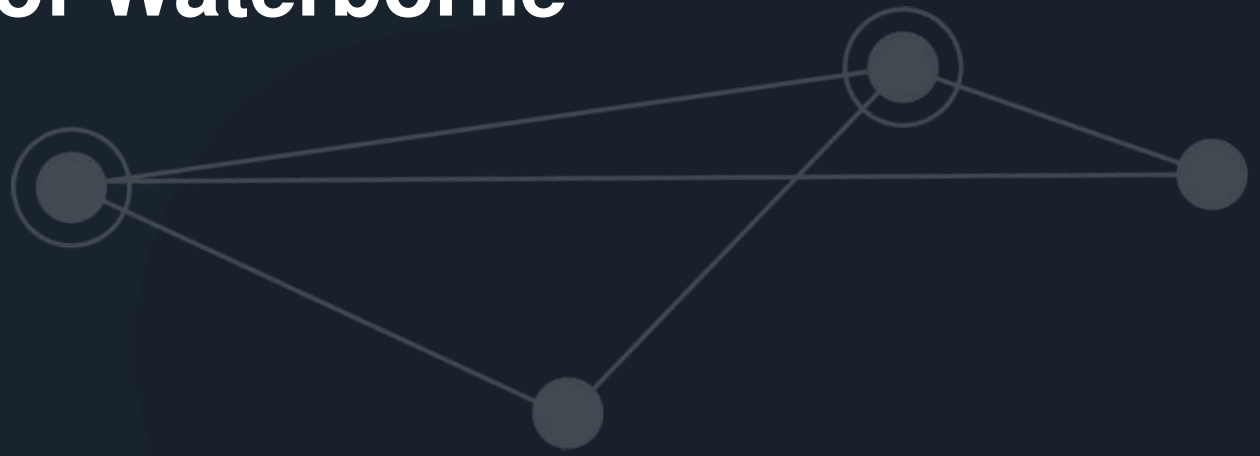
Advancion

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_2 loading), reducing overall CO_2 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**

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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

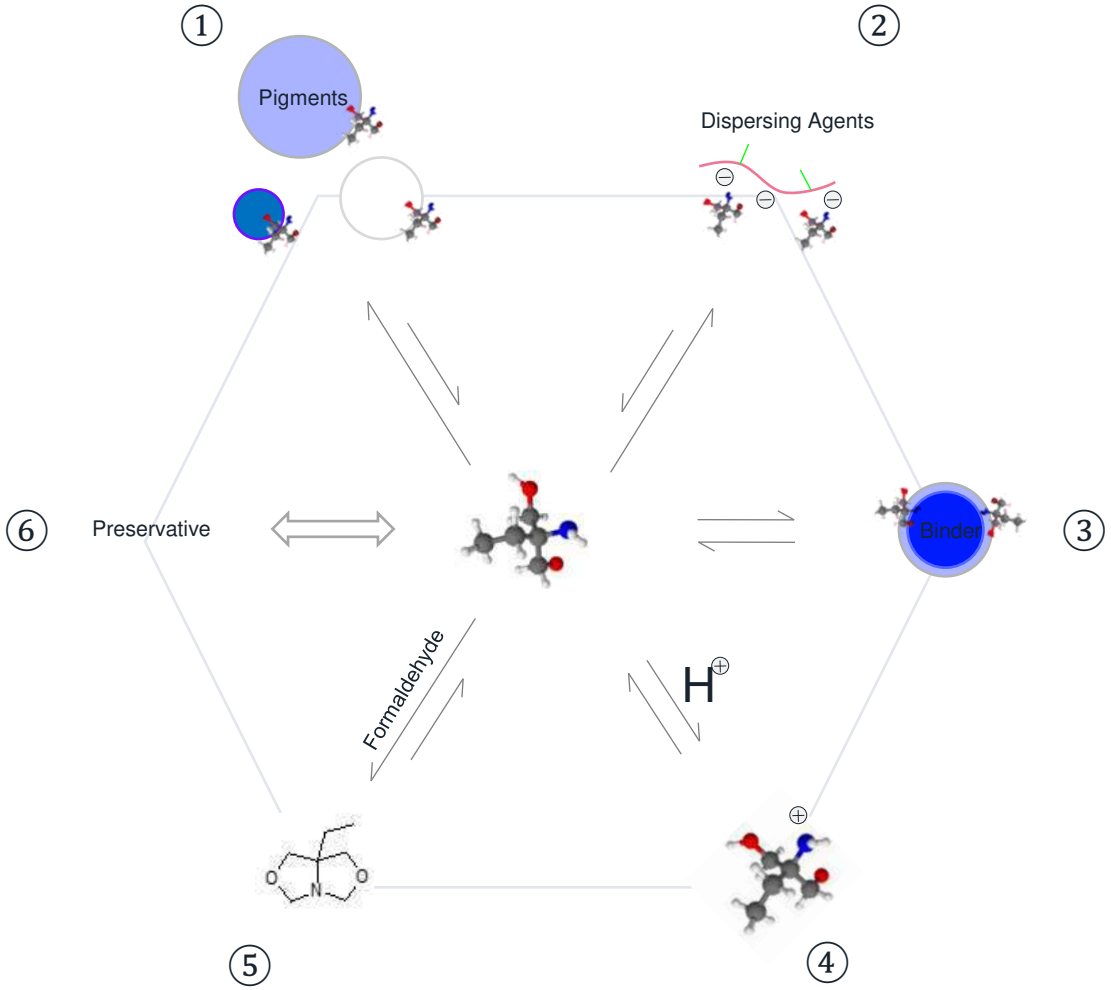
Emulsification
Pigment Dispersion
Corrosion Control

