Lorama Polysaccharide Resin Technology
LPRT

Company

Lorama Group Inc.

Founded in 1980 in Milton, Ontario, Canada

Locations

- Toronto, Canada (Rexdale & Milton) – Production/R&D
- Barbados - Administration
- Miami, FL - Logistics
- Cleveland, OH - Distribution
- Porto Alegre, Brazil – Production/Distribution

Lorama **P**olysaccharide **R**esin **T**echnology
LPRT

Lorama **P**olysaccharide **R**esin **T**echnology (LPRT):

Allows for the incorporation and stabilisation of water-in-oil emulsions using a film forming-
Polysaccharide Resin

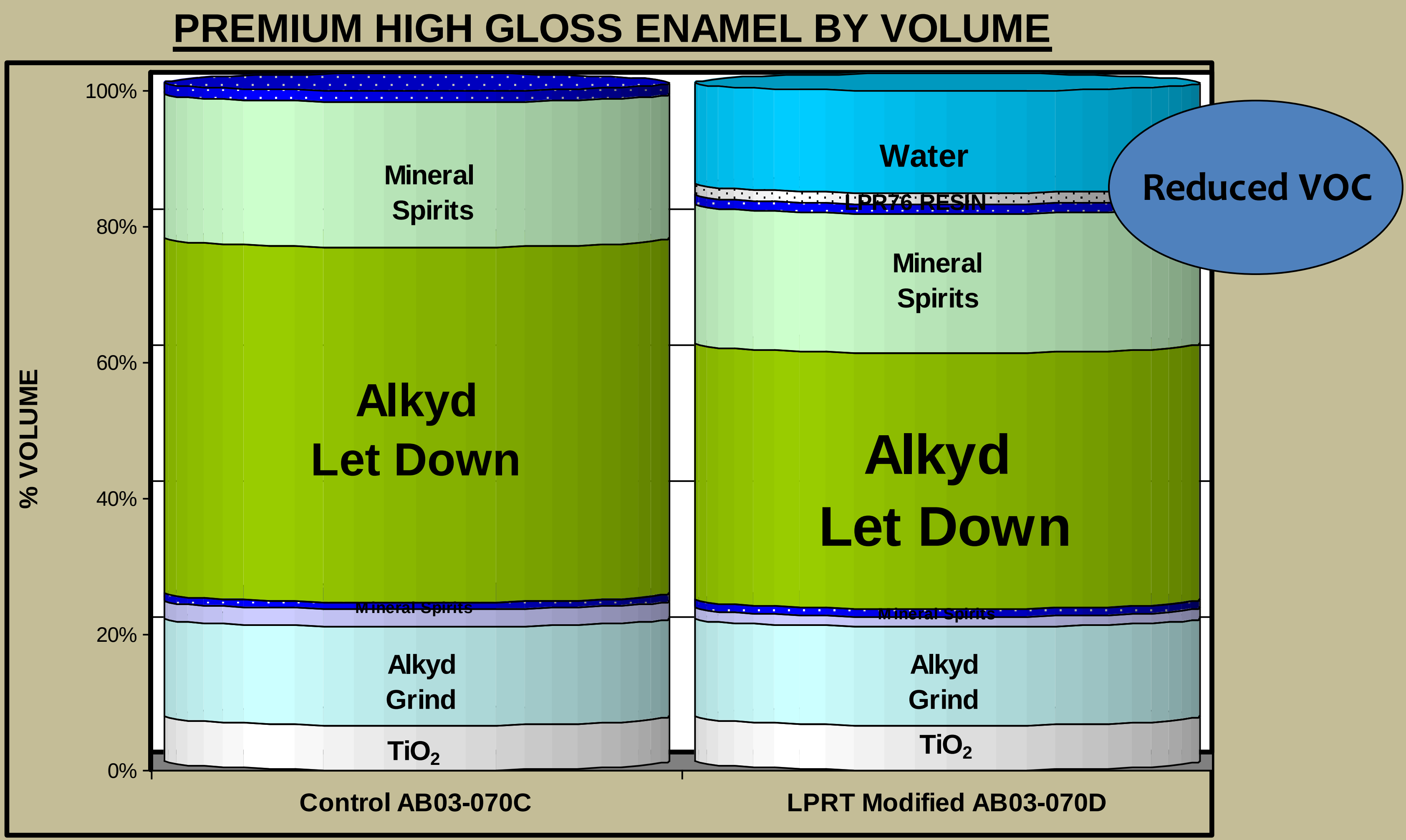
Expectations

Equal gloss @ 60°/20°
Equal or better gloss retention
Equal or higher viscosity
Equal or better sag resistance

Equal or better hardness
Equal or better adhesion
Lower Material VOC
Equal leveling

- **Lower material VOC**
- **Equivalent or better performance**
- **Lower raw material cost**

LPRT Modified Enamel



LPRT

The hydroxyl groups (OH) of the polysaccharide resin hydrogen bond with the carboxyl (COOH) groups of the alkyd forming a denser-higher molecular weight polymer network

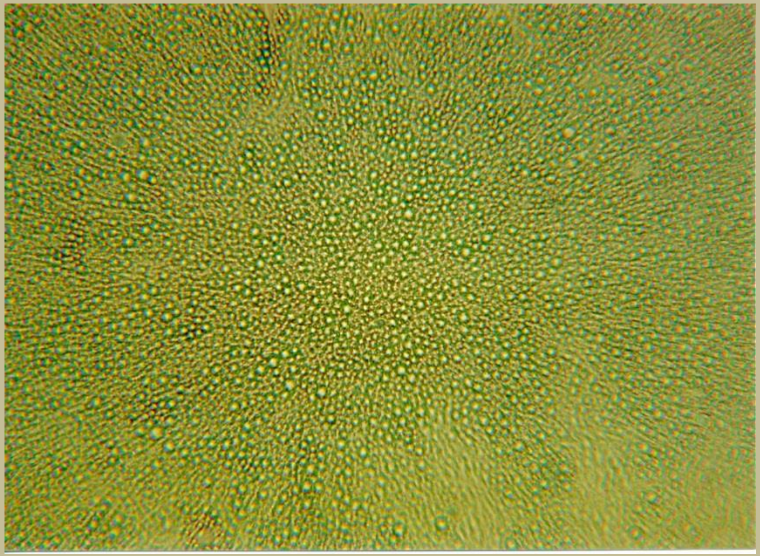
Functions of LPR76

The core product of LPRT is Lorama Polysaccharide Resin LPR76. Its functions are:

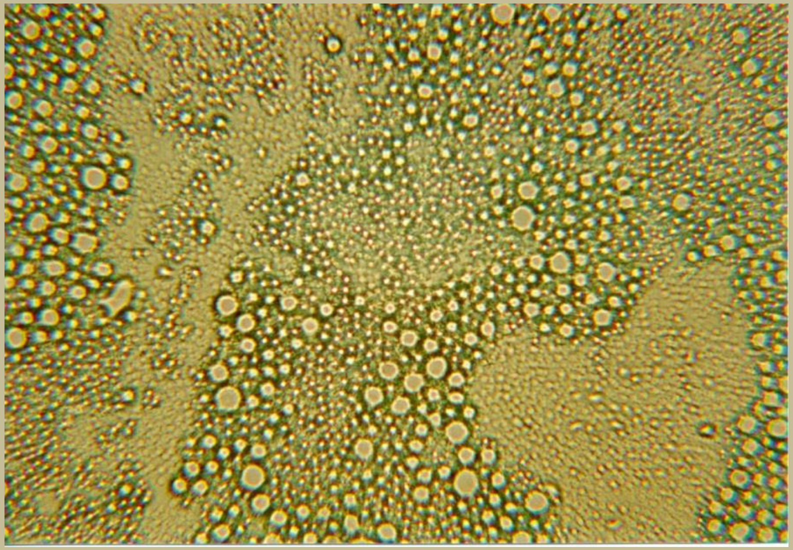
- Assisting in the creation and steric stabilisation of the water-in-oil emulsion
- Preventing the formation of gaps in the film caused by the evaporating water through hydrogen bonding with the alkyd
- Molecular association with the alkyd serving to improve Film Hardness

Emulsion with/without LPR76

Emulsion with LPR76



Emulsion without LPR76



40X magnification of water-in-oil emulsions:

- **The emulsion with LPR76 has a smaller average water micelle,**
- **More even water micelle distribution**
- **RESULT – The emulsion with LPR76 has greater stability, and better film properties than the emulsion without it**

Water Addition Methods

DWA

Direct Water Addition

EI

Emulsion Intermediate

Direct Water Addition

- LPR 76 Polysaccharide is added at the end of production
- Water is added and High Speed dispersed for 30 mins

- Batch process
- Modification of existing paint
- Less easy to check on emulsion stability (pigments/fillers)

Emulsion Intermediate

- An intermediate material or pre-mix containing alkyd, solvent, anti-foam, LPR76, and water
- Has a concentrated water content of approximately 60%

<u>Benefits</u>

- The same emulsion can be dosed into several different formulations
- Provides the best emulsion stability
- Allows for a greater rate of water addition

EI Formula

PROCESSING STEPS

Mix slowly

Alkyd Resin - 75% Solids	16.92% (w/w)
D40 Solvent	13.51% (w/w)
Anti-foam LAF121	0.20% (w/w)
Polysaccharide Resin LPR76	7.44% (w/w)
then add under high speed	
Water	61.94% (w/w)

Create doughnut-shaped vortex and avoid splashing.

Keep High Speed Dispersion for 30 minutes after adding the last drop of water.

