Coatings Trends & Technologies SUMMIT

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The Westin Chicago Lombard
70 Yorktown Center | Lombard IL 60148

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Exploring Solid Colorants: A Sustainable Alternative for Coating Formulation

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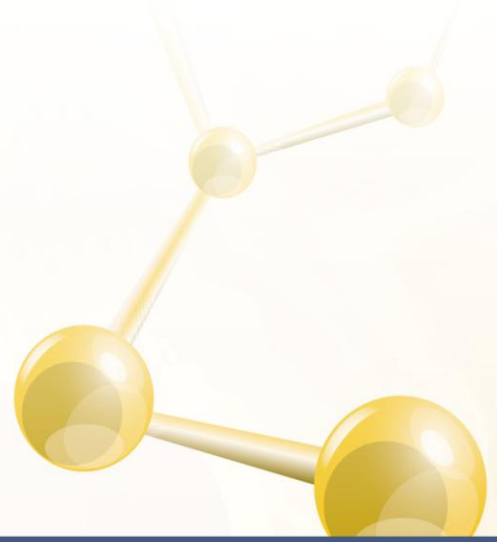


Agenda

- Industry ESG
- Why a Solid Colorant?
- Solubility / Carrier Choice
- Dispersion Results
- Performance Analysis / Case Study
- Summary & Key Takeaways

ESG (Environmental, Social & Governance)