Oxazolidine Additives

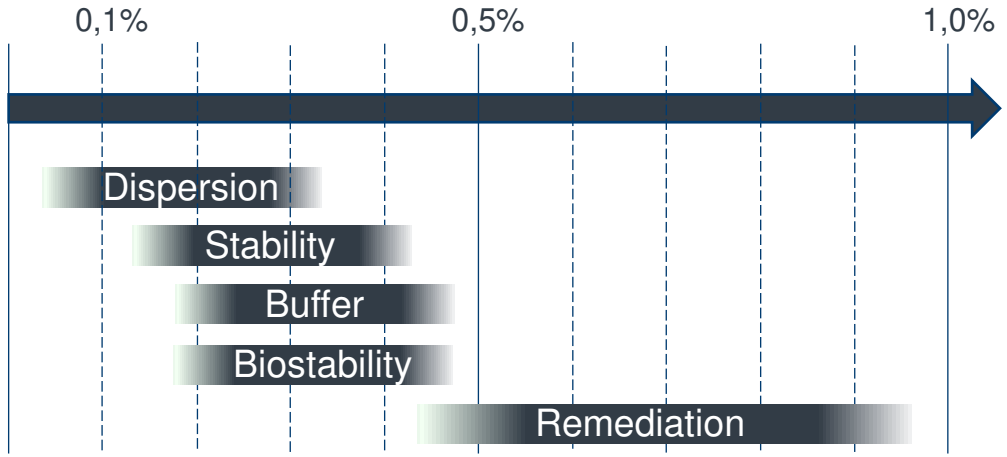
ZOLDINE™ MS-PLUS

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



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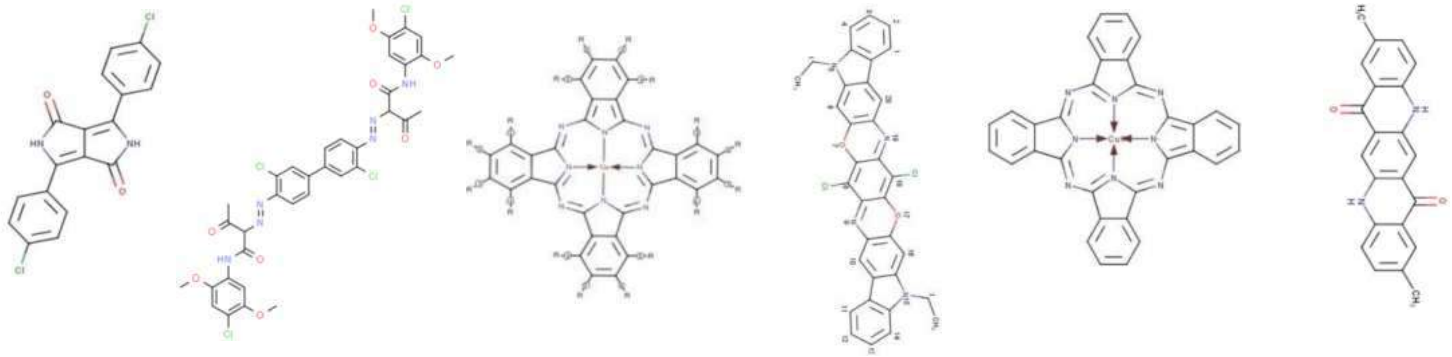
Overview of Organic Pigments Evaluated

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 (m²/g)	*16*	*21*	*40*	*80*	*52*	*77*



Evaluation of the Interaction Between AMP and Organic Pigments

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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
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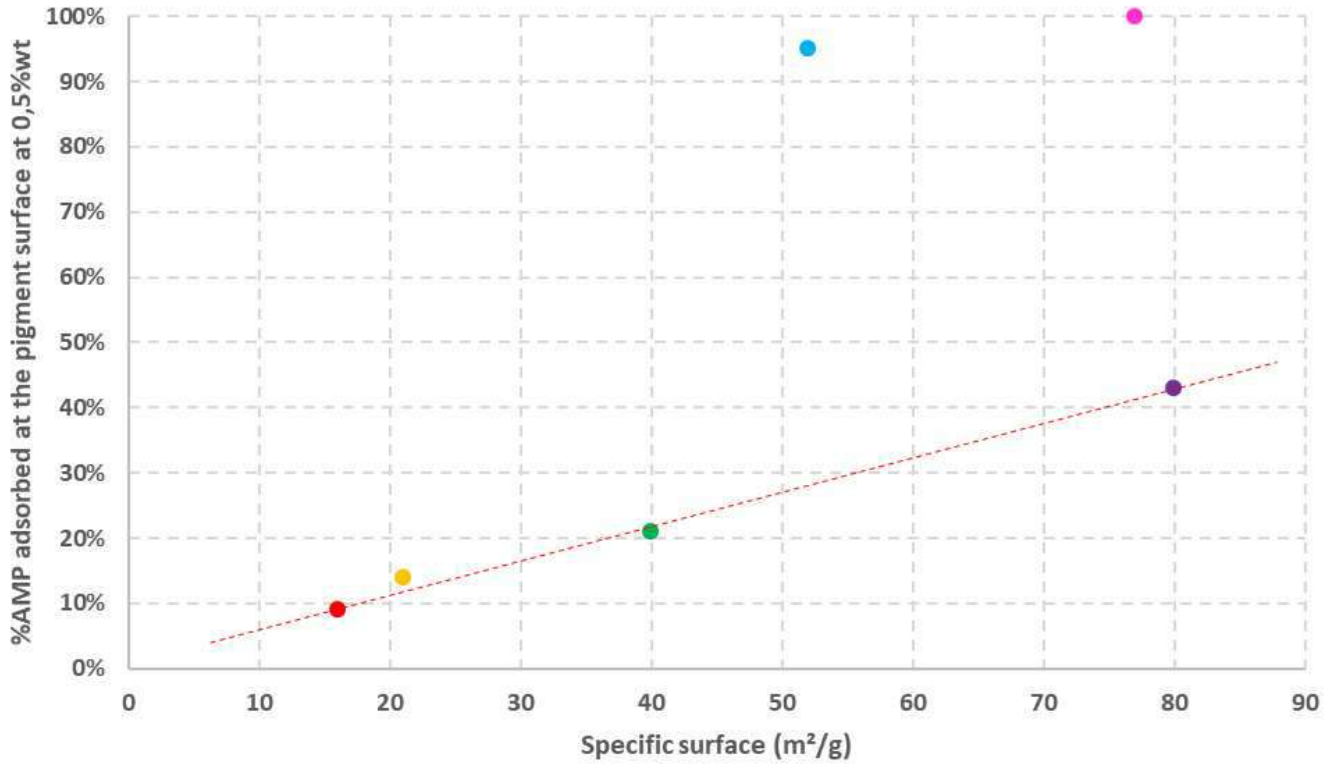

Adsorption and Specific Surface

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

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Pigment	PR 254	PY 83	PG 7	PV 23	PB 15:3	PR 122
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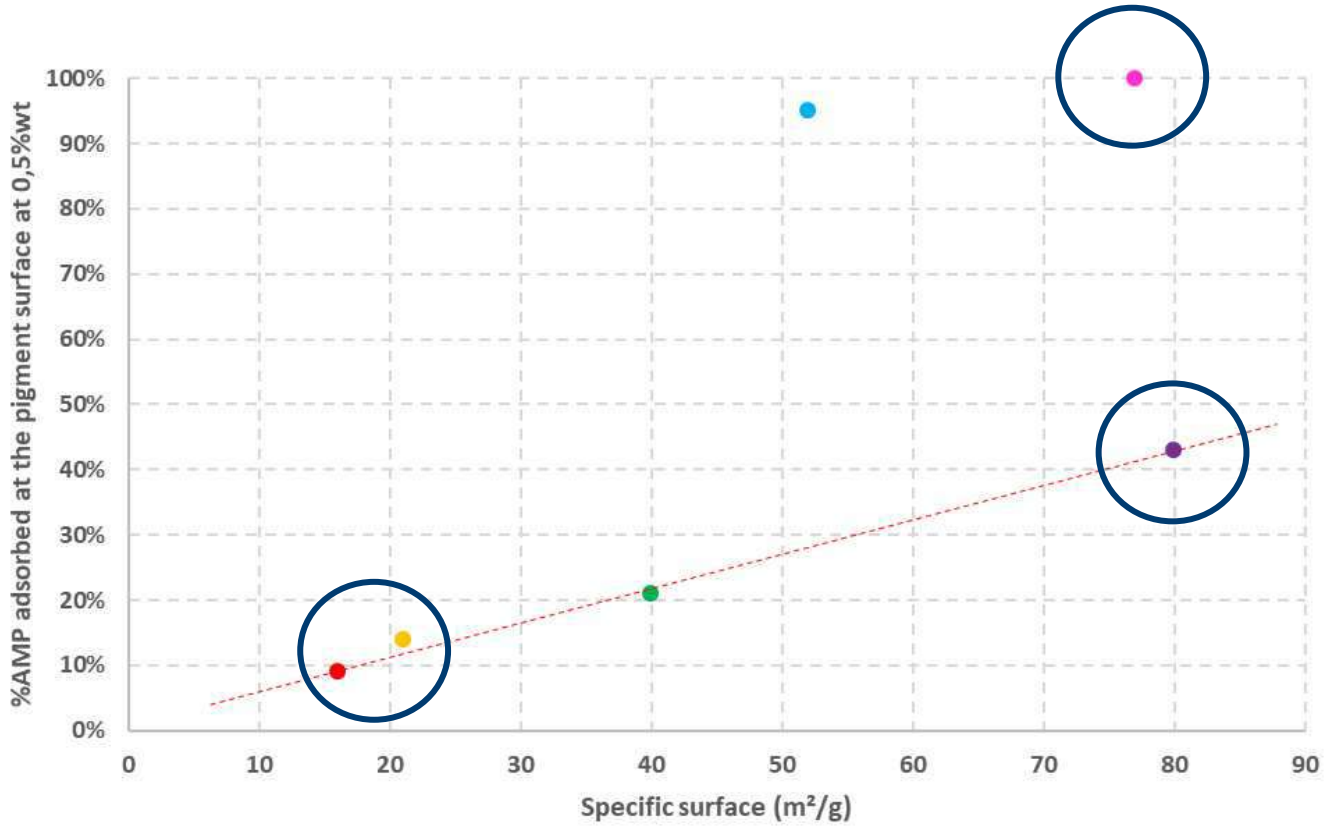