Water Addition

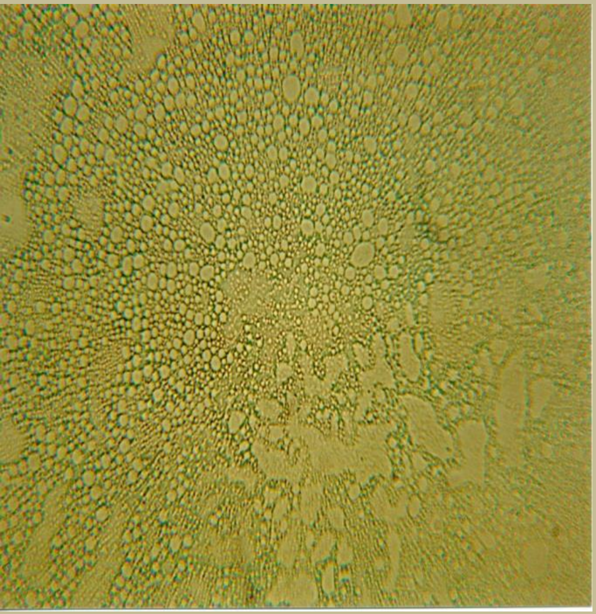
Rate of Water Addition in the laboratory vs production

	Water Addition vs. Required Agitation	
	Laboratory	**Plant**
Water Addition	0.2-3.0 litres / minute	Minimum 100 litres / minute Up to 300 litres/minute
Tip Speed	7-10 metres / second	20-35 metres / second Minimum blade diameter = 0.4m
Difference	Less powerful equipment limits rate of water addition	High speeds allow for greater rate of water addition
Viscosity (KU)	95 - 105 @ 25°C	95 - 105 @ 25°C

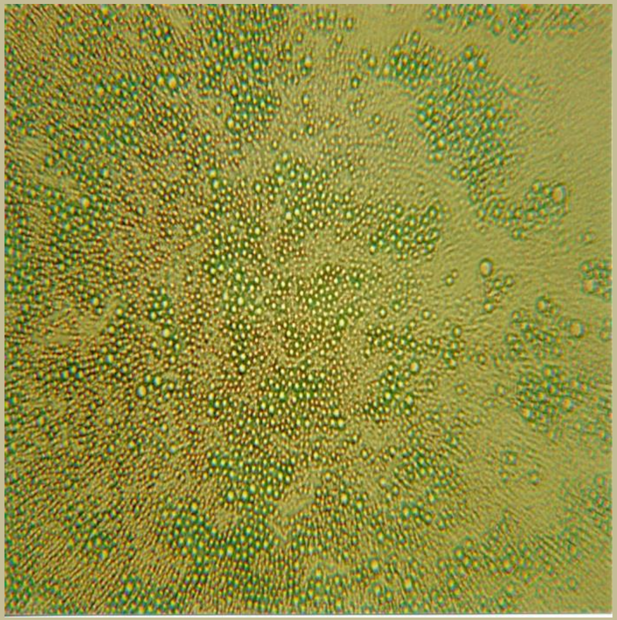
Time of Emulsification

The recommended mixing time when creating the Emulsion Intermediate is 30 minutes

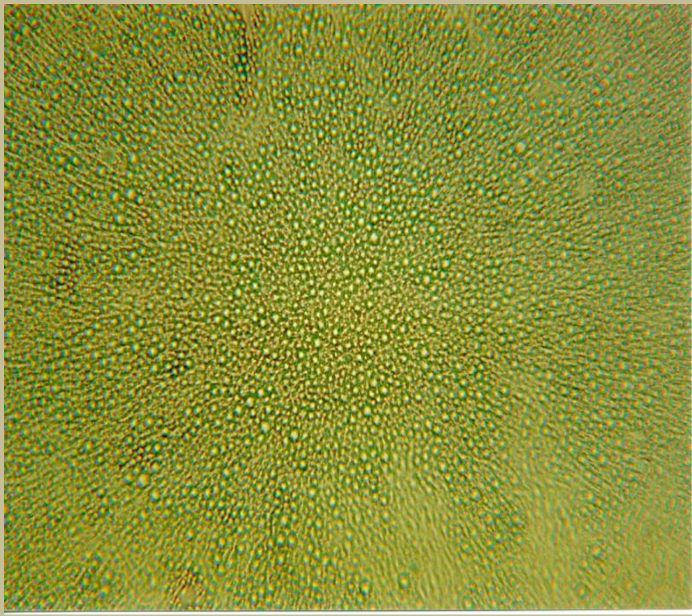
10 minutes



20 minutes

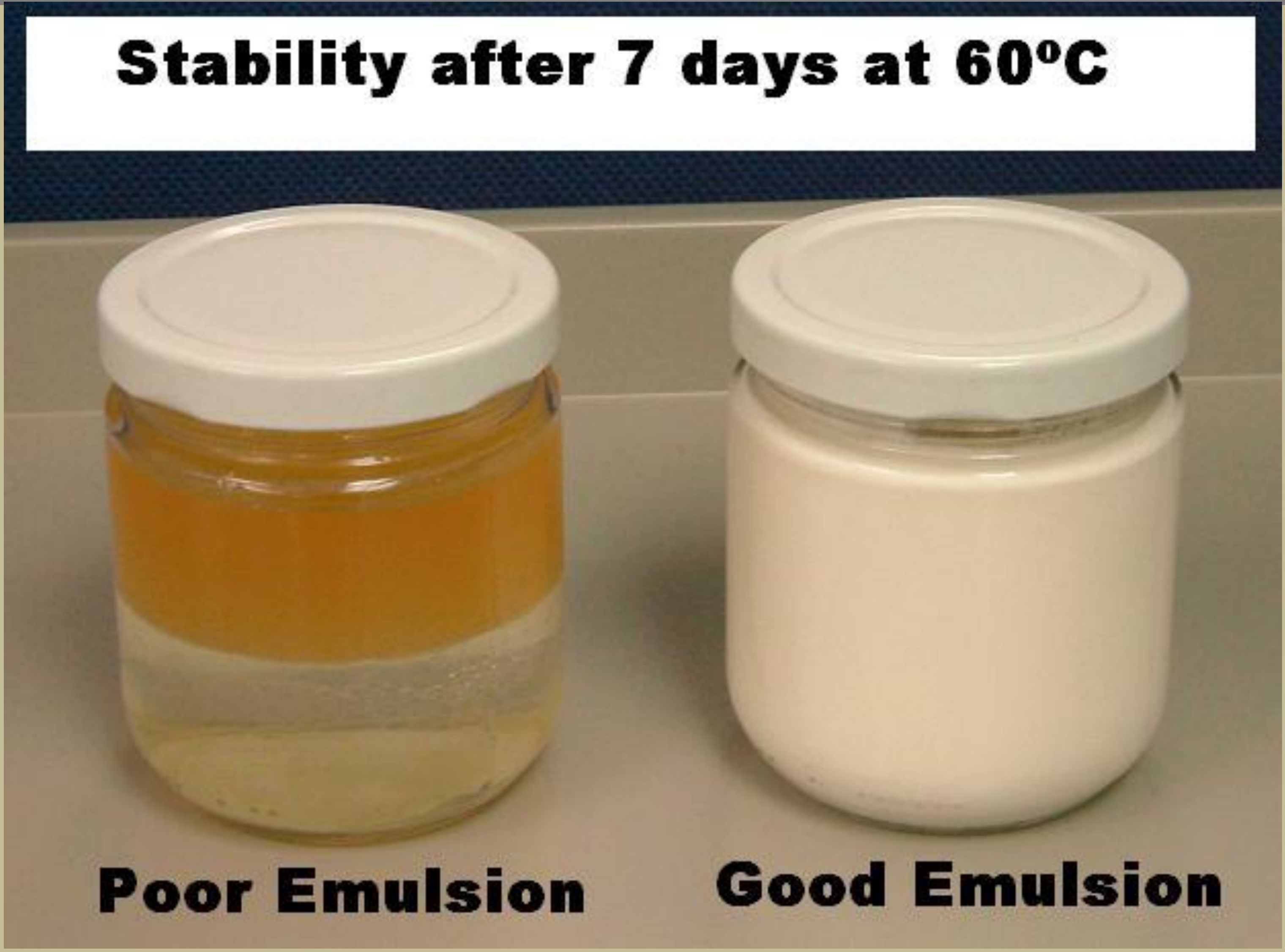


30 minutes



Do not let the Emulsion Intermediate heat up past 50°C to prevent solvent evaporation and excessive solvent loss

Stability of EI

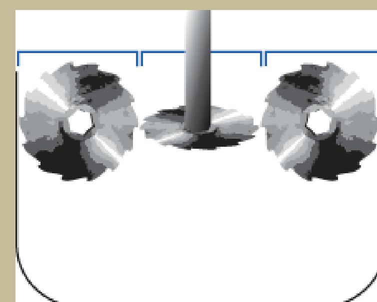


Mixing LPRT

EFFECTIVE MIXING IS CRITICAL WHEN USING LPRT

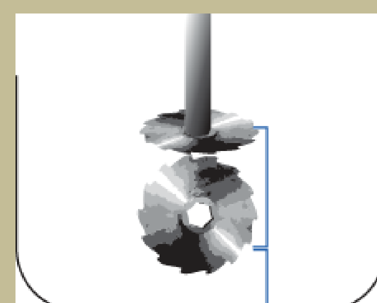
Blade Sizing

The blade diameter should equal 1/3 the tank diameter to ensure good laminar flow, and to get the most efficient dispersion from the equipment.

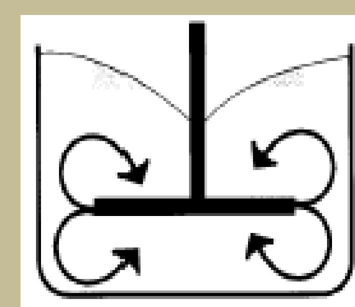


Blade Positioning

The blade should be 1 to 1.5 blade diameters off the bottom of the tank.



Good laminar flow will result in a good vortex.



Emulsion Development

Viscosity of the emulsion increases as the water is broken into fine micelles and emulsified in the alkyd

As water is added viscosity of the emulsion should increase

Viscosity of emulsion should increase as time under high speed agitation increases

Good Emulsion Development

Poor Emulsion Development

Emulsion Intermediate – Don'ts

Do not allow water to pool on the top during water addition

Do not stop agitation after adding water

Do not exceed 30 minutes agitation time

Never use gear pumps to transfer EI (use diaphragm or screw pumps)

Never add solvent to the EI to adjust viscosity or improve flow for transfer

Do not clean/wash tank with water. Always use solvent

Emulsion Intermediate – Dos

Development Stage:

Set required viscosity specification range ±5 KU

Oven Stability Test – 7 Days @ 60° C

Quality Control:

Check viscosity (falls within specified range)