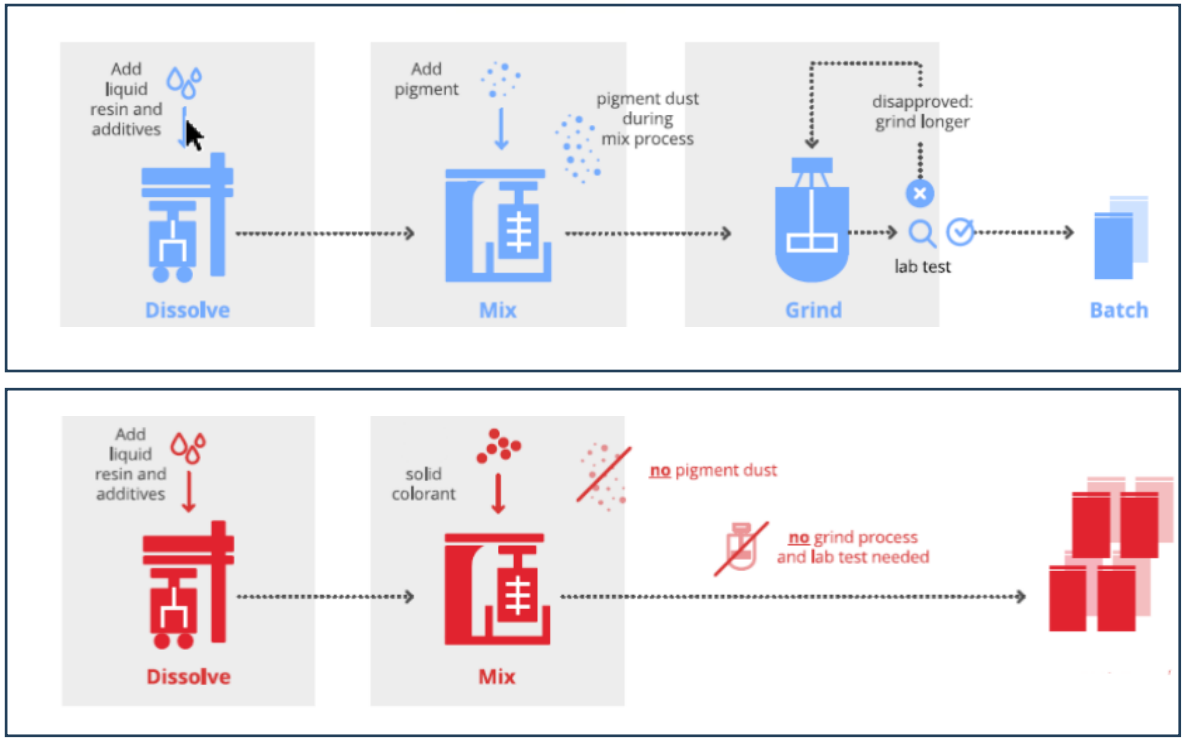
Why ESG matters in Coatings

- Regulatory Drivers (EPA, VOC/HAP rules, SCAQMD, OTC States)
- Investor & Stakeholder Pressure (SEC climate disclosures, ESG reporting)
- Customer Expectations (LEED, BREEAM, low-emission products)
- Operational & Reputational Risk (compliance, safety, brand protection)
- Cost & Efficiency Gains (energy, waste, insurance, lean production)

Why a solid colorant?

- What problem does the solid colorant solve
  - Liquid handling, when adding liquid colorant
  - Dust forming in production when adding pigment
  - Long production time
  - High energy use
  - Flexibility and ‘Just in Time’
- What is a solid colorant and how does it work

Why a solid colorant?



Why a Solid Colourant?

Validation of 2 different technology approaches for producing solid colorants and their applications

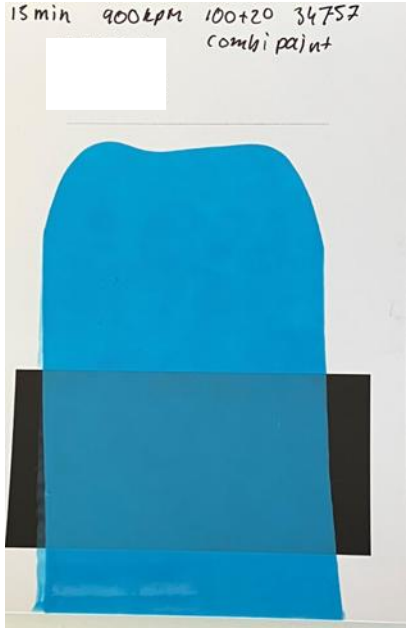
Parameter	Technology A	Technology B
Composition of solid colorant	Pigment + carrier	Pigment dispersion in water
Application	Universal, both water based and solvent based systems	More dependant on paint composition because of additives etc., only applicable in waterborne systems
Number of production steps	1	2
Output production	high	lower
Application	In plant	POS
Dosing of solid colorant	Gravimetric	Volumetric

Solubility / Carrier Choice

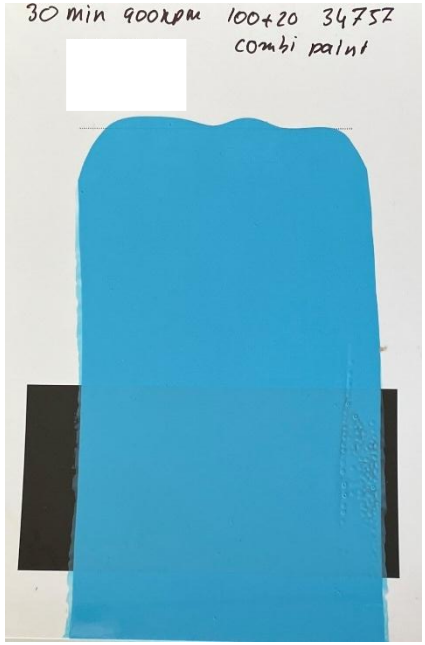
- Composition of the solid colorant: only pigment and a carrier
- Requirements carrier:
  - Easily soluble in base paint
  - Compatible in different paint systems
  - Compliant with regulations
- This resulted in different product ranges with different carriers for different coating systems
  - Solvent based - Universal
  - Solvent based - Alkyd
  - Water based

Solubility solid colorant

Progress of color strength over time:



15 minutes



30 minutes

45 minutes

60 minutes

Solubility: carriers

To select the most suitable carrier and product, different solubility tests were performed in solvents that are common in paints

Solvent Group	Example of solvent	Carrier for solvent based - Universal	Carrier for solvent based - Alkyd	Carrier for Water based
Water	Water	Insoluble	Insoluble	Soluble
Non-Polar	Shellsoll D60	Insoluble	Soluble	*partly soluble*
Polar	Alcohols / Ketones	Soluble	*partly soluble*	Insoluble