Selection of 4 pigments for the grinding process

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

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Optimized Experimental Protocol

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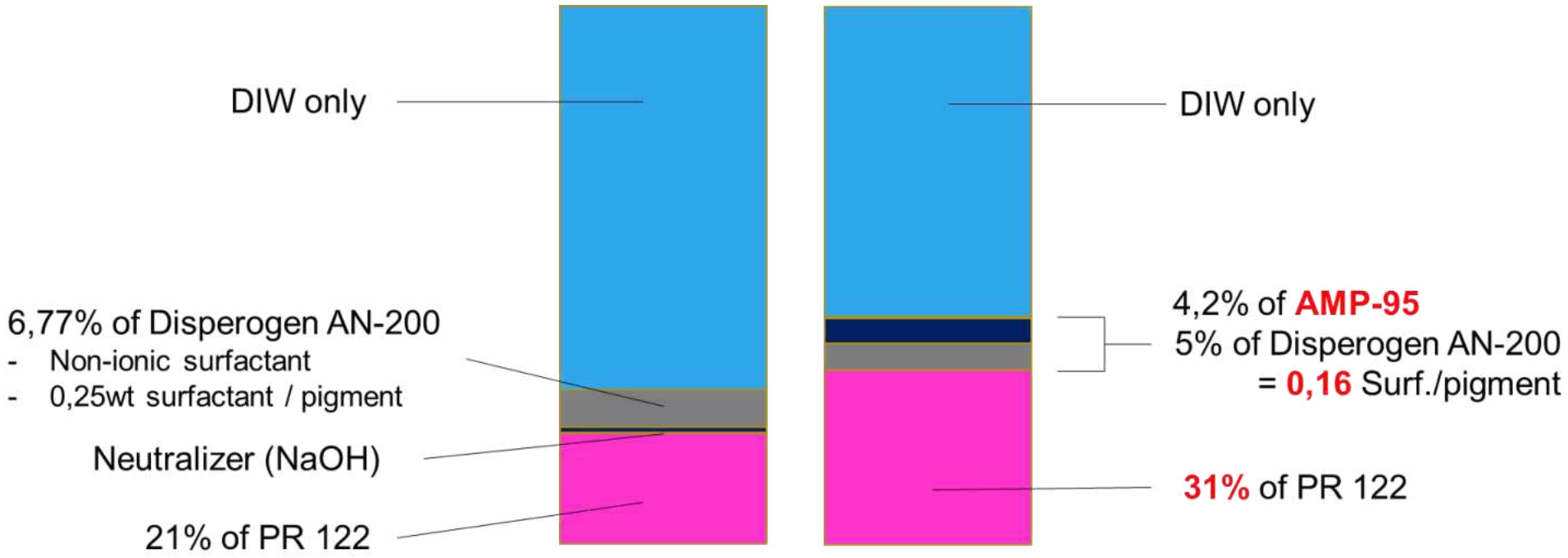
Formulation Selection



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

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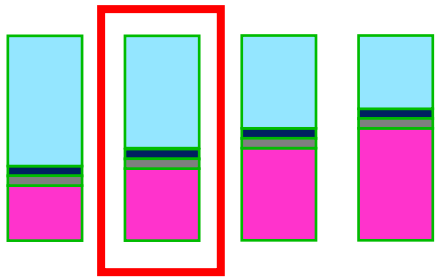
Optimizing the Waterborne Dispersion with AMP

Organic pigment grinding

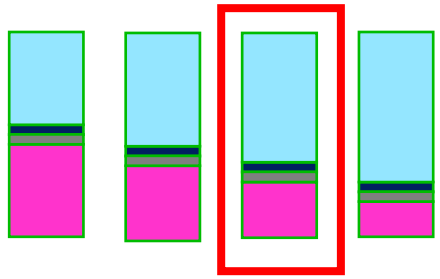
Optimization of the **%SCg** during grinding (similar particle size distribution and viscosity)

Pigment / dispersant ratio is constant.



Dilution of the waterborne dispersion

Optimization of the final **%SCf** (equivalent viscosity)



Commercial paint tinting

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

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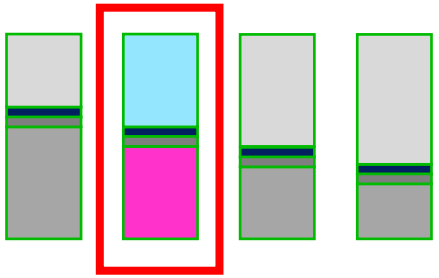
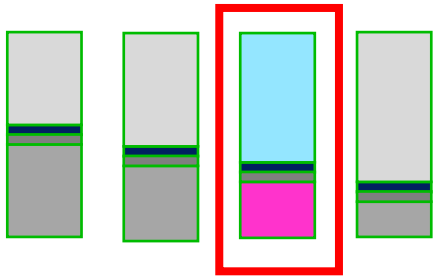
Optimizing the Waterborne Dispersion with AMP

Organic pigment grinding



High viscosity does not allow experimental evaluations

Dilution of the WB dispersion



Initial and 4W@45°C performance:

- Particule size distribution
- Viscosity
- pH

Commercial paint tinting

Initial and 4W@45°C performance:

- Particule size distribution
- Viscosity
- pH
- Colorimetric tests

Comparison of 4 Pigments

PV23 PR122 PR254 PY83

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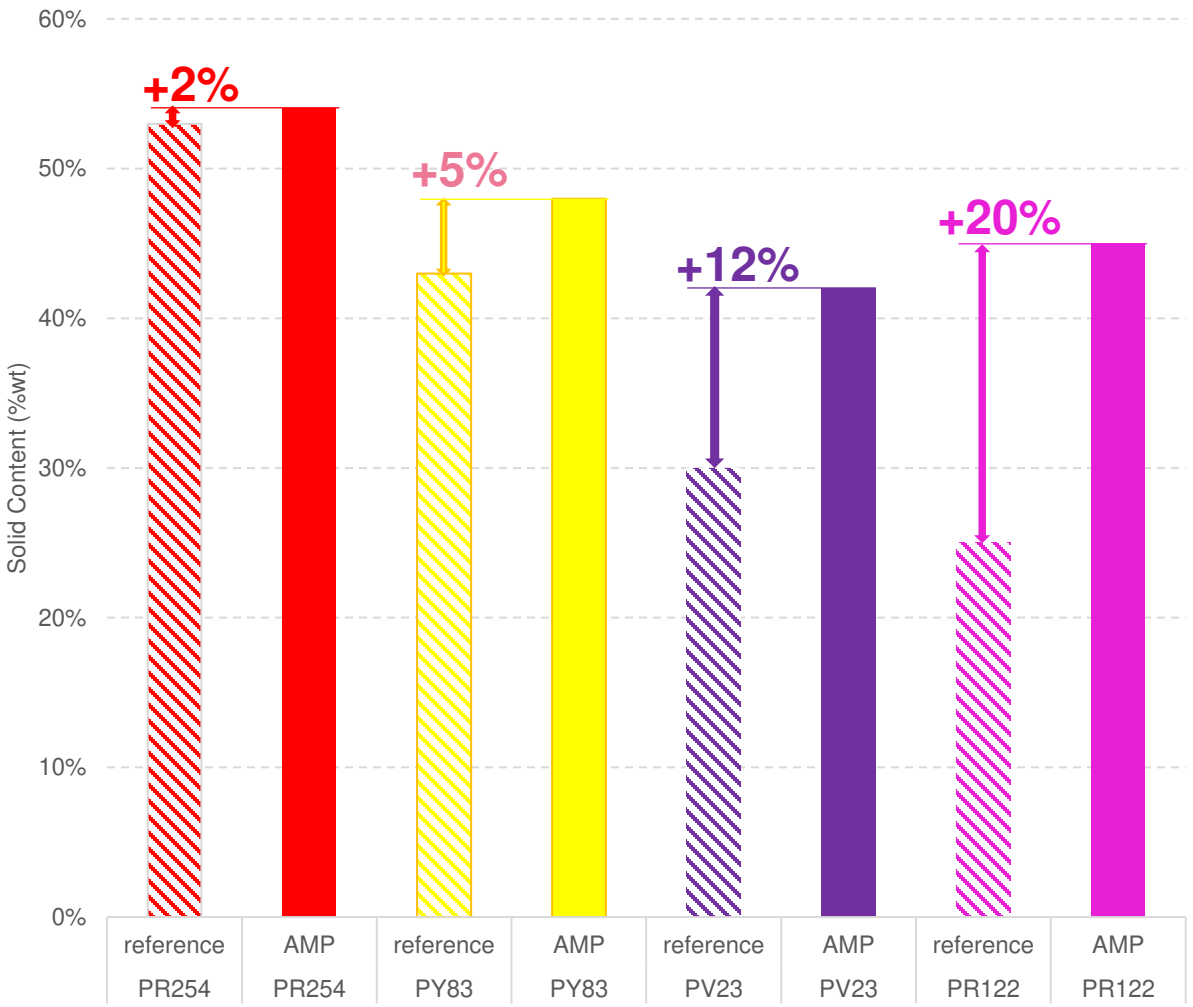
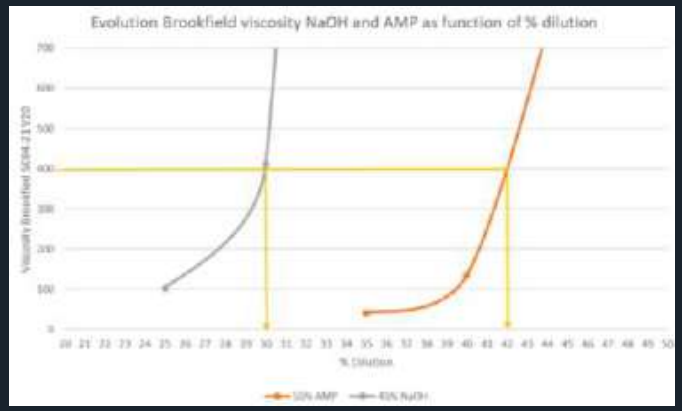
Optimizing Solid Content



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



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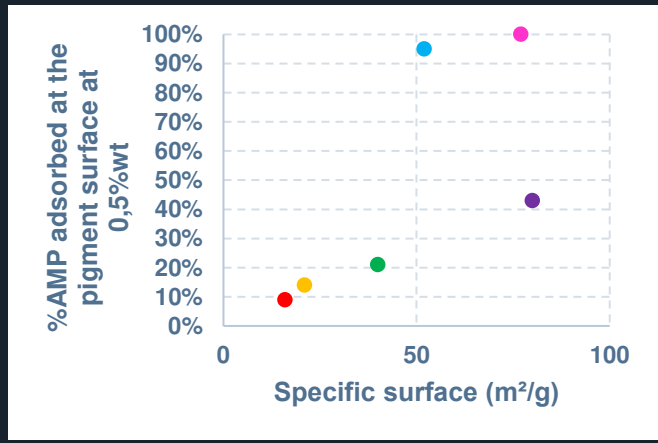
Optimizing Solid Content

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



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Overview of Tinting Strength