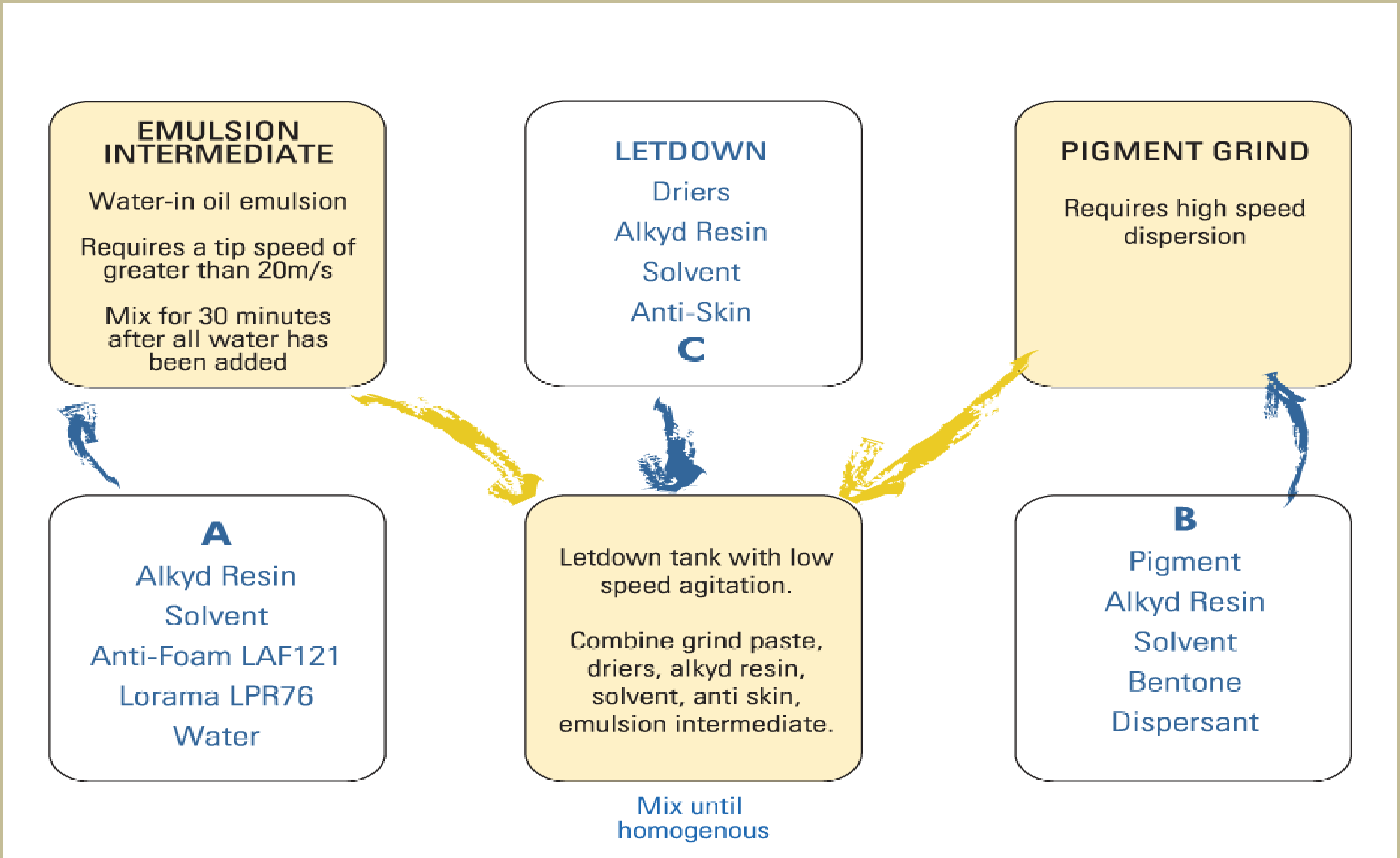
Centrifuge test (1:1 dilution with Xylene 3-4000rpm/20 mins)

For Storage Tank:

Agitate for 10 mins daily at low speed (max. 80 rpm)

Use a recirculating pump (diaphragm pump)

Preparing a Paint



Where can LPRT be used?

Premium Enamels
Economy Enamels
Coloured Enamels
Primers & Undercoats
Floor Paints
Roof Paints
High Gloss, Semi-Gloss, Satin, Matt & Flat paints
Tintable Bases for POS/In Plant tinting systems

Only suitable for Alkyd Based systems

LPRT VOC Reduction

Action	Result
1. Reduce alkyd resin to make room for water	• Overall organic solvent content is reduced as alkyd is reduced
2. Removal of extenders and fillers as necessary	• More room for water, reduced PVC, enhanced gloss retention = better film properties and lower cost
3. Incorporate LPR76 and water	• Water (a non-VOC) fills the volume left by the removal of alkyd

The result is less grammes of volatile organic compounds (VOC) per litre of paint

Achieving VOC Compliance

- High solids Resin systems

  Same approach as conventional alkyd systems but some compromise needed

- Introduction of water –
  - Polysaccharide
  - Surfactant
  - Amine

  Requires some “alternative” thinking vs traditional alkyd systems

High Solids cf LPRT

+ Very stable (no water needed to achieve VOC)

- Greater yellowing tendency
- Slower drying
- Softer films
- Require Co for drying (in doubt for future)
- More expensive

Surfactants vs LPRT

+ Ease of use

- Less stable in emulsion
- More raw materials
- Possible plasticising effect (soft film)
- Surfactant migration
- Tinting issues when used in bases

Amines vs LPRT

+ Lower usage levels

- Effect on drying
- Yellowing
- Potential odour issues
- Stability

General Recommendations

- Lined Cans – Epoxy Phenolic coated
- Always use a silicone free de-foamer
- Replacing 2% of D40 with D60 or similar slow evaporating solvent to improve rheology
- Selective use of extenders, consult with Lorama prior to use

Raw Materials with caution

- Silica
- Mica
- Calcium Carbonate with Surface Treatment
- Clays with Surface Treatment
- Silicone Based Defoamers
- Defoamers for water based systems
- Water Miscible Solvents
- Anionic Surfactants/Dispersants

Dry Time Stability

- This is due to the hydrolysis of the alkyd resin (ester link breakage).
- Portion of a cobalt drier goes to the water phase.
- Partial hydrolysis of the driers.
- Using dispersants with High Amine Value. Amines form chelates with the cobalt, reducing its effectiveness.
- Breaking of the Methyl Ethyl Ketoxime due to temperature, generating MEK and an amine.
- Alkyd resins with low molecular weight.

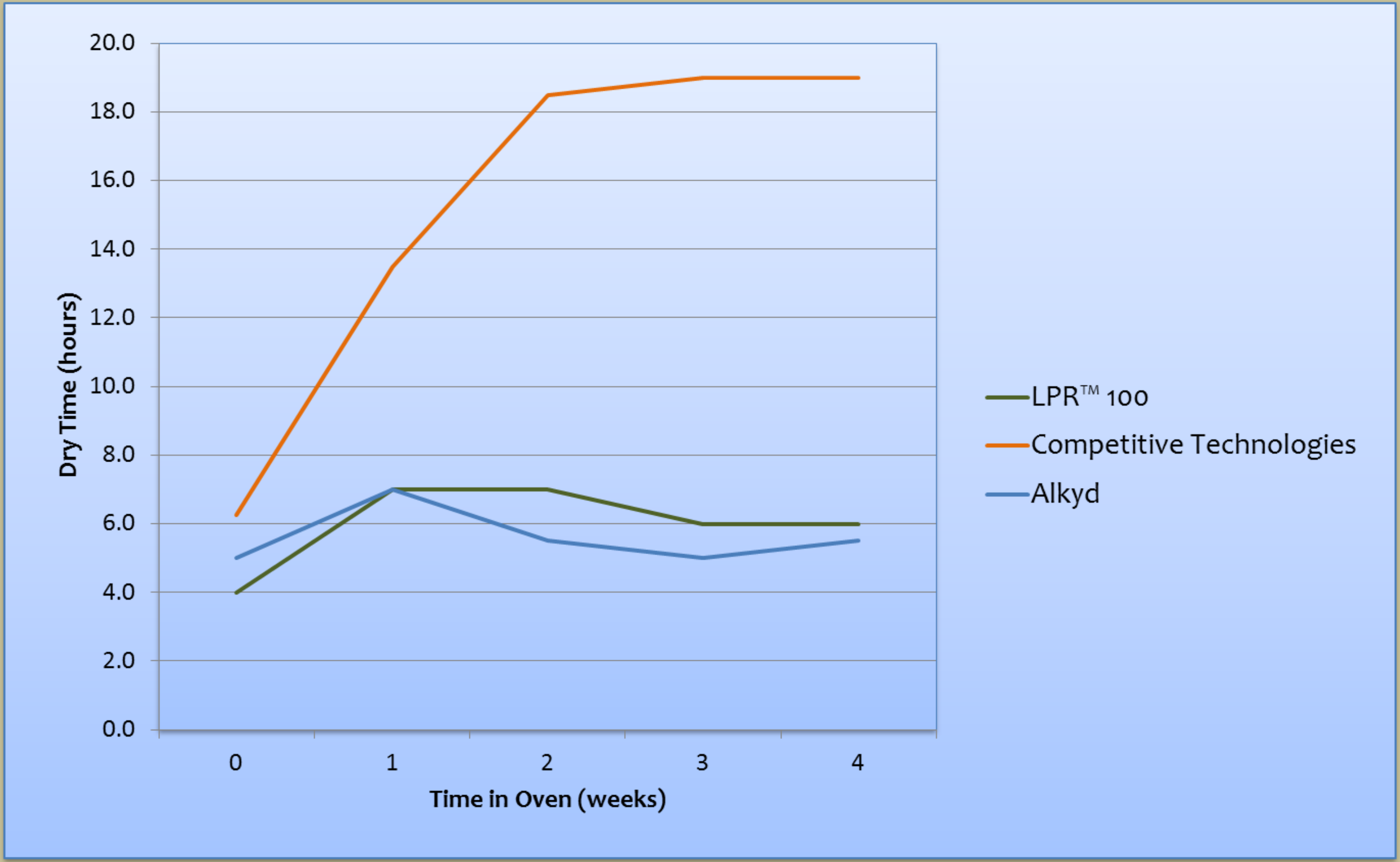
Dry Time Issue Solutions

- Use a Loss of Dry Inhibitor
- Use alkyd resins with urethane backbone (3-5%).
- Use combination of Long Oil Alkyds with Chain Stopped Alkyds at 60-65% Solids.
- Not all new compounds based on Manganese have been tried but Manganese is less effective than cobalt, needs to be used at higher levels and can compromise whiteness.

