	25%	320	250	260	260	200	200	140	140
	20%	280	300	250	240	200	200	140	150

- Mean of particle size of PR122 waterborne dispersion is systematically lower in the presence of AMP

# Waterborne Dispersion of PR 254: Grinding

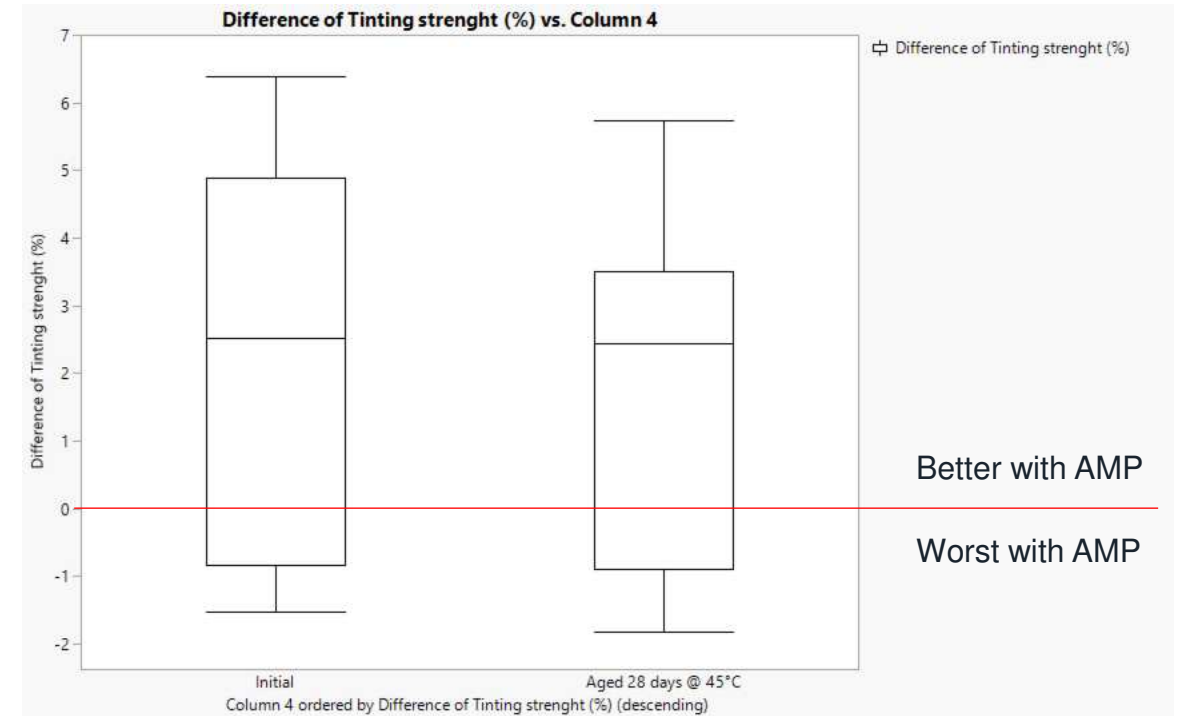


# Waterborne Dispersion of PR 254: Storage Stability



# Tinting Efficiency with 8 Commercial Paints

Paint's reference	Pigment	Time in days (pigment paste/paintstorage )	Force K/S (Max) (AMP- NaOH)	Best coloring strength with AMP
V33	PR254	Initial	96,24	+3,76%
ENVIE	PR254	Initial	94,74	+5,26%
INDEKO SENS MAT	PR254	Initial	101,52	-1,52%
INDEKO MAT	PR254	Initial	101,35	-1,35%
INTER ACRYL MAT	PR254	Initial	97,99	+2,01%
INTER ACRYL SATIN	PR254	Initial	93,62	+6,38%
INTERLAQUE SATIN	PR254	Initial	99,31	+0,69%
INTERALKYDE SATIN	PR254	Initial	96,96	+3,04%





**Advancion**



# Confirmation with the comparison of Delta L\*