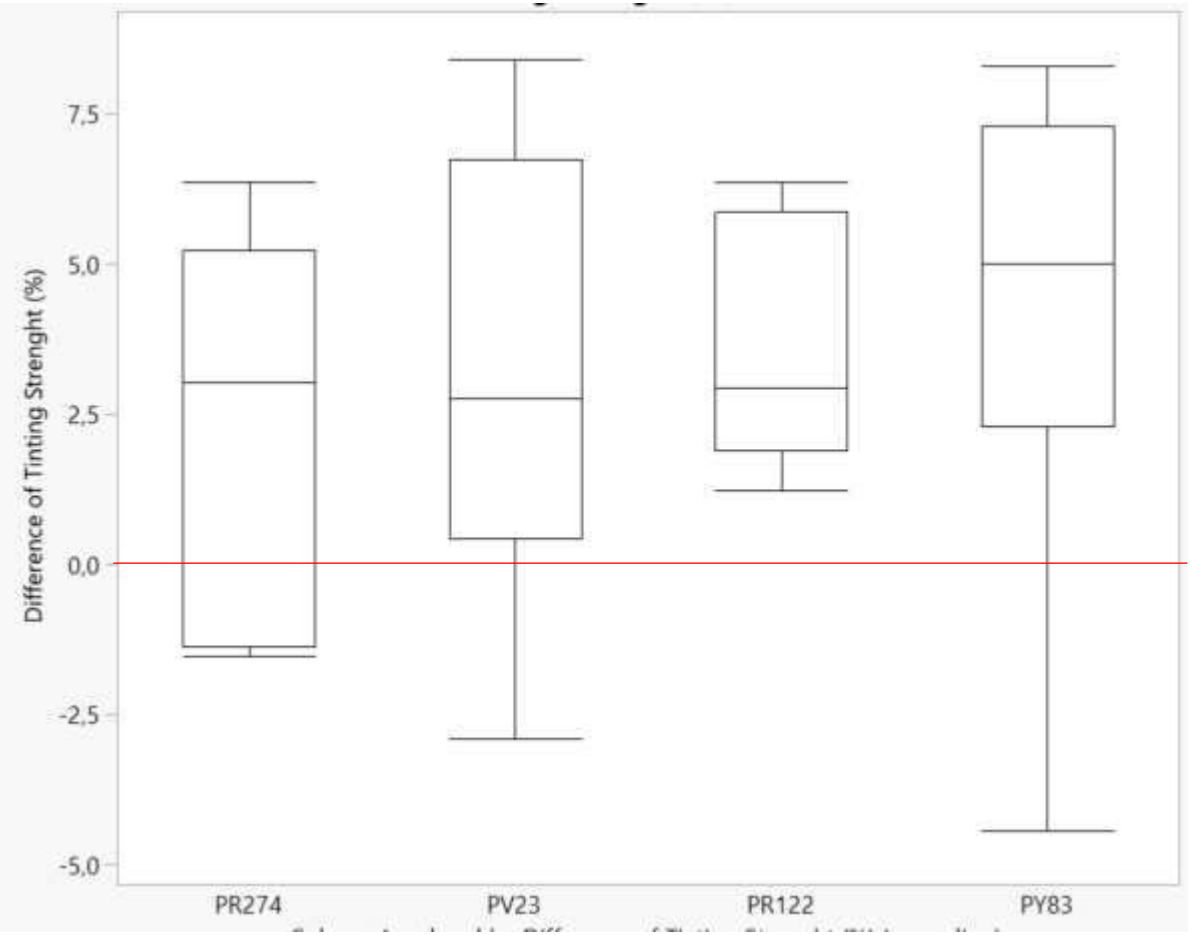

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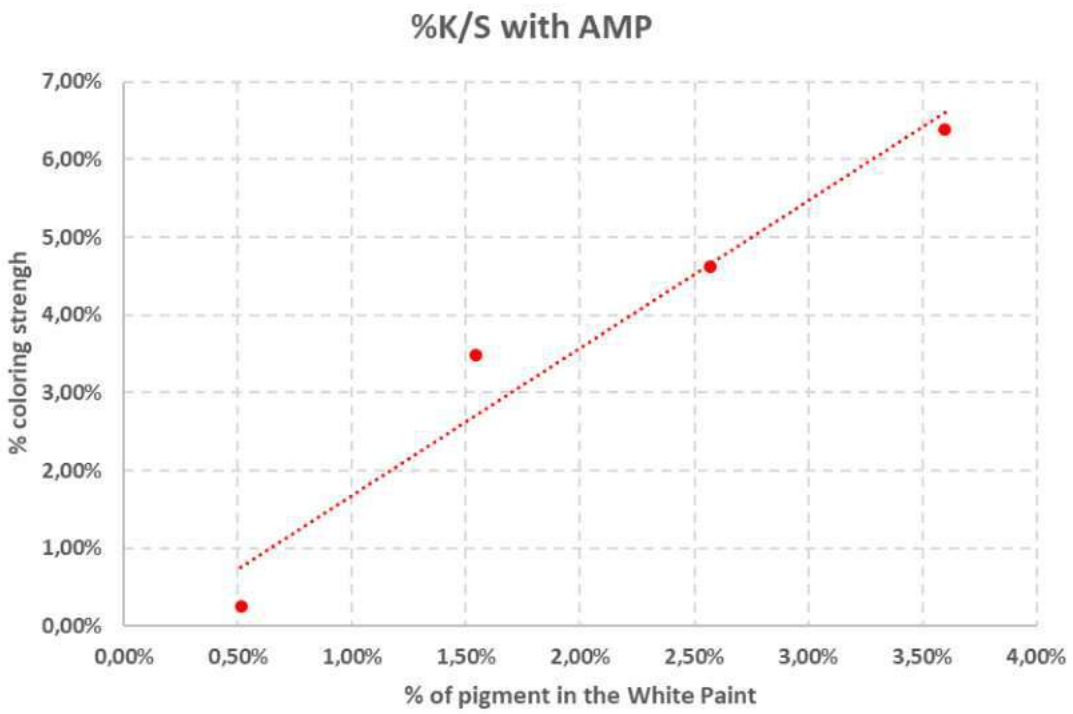
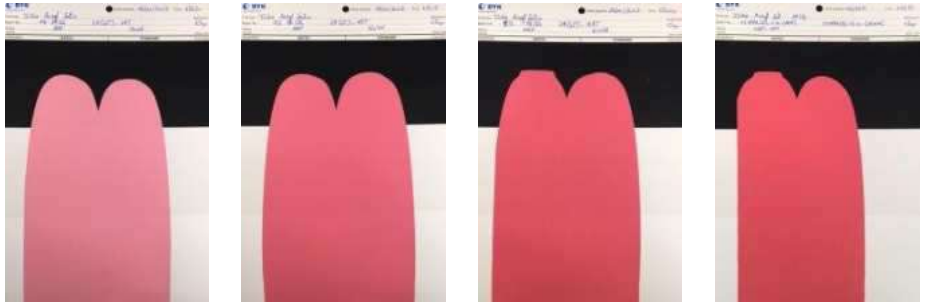
Illustration of Pigment Savings with AMP / PR254





Waterborne organic pigment dispersion with AMP

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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**

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Advancion Technical Contact

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Samples, Technical literature, and more at advancionsciences.com

Illustration of the Experimental Protocol

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PR 254

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
AMP95	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
Total	100.00	100.00	100.00	100.00	100.00

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					
Sol NaOH 25%	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	
Total	100.00	100.00	100.00	100.00	100.00

- 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

PR 254

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			

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PR254 - Viscosity

PR 254

Organic pigment grinding											
		NaOH					AMP-95				
		%SC grinding					%SC grinding				
		45%	50%	55%	60%	65%	45%	50%	55%	60%	65%
Dilution of the WB dispersion	%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

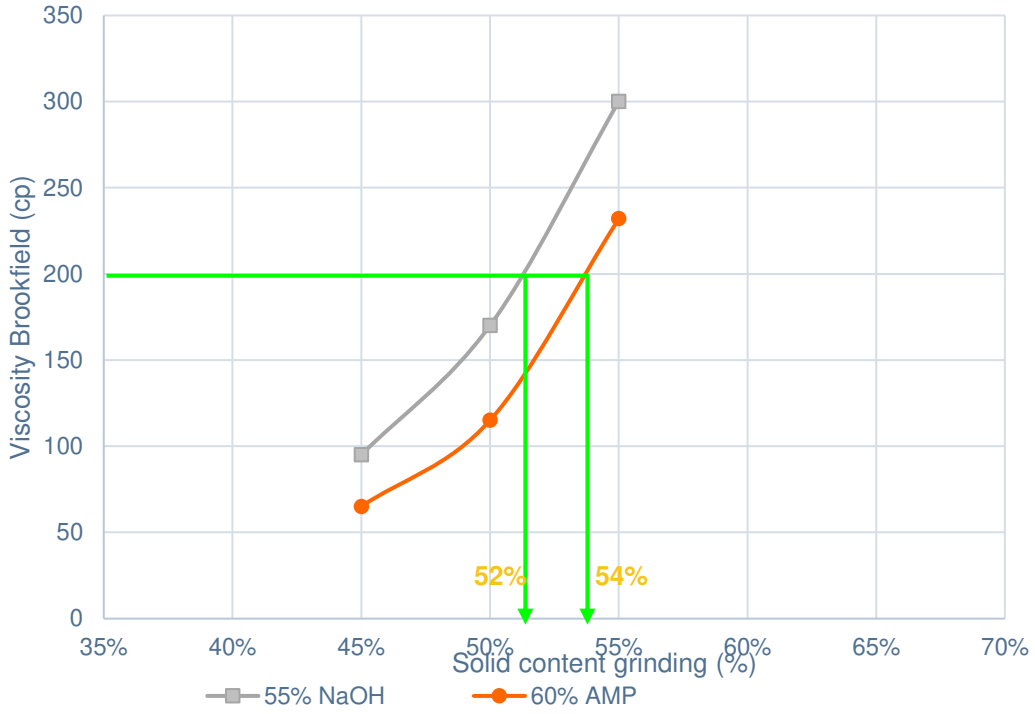
- All **viscosities** with the 50 / 50 AMP / Disperogen AN-200 blend are **much more fluid**
- The significant impact of AMP does not allow to compare grinding or dispersion at the same viscosity (i.e., with a similar shear rate during grinding)