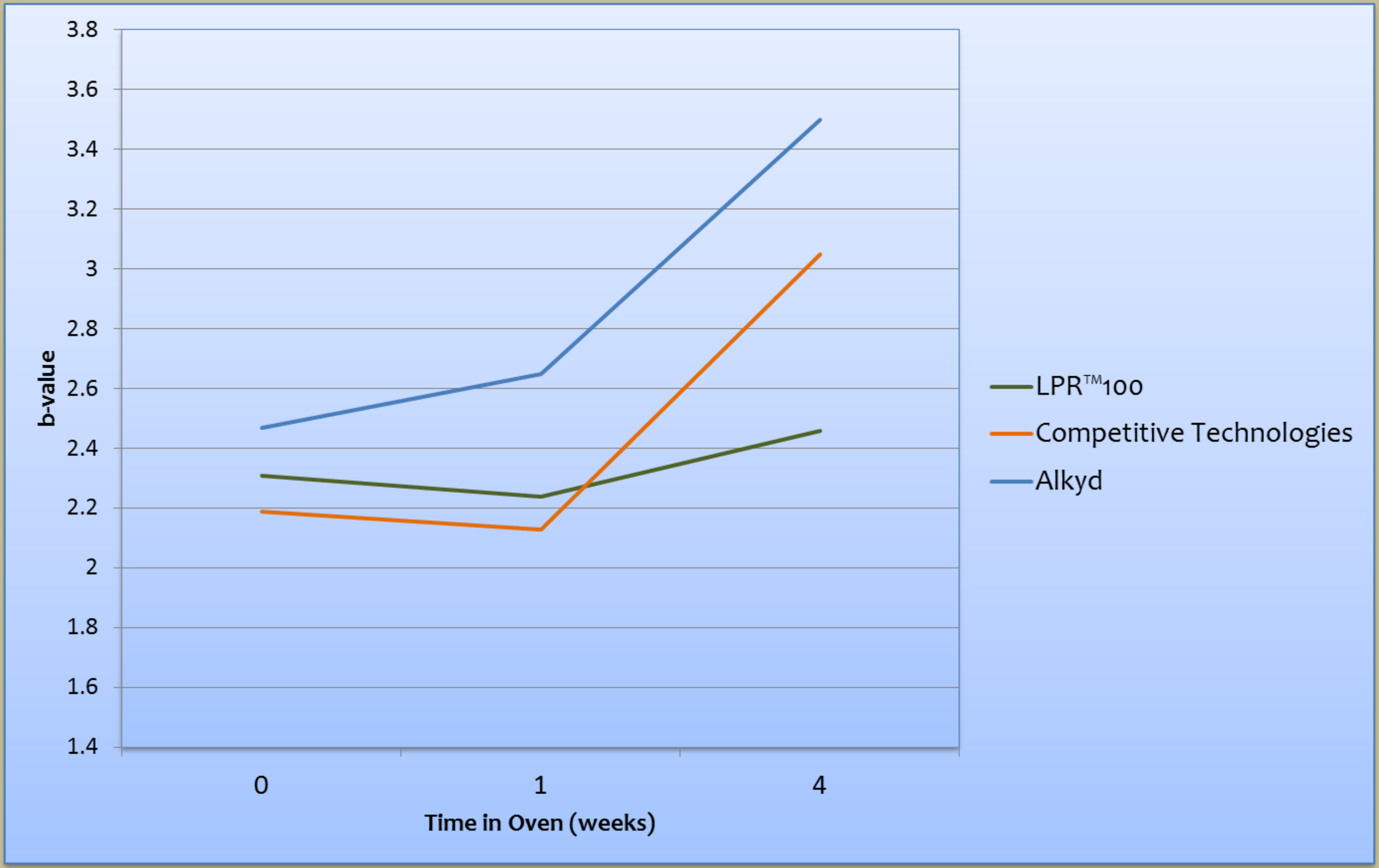
LPR 100

- Next Generation LPR 76
- Improvement in Yellowing resistance
- Improved dry time stability

LPR 100 – Dry time stability



LPR 100 - yellowing



Case Studies

1. High Gloss Economy paint (40% water/70% solids LOA – Duramac 5070/70)

2. Gloss Economy paint (18% water/85% solids LOA resin – Polialkyd AF 704/85)

3. Gloss paint (20% water/blend of 70% LOA/60% MOA)

Formulations - Case Study 1

Economy White Alkyd Enamel - 40% water

	Material	**Weight**
Grind	LOA Duramac 50-5070	6.29
	Mineral Spirits	0.47
	Rheofal 101 (Organo clay)	0.23
	HS Disperse 10 mins - then add	
	LDA 100 (Dispersing agent)	0.29
	TiO_2	11.50
	Mineral Spirits	1.75
	Grind to <10 µ, wash tank with	
	Anti-skin (OMG Skino #2)	0.01
Let Down	MOA 60% Solids	7.74
	18% Zr Drier (Hex-cem)	0.45
	12% Co Drier	0.15
	10% Ca Drier	0.30
	Mix 5 mins low speed	
	Anti-skin (OMG Skino #2)	0.18
	Mix 30 mins low speed	
	Mineral spirits	3.64
E.I.	Emulsion Intermediate	67.00

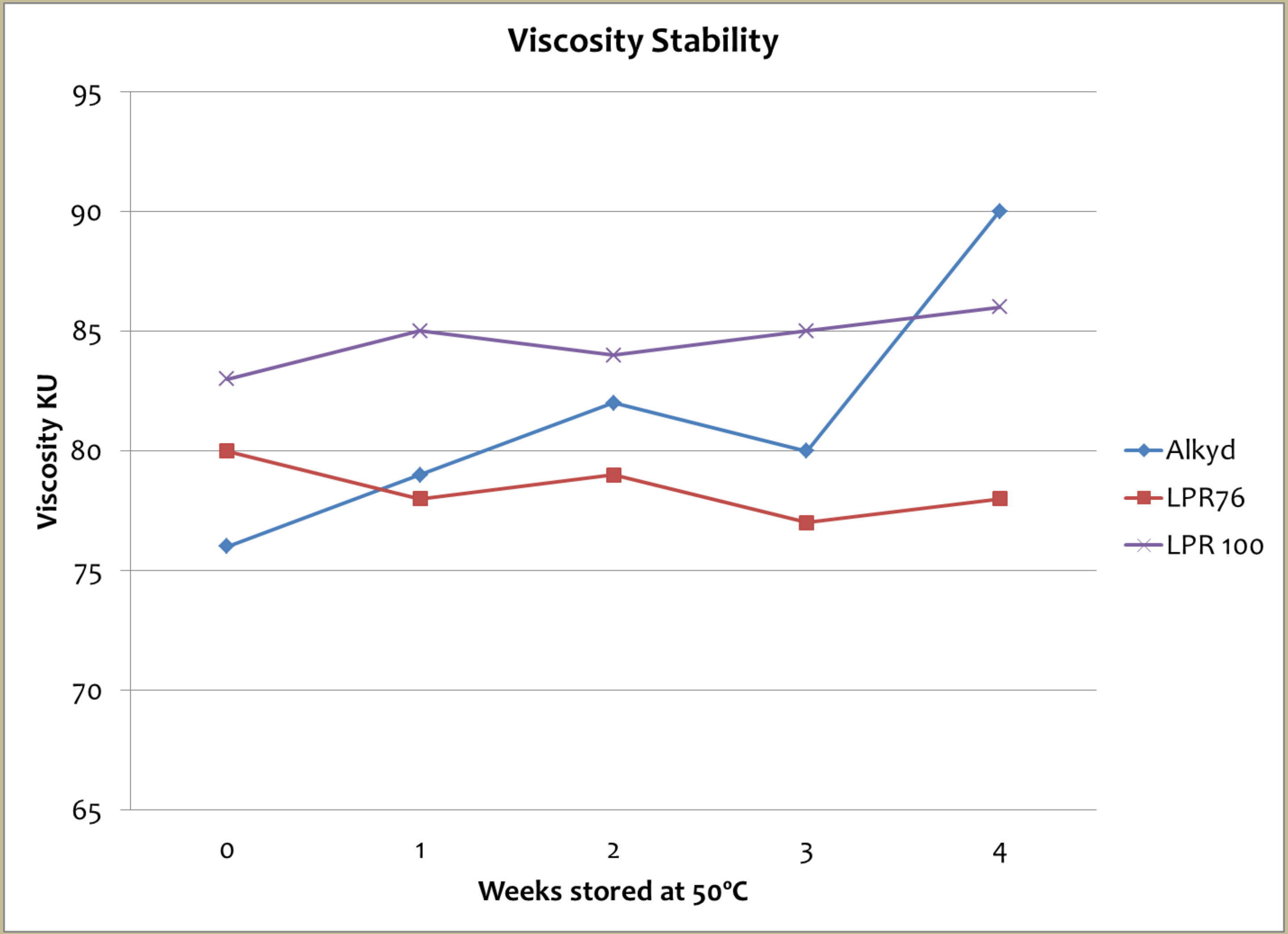
Emulsion Intermediate

Material	**Weight**
LOA 70% (Duramac 50-5070)	20.00
Mineral Spirits	12.00
Defoamer (LAF 121)	0.50
LPR 76 Polysaccharide	7.50
Water	60.00
Total	100.00
% Resin Solid	14.00

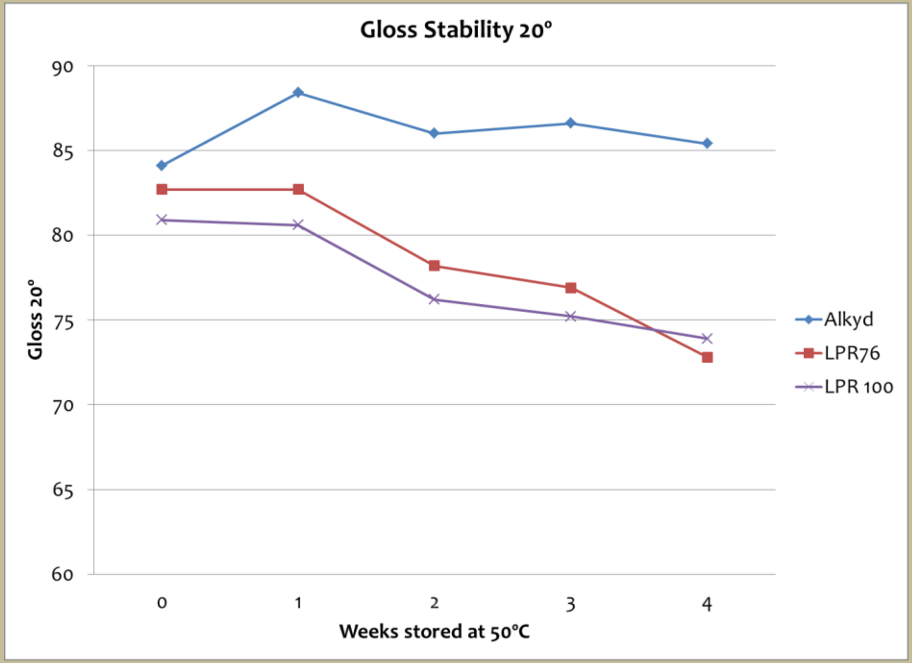
Paint Properties

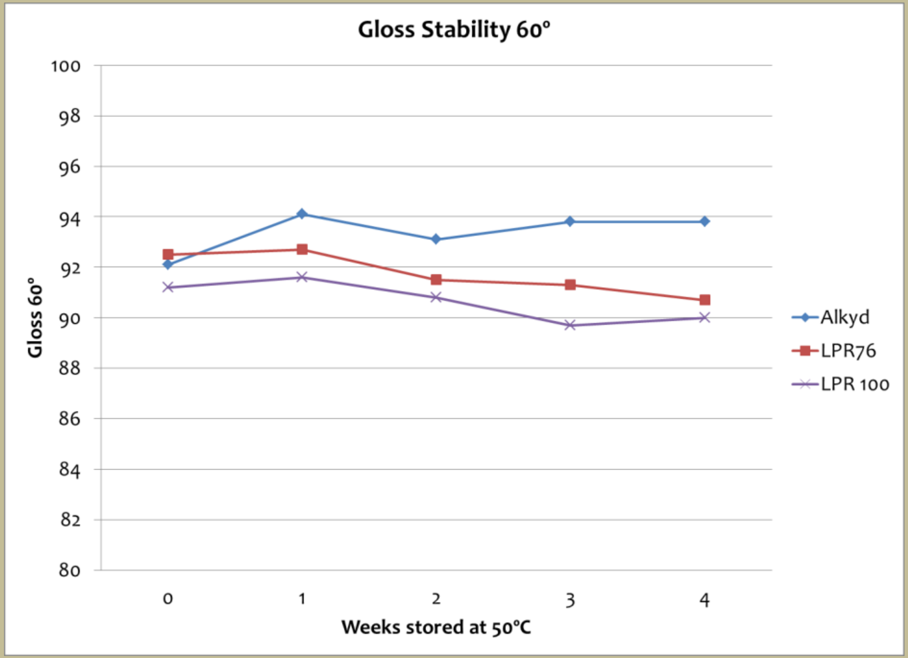
VOC	237.18
% Pigment	11.73
Pigment:Binder ratio	0.521
% Resin Solids	19.20
% Pigment Volume	3.17
PVC	12.78