Solubility solid colorant

Standard process of testing a solubility (lab scale):

1. Equipment: dissolver and vessel
2. Solid colorant can be added to the transparent base material

   Amount of solid colorant to be added is dependent on the needed color strength
3. After 30-60 minutes of stirring, all the solid colorant is dissolved in the base material
4. Paint is ready – standard paint tests can be performed for QC

Solubility solid colorant

Solubility: solid colorant

- Solubility in the first hour was tested
- Improved solubility is followed by increase of color strength
- Color strength at 60 minutes is set as reference

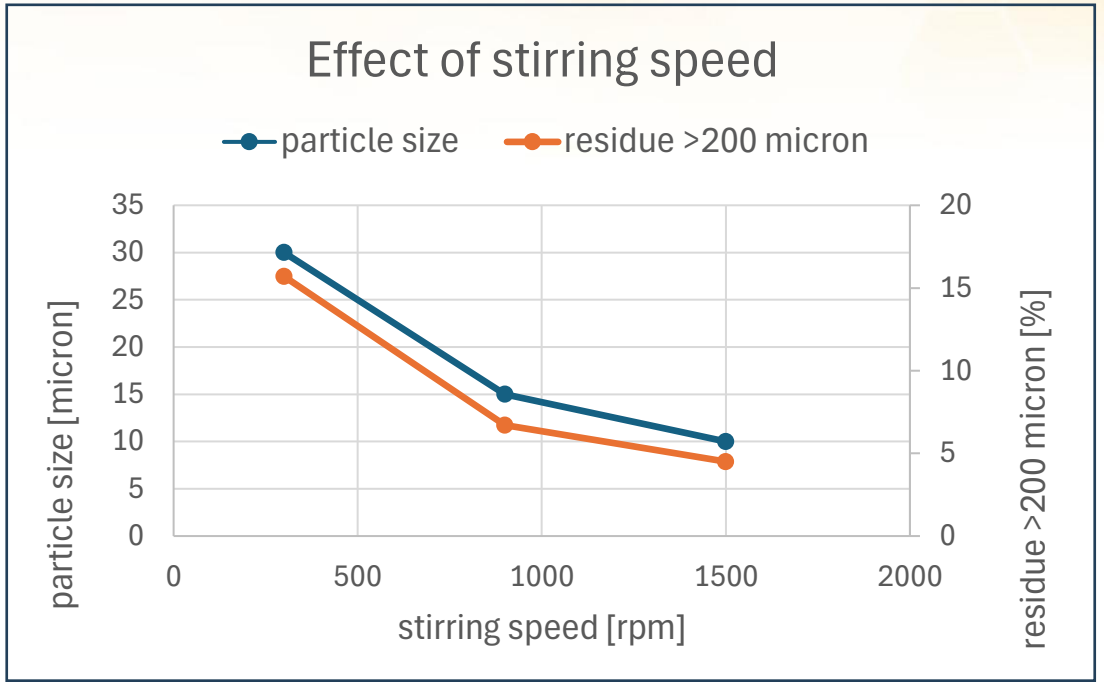
Solubility solid colorant

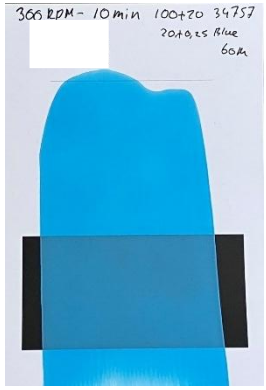
Effect of stirring speed on solubility was investigated

- 10 minutes dissolving time for different speeds

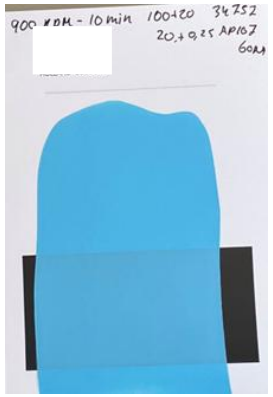
Solubility improves with increasing stirring speed:

- Less residue with higher speed
- Smaller particles with higher speed
- Higher color strength with higher speed

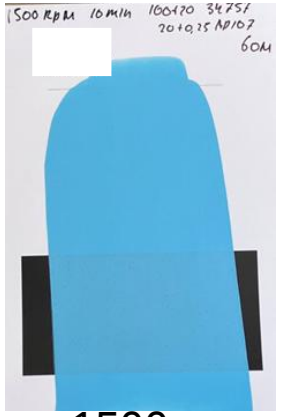




300 rpm



900 rpm

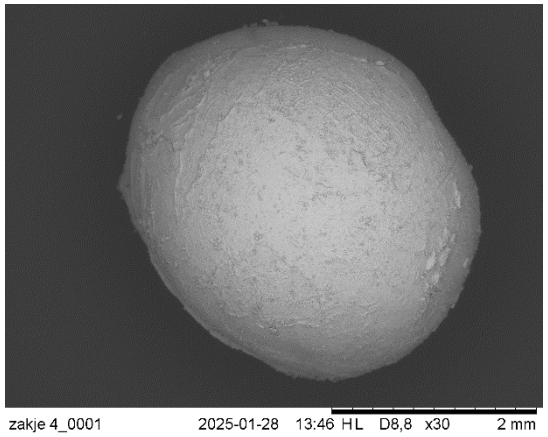


1500 rpm

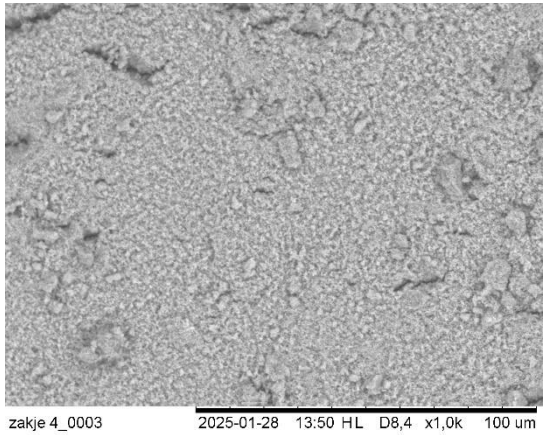
Solubility: Processing

Different parameters in our process effect the particle properties and therefore solubility

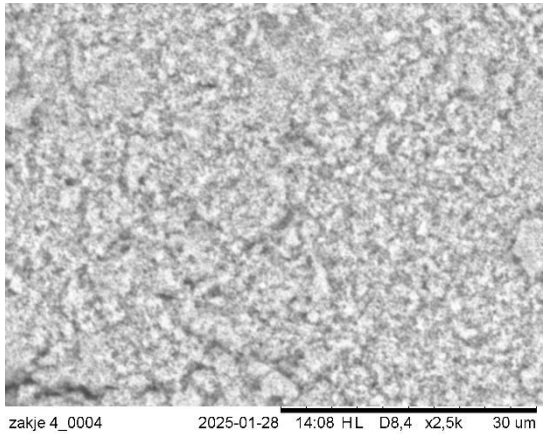
Particle property	Effect on solubility	Process settings	Remark
Rough/porous outer surface	Improves the solubility	Output, temperature, pressure	
More brittle particle	Improves the solubility	Finishing	Optimum needed between brittleness and hardness to have sufficient solubility and prevent dust formation
Size of pearls	Smaller pearls improve the solubility	Finishing	Optimum needed between processability (more difficult for smaller pearls) and solubility