Comparison of Tinting Strength

PR 254

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.

%SC WB dispersion	NaOH %SC grinding					AMP-95 %SC grinding				
	45%	50%	55%	60%	65%	45%	50%	55%	60%	65%
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



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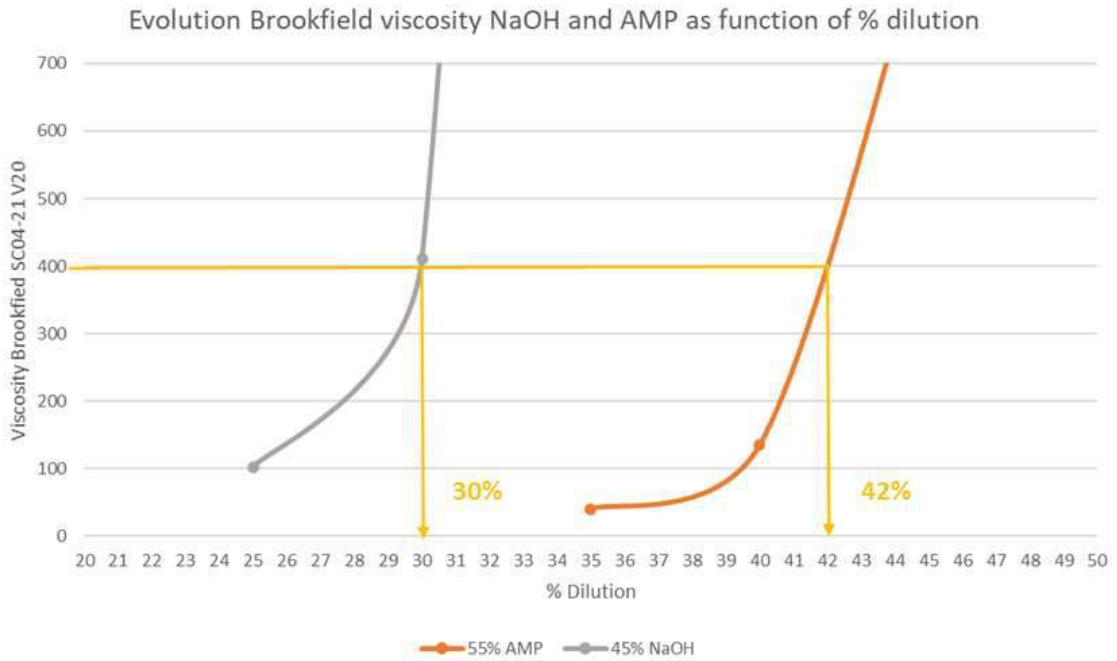
Comparison of Tinting Strength

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	35.6	65.4	30.5	30.8	30.8	32.4	35.4	70.6	36.7
Fluid	Fluid- paste	Paste	Paste	very Fluid	very Fluid	very Fluid	Fluid-paste	Paste	Paste-Solid
620	Not possible	Not possible	Not possible	25	72.5	250	3913	Not possible	Not possible
250	200	Not possible	Not possible	220	200	180	170	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*
	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*						



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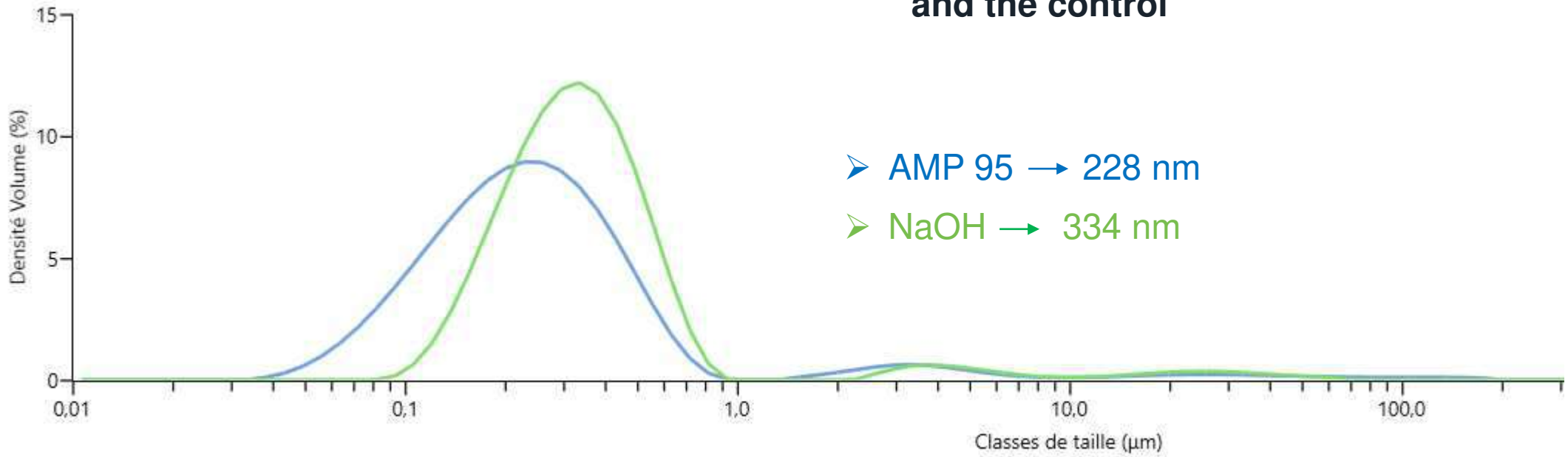
Waterborne Dispersion of PR 122: Grinding