Viscosity Stability - Case Study 1

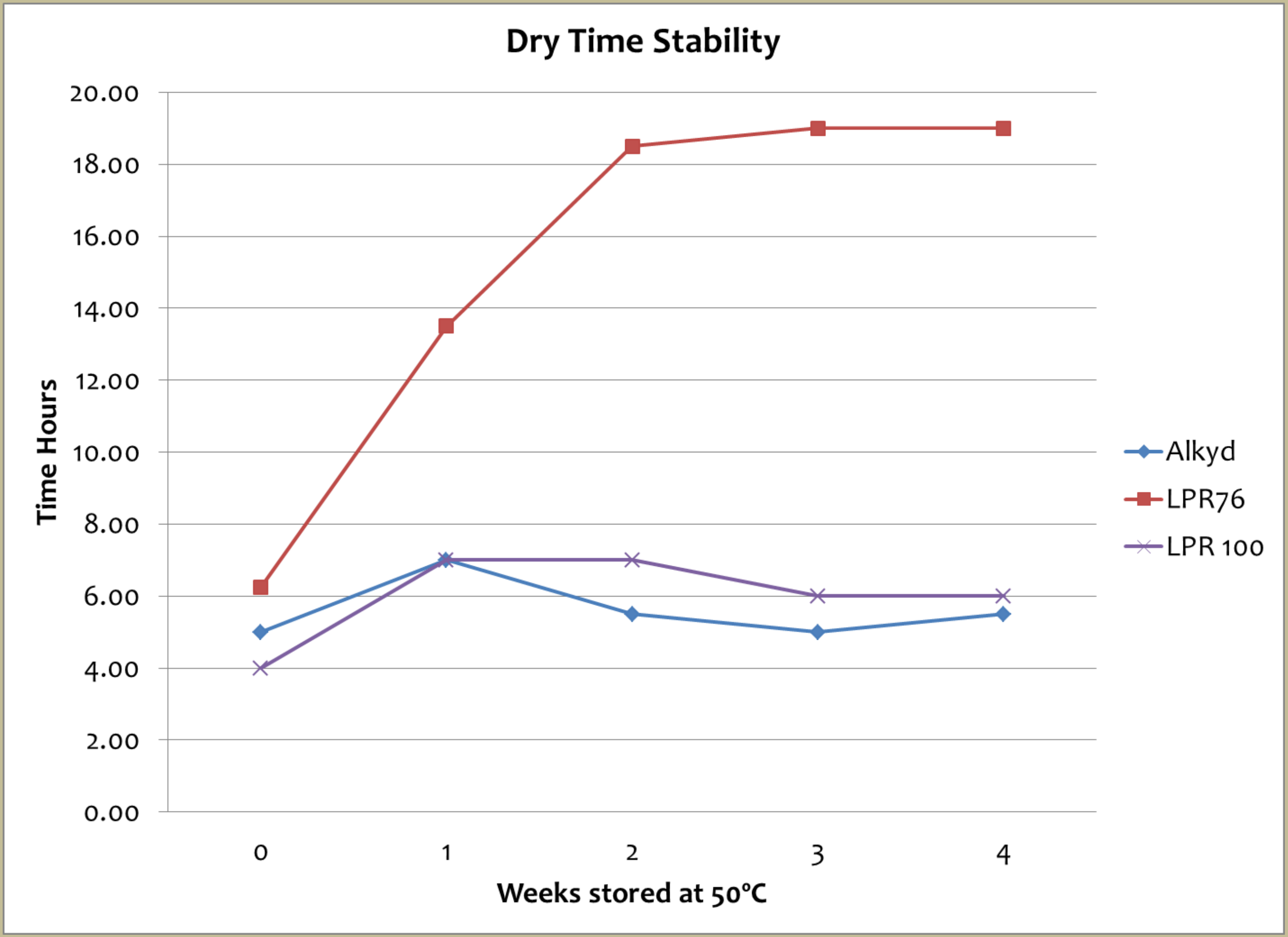


Gloss Stability - Case Study 1

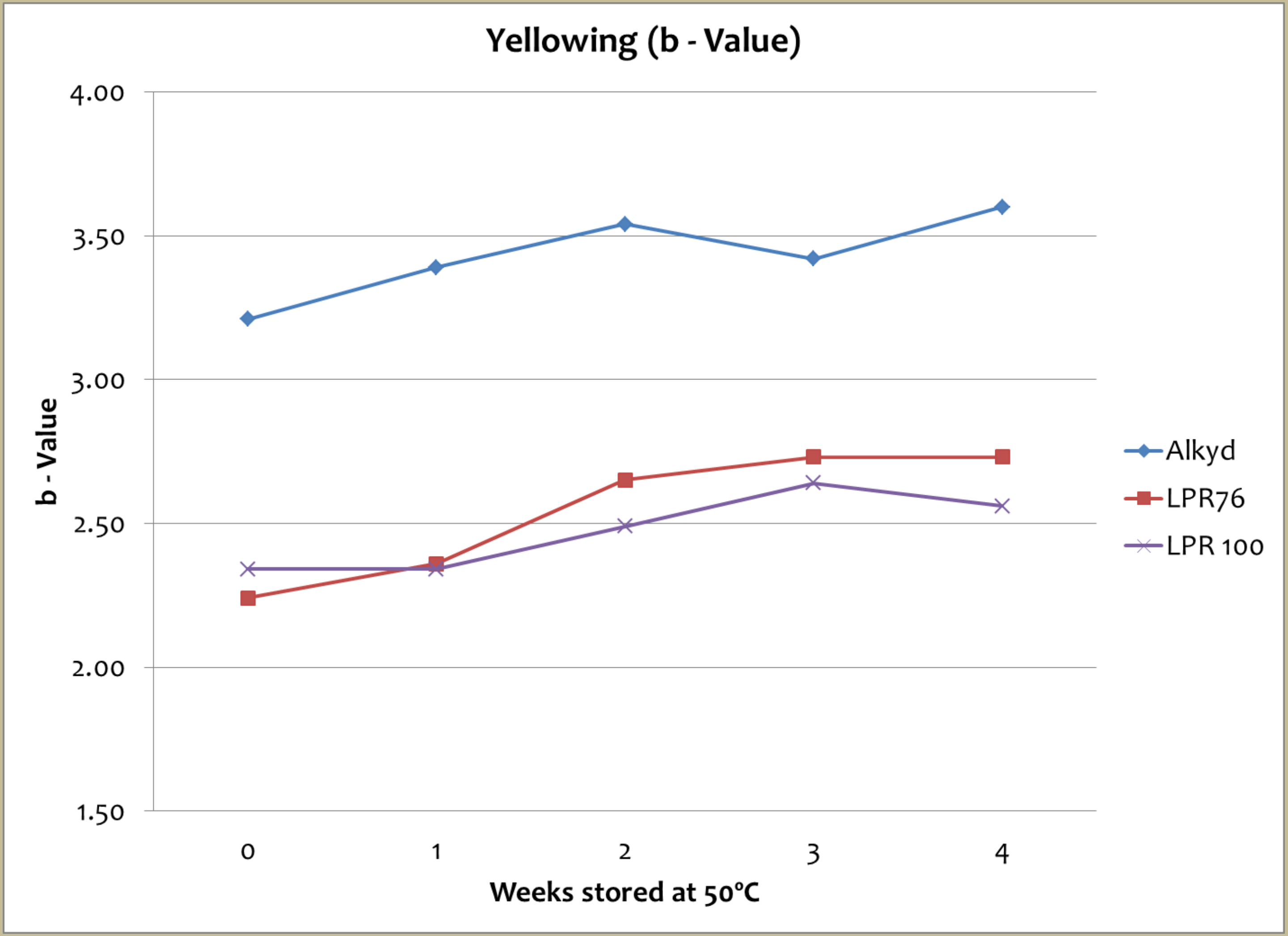




Dry Time Stability - Case Study 1



Yellowing - Case Study 1



Case Study 2

Economy White Alkyd Enamel - 18% water

	Material	Weight
Grind	LOA 85% (Polikyd AF 704)	10.78
	D40	1.87
	Bentone SD 1	0.18
	HS Disperse 10 mins - then add	
	LDA 100 (Dispersing agent)	0.70
	TiO_2	28.00
	Mineral Spirits	2.91
	Grind to <10 µ, wash tank with	
	Anti-skin (OMG Skino #2)	0.04
Let Down	LOA 85% (Polikyd AF 704)	17.29
	18% Zr Drier (Hex-cem)	0.63
	12% Co Drier	0.24
	10% Ca Drier	0.50
	Mix 5 mins low speed	
	Anti-skin (OMG Skino #2)	0.26
	Mix 30 mins low speed	
	Mineral spirits	6.60
E.I.	Emulsion Intermediate	30.00