30 times enlargement



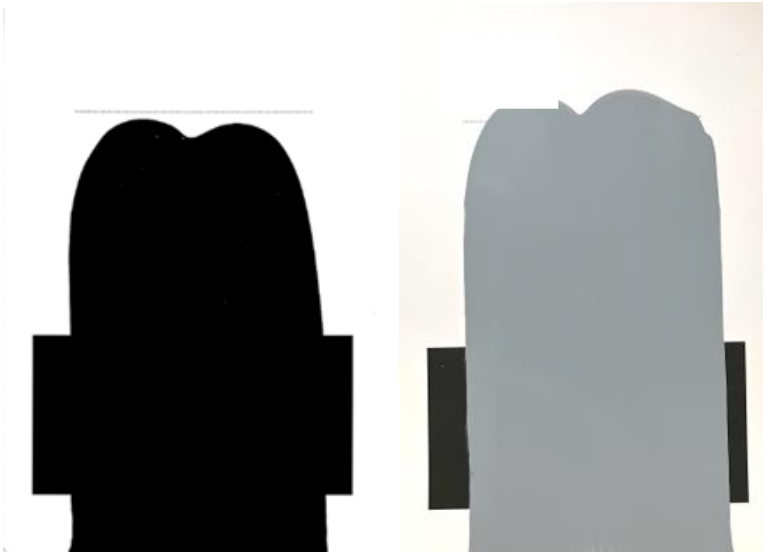
1000 times enlargement



2500 times enlargement

Dispersion Results

- The production process of the solid colorant sufficiently reduces the pigment particle size
  - Particle size +/- 15 micron as determined via Hegman test
- Dispersion is easier and often requires less energy
- Color strength of the solid colorant is comparable to liquid colorants



Comparison of liquid colorant (left in drawdowns) and solid colorant (right in drawdowns)

Solubility solid colorant – PVC

PVC = Pigment Volume Concentration

- A solid colorant contains, in weight, a higher amount of pigment than resin. But in volume, the amount of resin is higher compared to pigment → solid colorant has the effect of lowering the PVC
- Both for solvent-based and water-based
- Example for white solvent-based:

Raw material	Weight %	Density [g/cm3]	Volume	Volume %
Resin	25	1,1	22	55
TiO2	75	4,1	18	45

Product	Effect on PVC	Effect on coating
Liquid colorant	Dependent on composition	
Pigment	Increases PVC	More matte, porous, less durable
Solid colorant HCA	Decreases PVC*	More glossy, smoother, more durable

** the level of PVC decrease is dependent on color, dosing level, and composition of the base paint*

Customer Case Study

Objective: Introduction of solid colourant in the production process.

- When a sample arrives in QC, the first thing done is a 50 micron drawdown to ensure there are no large particles in the film.
- If that is OK, a grind check is done on the sample to ensure it is below 10 microns.
- Tests are then done on the viscosity and the SG of the product.
- 2 x litre are then weighed out and tinted to the 2 test colors.
- These test colors shaken for 3 minutes, then put into aerosols, gassed, and sprayed.
- Once the films are dry, they are measured against the lab standards.

Customer Case Study

50 Micron drawdown, after 15 minutes.

50 Micron drawdown, after 1 hour.

Customer Case Study

Solid Colorant shows savings in energy consumption through the cycle.

	Customer Feedback
Milling	• Saving milling time • Saving power needed for milling • Only mixing/dissolving of pearl is needed
Batch size	• Production of small batches costs a lot of energy relatively • By adding the pearl to the base paint, it is easier to produce small batches with low energy costs (see above)
Transport	• Compared to liquid colorant, transport of solid colorant is more cost efficient (less vessels) as no liquid needs to be transported

Customer Case Study

Production Key Indicators

- Fineness
- Color Strength
- Viscosity
- Cost Impact

Performance Key Indicators

- Gloss
- Drying Time
- Compatibility
- Shelf Life

Customer Case Study

Summary of solid colorant versus existing methods of coloring:

	Liquid colorant	Pigment	Solid colorant
Handling & Ventilation	+/-	-	+
Storage	-	+	+
Shelf life	-	+	+
Milling time	+	-	+
Energy consumption	+	-	+
Production QC time	+/-	-	+
Cleaning & Waste	-	-	+/-

Summary

- The adoption of solid colourants in our paint production has delivered measurable gains in efficiency, flexibility, and sustainability — without compromising quality.

- “Solid colourants have enhanced operational efficiency while supporting our net-zero ambitions, making them a strategic step forward for both production performance and environmental responsibility”

- What’s Next?

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Thank You for your Attention!

Any Questions?