Measurement of Average Particle Size

Significant decrease of particle size between AMP and the control



- AMP 95 → 228 nm
- NaOH → 334 nm

PR122 – Particle Size

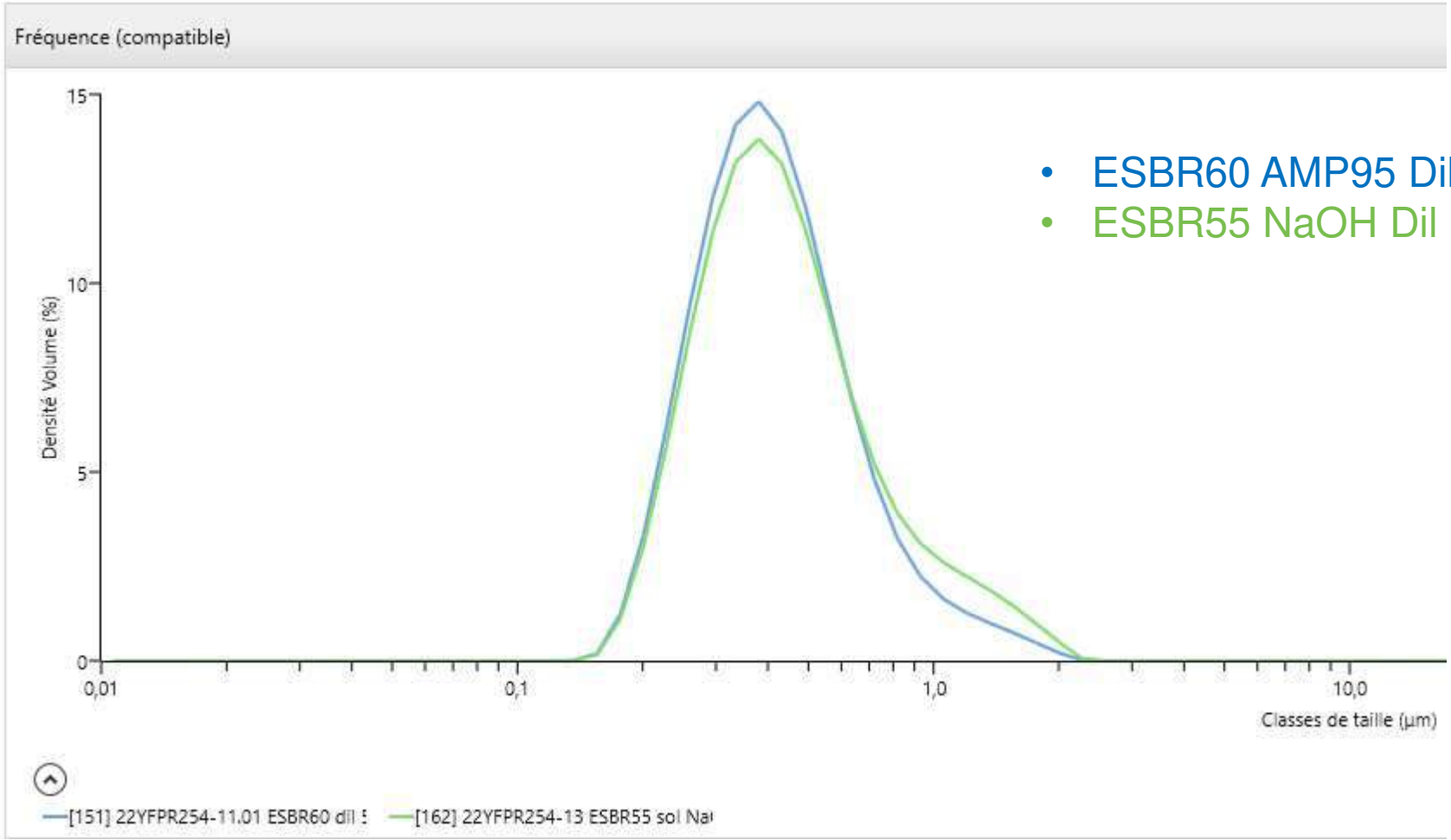
PR 122

Organic pigment grinding									
		NaOH				AMP-95			
		%SC grinding				%SC grinding			
Dilution of the WB dispersion	%SC WB dispersion	40%	45%	50%	55%	40%	45%	50%	55%
	50%				*paste*				*140*
	45%			*paste*	*paste*			*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

PR 254



- ESBR60 AMP95 Dil 54% - 380 nm
- ESBR55 NaOH Dil 52% - 380 nm

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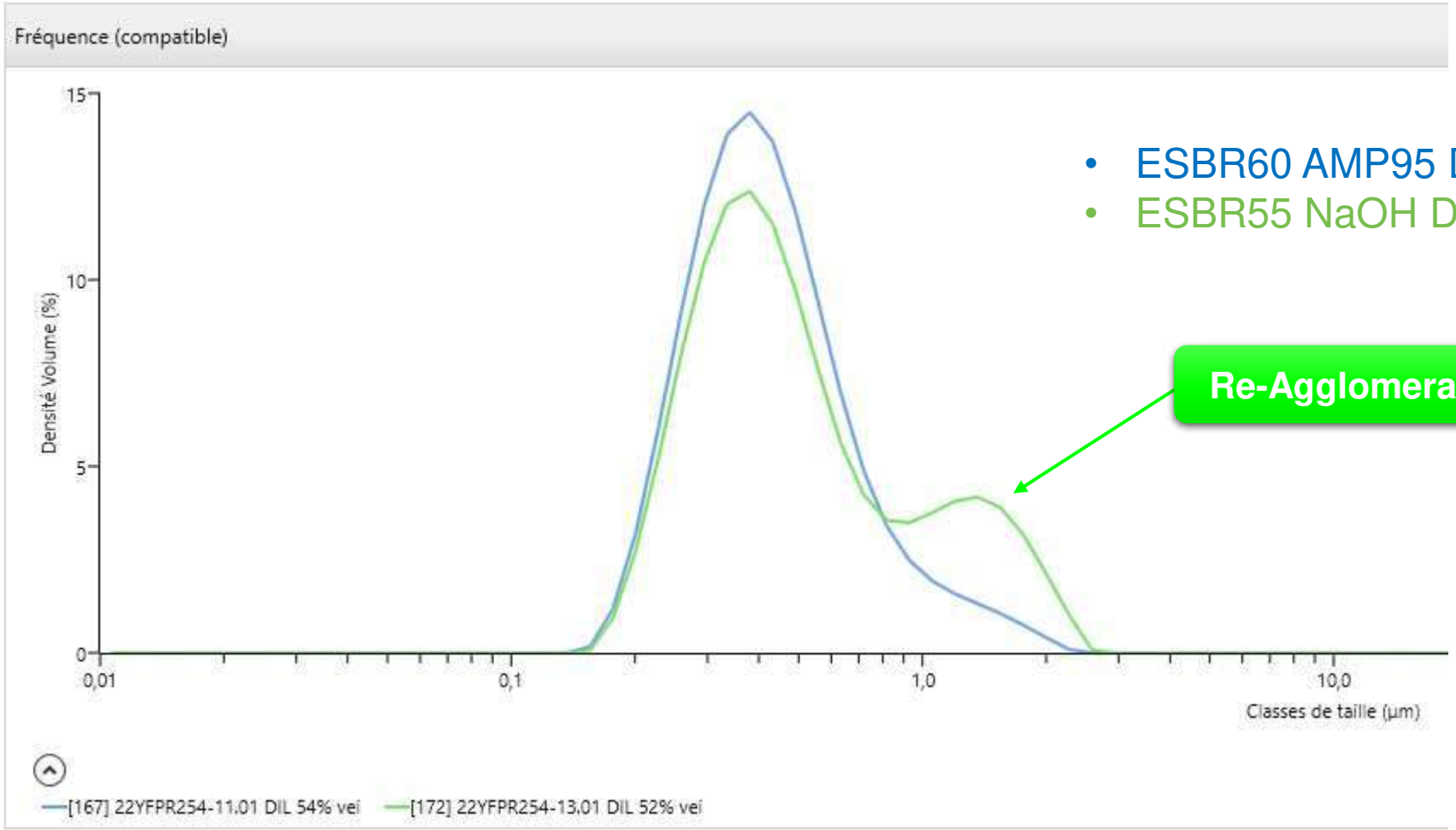
Waterborne Dispersion of PR 254: Storage Stability