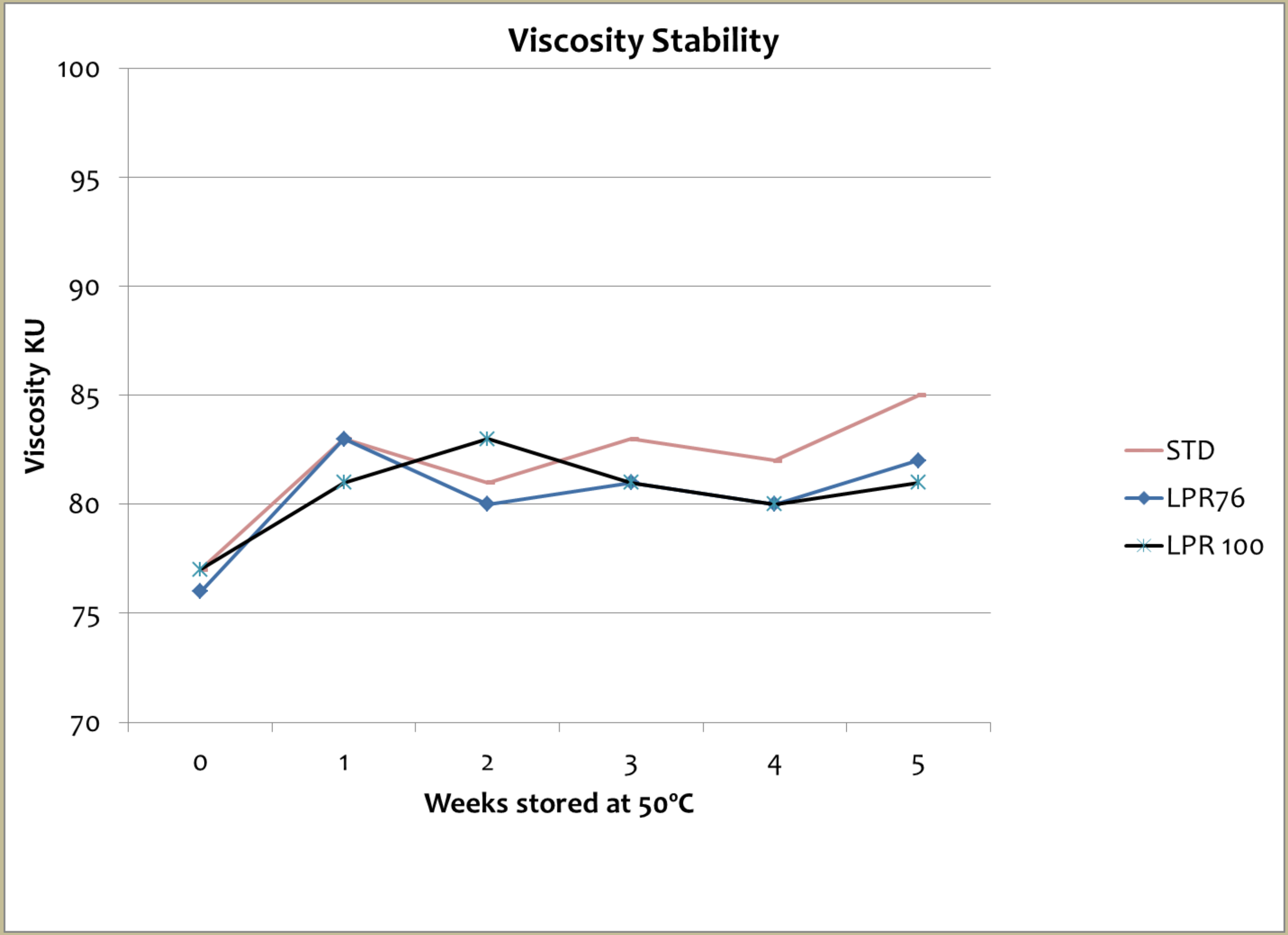
Emulsion Intermediate

Material	Weight
LOA 85% (Polikyd AF 704)	18.20
D40	14.30
LPR 76 Polysaccharide	7.50
Water	60.00
Total	100.00
% Resin Solid	15.47

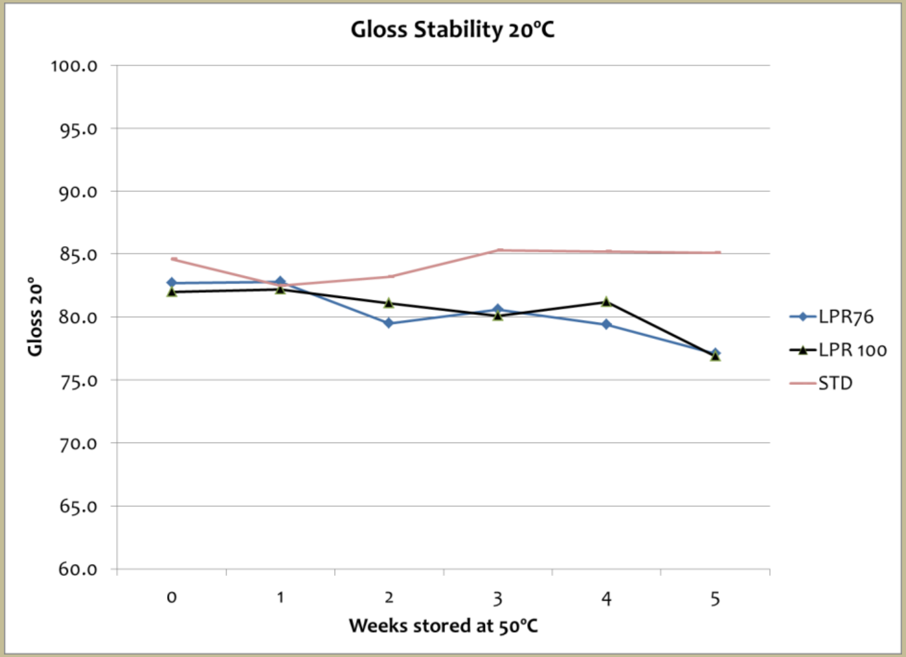
Paint Properties

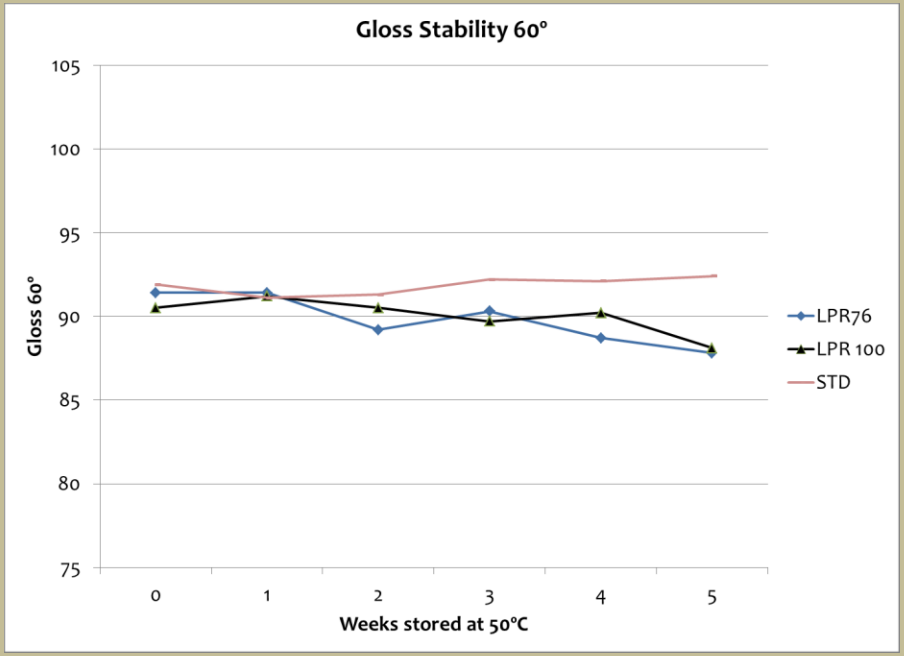
VOC	257.69
% Pigment	28.18
Pigment:Binder ratio	0.909
% Resin Solids	28.50
% Pigment Volume	8.52
PVC	19.32

Viscosity Stability - Case Study 2

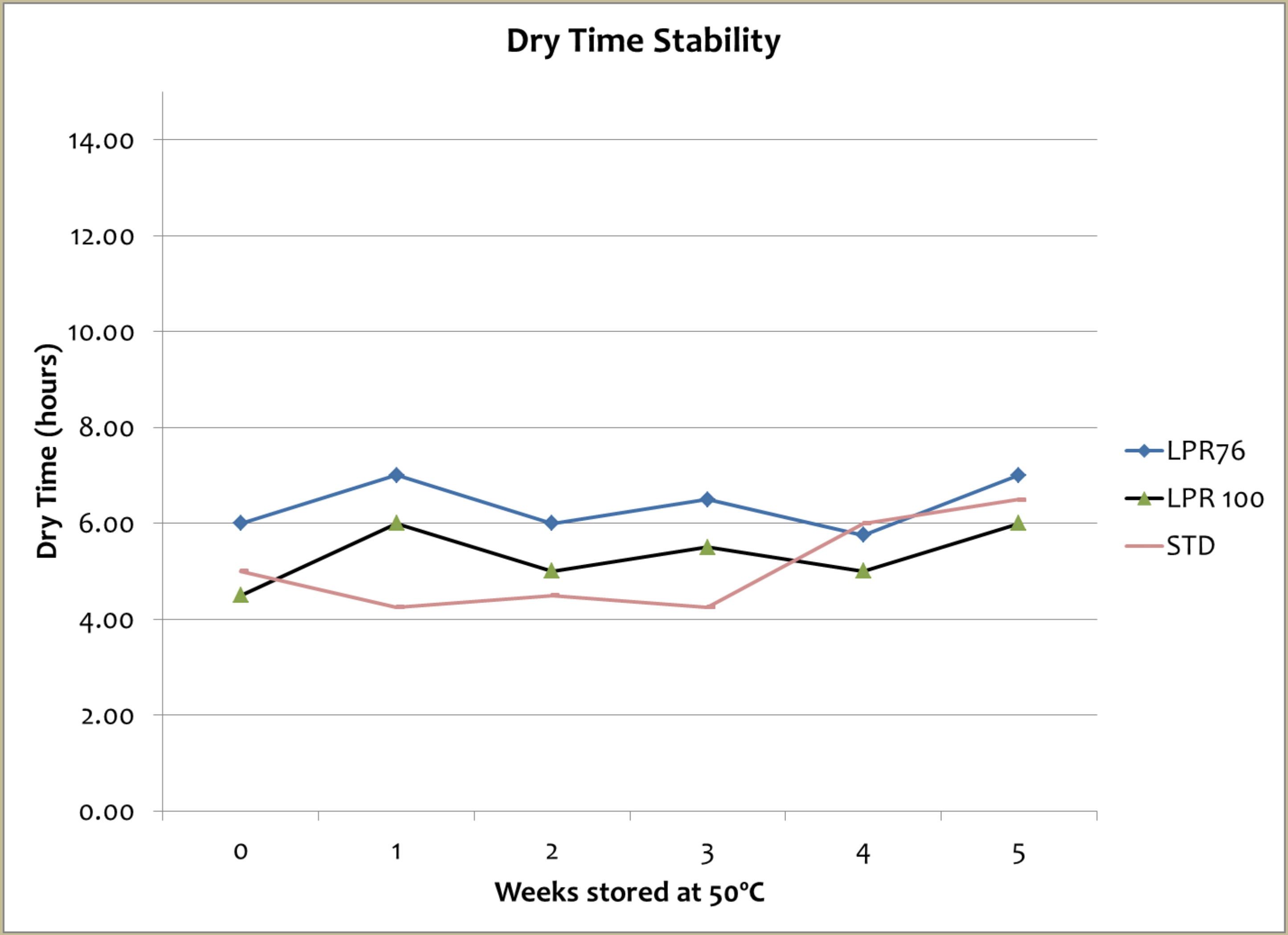


Gloss Stability - Case Study 2

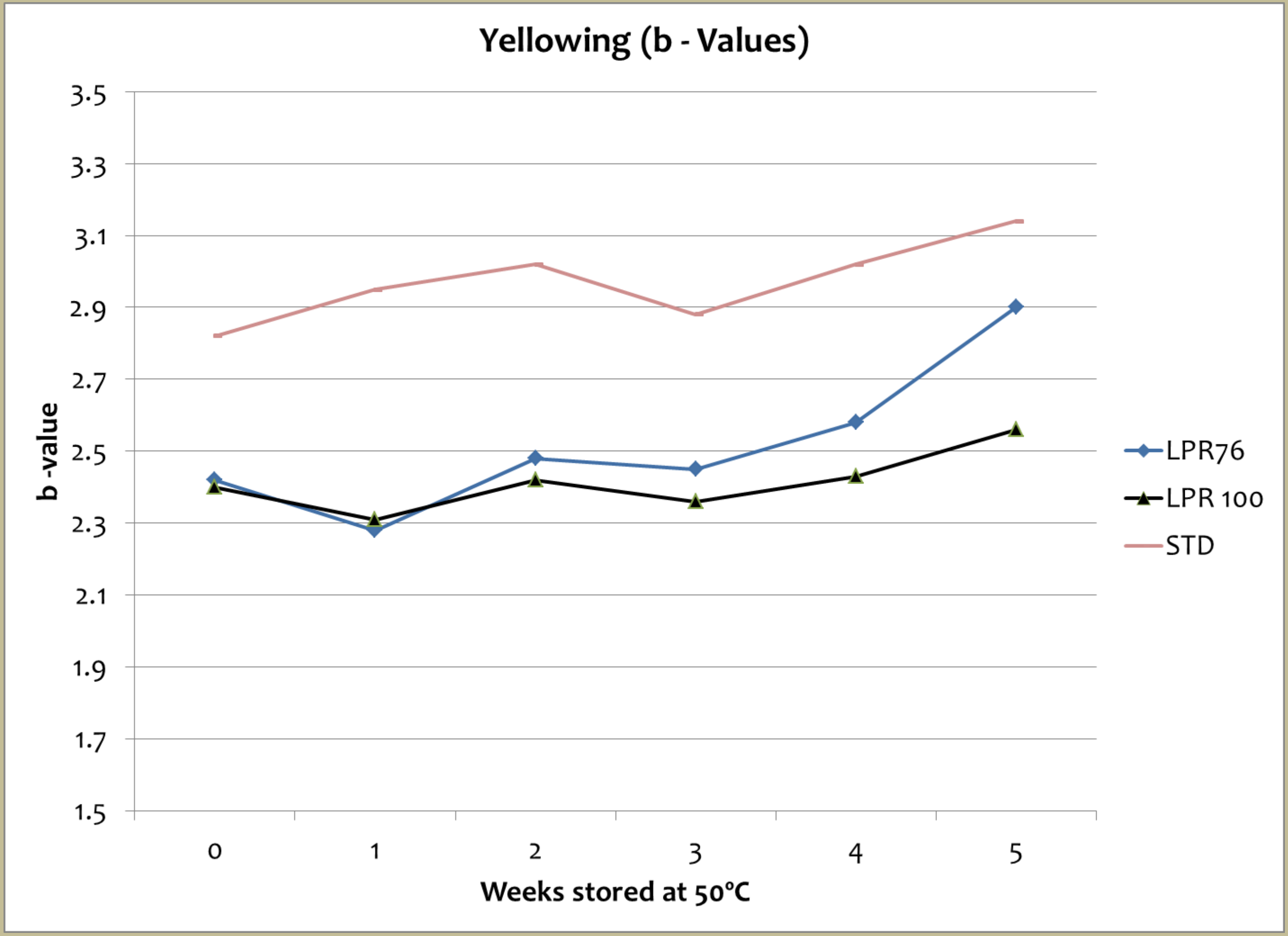




Dry Time Stability - Case Study 2



Yellowing - Case Study 2



Formulations - Case Study 3

White Alkyd Enamel - 20% water

	Material	Weight
Grind	LOA 70% solids	6.17
	Mineral Spirits	1.33
	Bentone SD1 (no activator)	0.17
	HS Disperse 10 mins	
	Add under agitation	
	LDA 154 (Dispersing agent)	0.50
	TiO_2	17.26
	Mineral Spirits	2.51
	Grind to <10 µ, wash tank with	
	Anti-skin (OMG Skino #2)	0.05
Let Down	MOA 60% Solids	26.61
	12% Zr Drier (Hex-cem)	0.54
	8% Co Drier	0.28
	5% Ca Drier	0.90
	Mix 5 mins low speed	
	Anti-skin (OMG Skino #2)	0.21
	Mix 30 mins low speed	
	Mineral spirits	7.85
E.I	Emulsion Intermediate	35.92

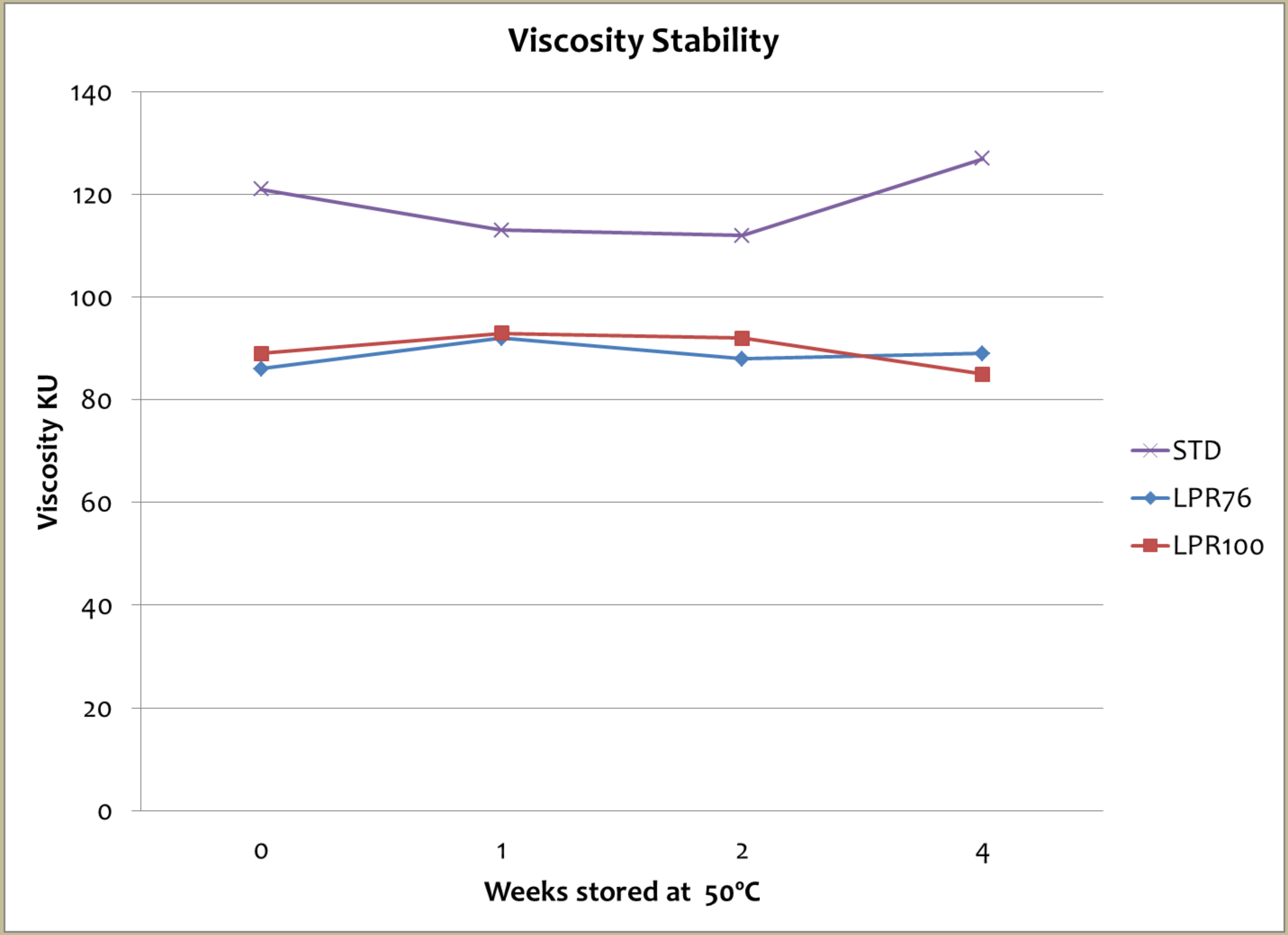
Emulsion Intermediate

Material	Weight
MOA 60% solids	25.00
Mineral Spirits	14.00
Defoamer (LAF 121)	0.50
LPR 76 Polysaccharide	5.50
Water	55.00
Total	100.00
% Resin Solid	15.00

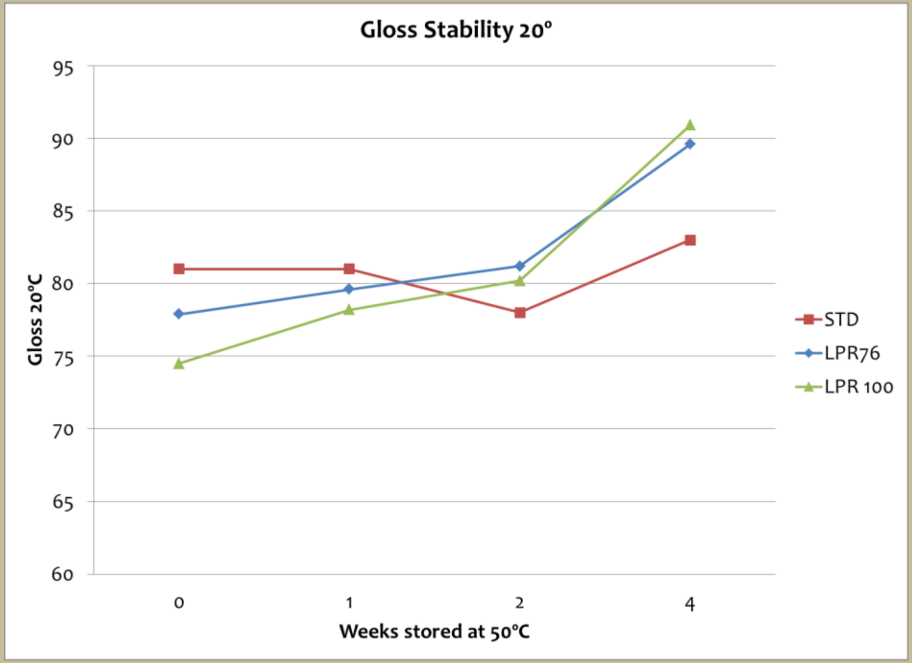
Paint Properties

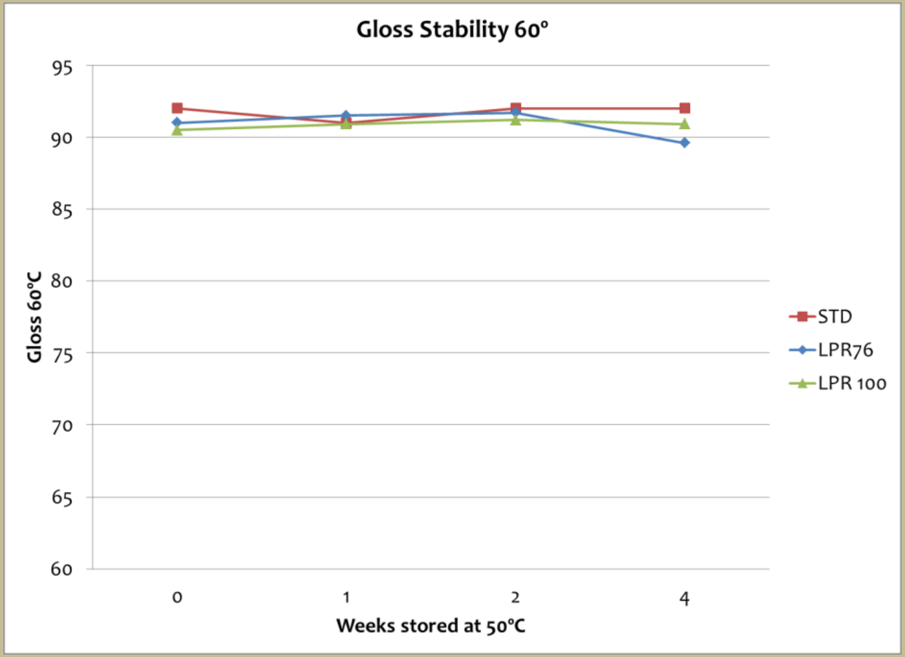
VOC	403.4
% Pigment	18.47
Pigment:Binder ratio	0.623
% Resin Solids	27.44
% Pigment Volume	5.35
PVC	15.56