PR 254



- ESBR60 AMP95 Dil 54% - 380 nm
- ESBR55 NaOH Dil 52% - 380 nm

Re-Agglomeration

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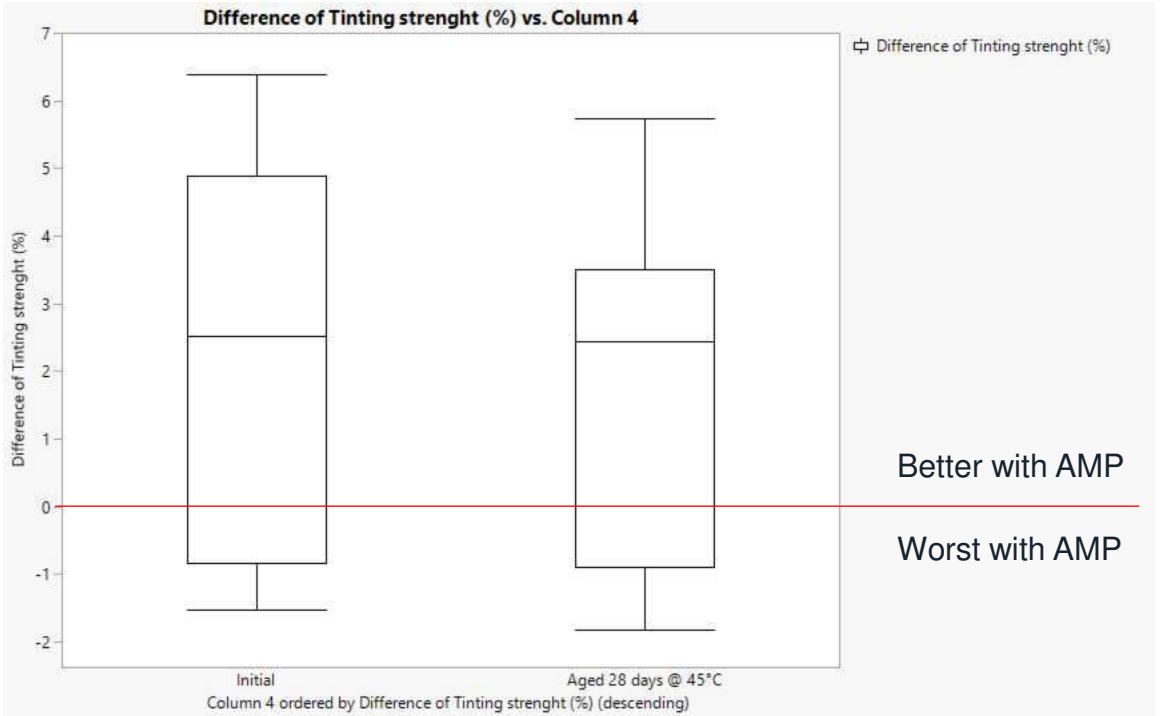
Tinting Efficiency with 8 Commercial Paints

PR 254

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%



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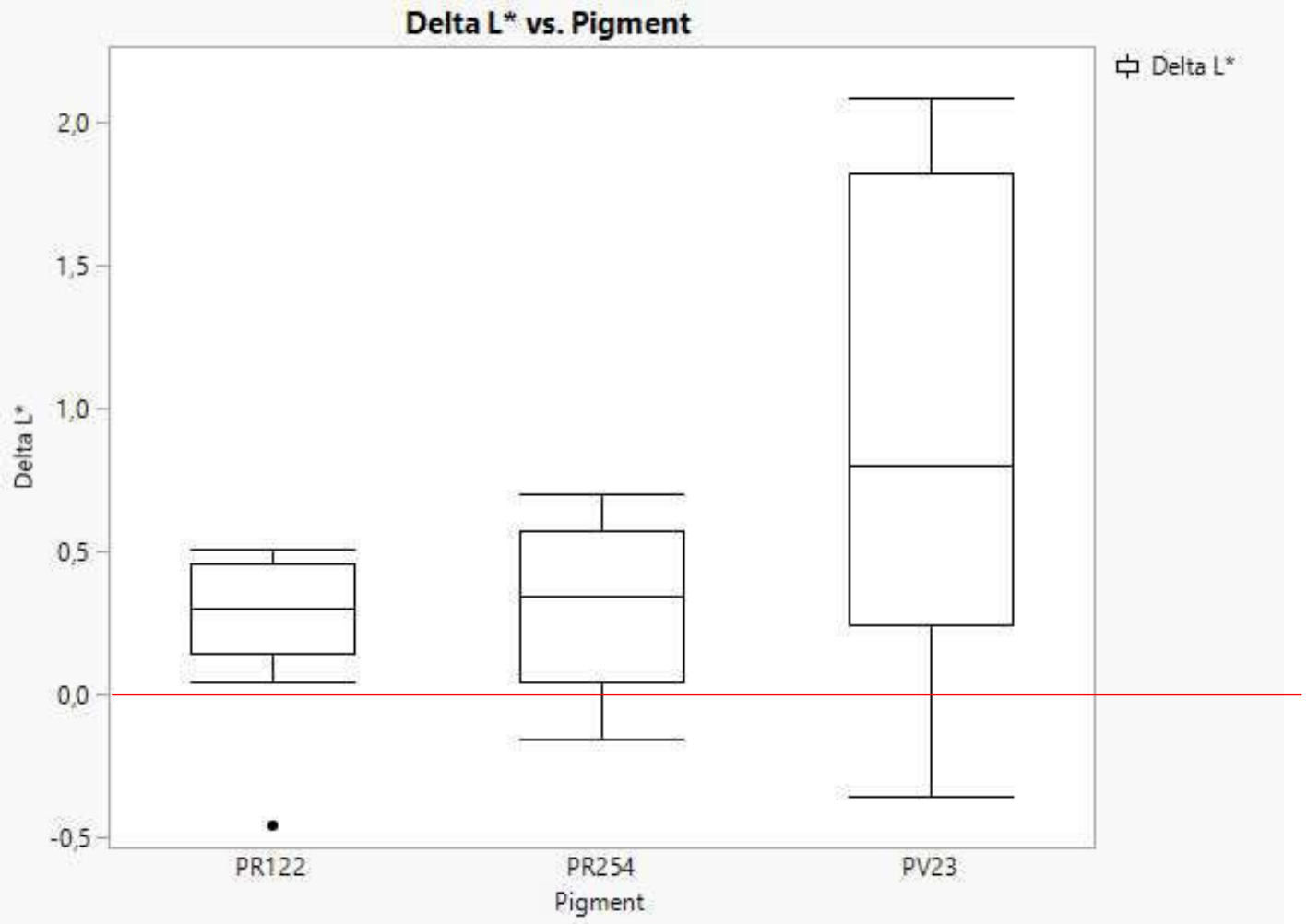
Confirmation with the comparison of Delta L*



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