Viscosity Stability - Case Study 3

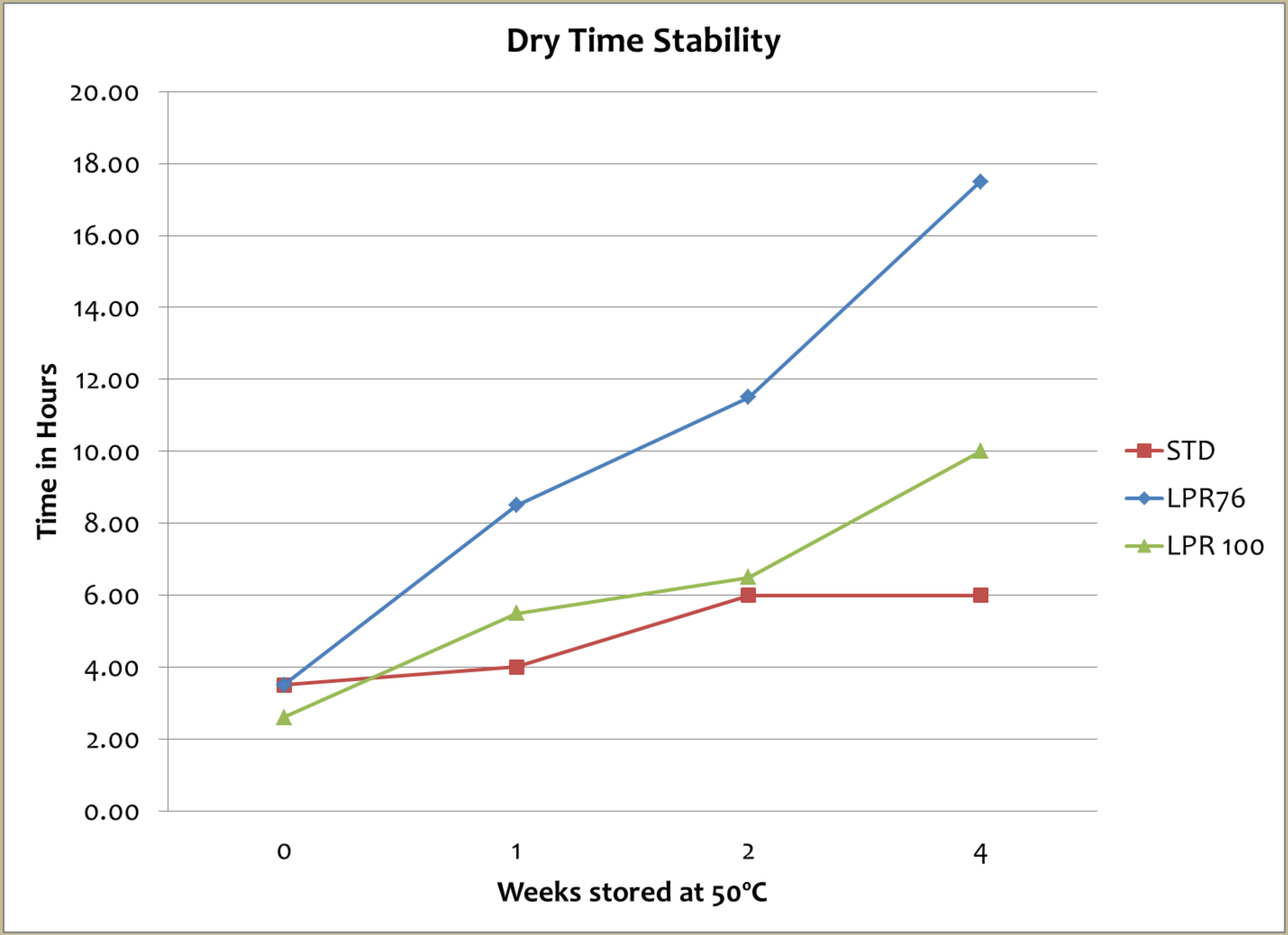


Gloss Stability - Case Study 3

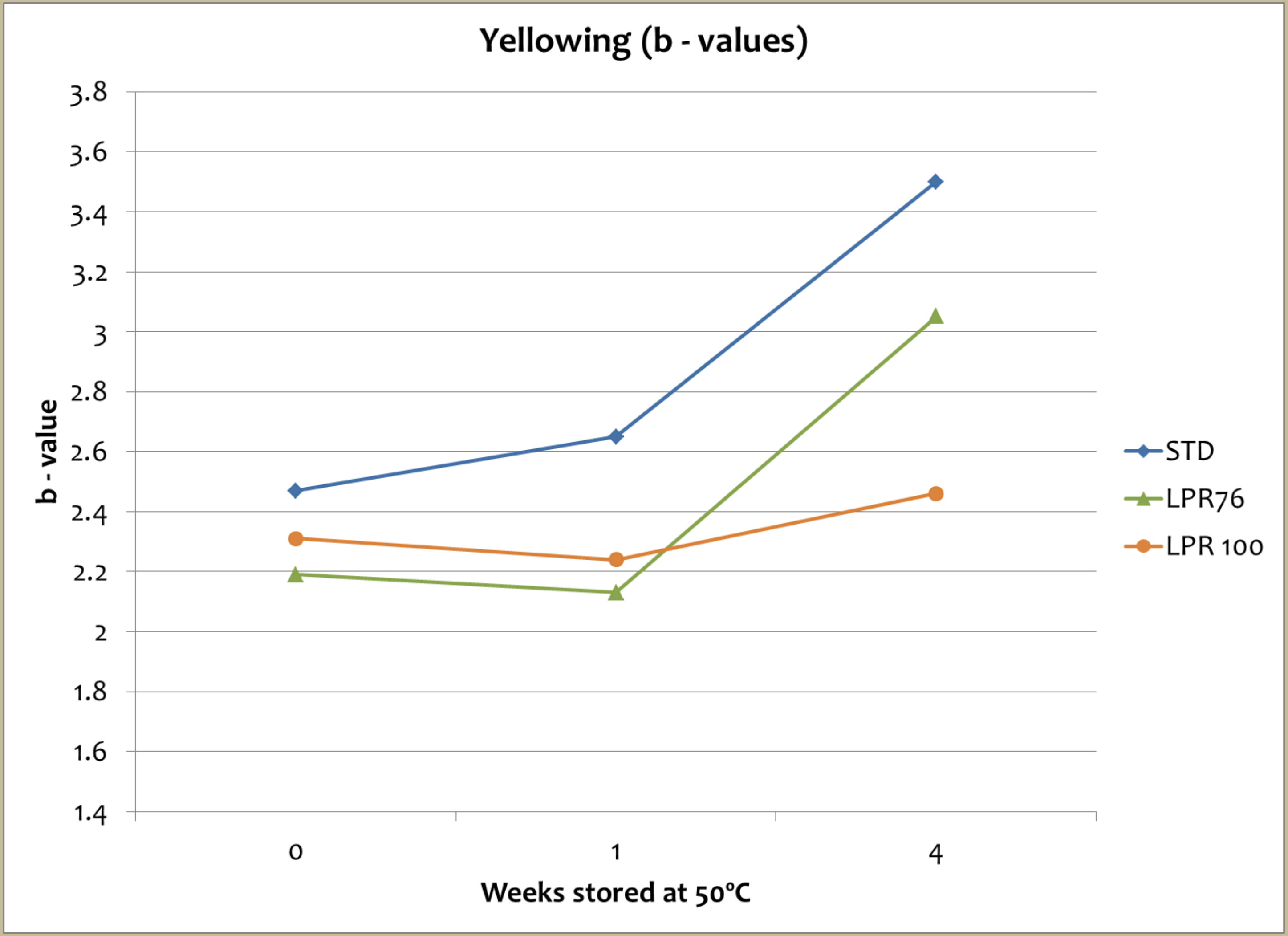




Dry Time Stability - Case Study 3



Yellowing - Case Study 3



Summary

LPRT enables –

- VOC compliance < 300 g/L with standard alkyd resins
- Reduction of cost with no reduction in quality
- Potential improvement in colour acceptance
- Improved dry time protection - LPR 100
- Reduced yellowing in some systems - LPR 100

End of Part 1

ColourFal Zerø
Zero VOC Universal Colourants

ColourFal Zerø™ Universal Colorants

Innovative technology provides an elegant solution to VOC Free tinting challenges

- Patented sustainable chemistry
- Contains raw materials made from renewable resources
- Binder-free technology
- Humectants that eliminate dry out and prevent freezing at -15°C
- Optimized for performance across binders used in decorative paint
- Ideal rheology for flow and stop-on-demand

Tinting System Problems

- Limited compatibility
- Drying in nozzle
- Dripping
- Flocculation/Rub up
- Automation
- Settling
- Viscosity drop on tinting
- Poor freeze/thaw stability

Compatibility/Colour Acceptance

Compatibility - ColourFalZerø

- Acrylic
- Alkyd (LOA, MOA)
- Alkyd emulsions (water-in-oil and oil-in-water)
- Styrene acrylic
- PVA
- Pliolite
- Polyurethane

Drying in Nozzle - ColourFalZerø

Impact:

- leads to blockage
- expensive machine maintenance
- Mis-tints/waste
- Inefficient colour system use

- Solutions:
- mechanical – moistening pads (inefficient)
- chemical – correct humectant (EcoFlo)

Dripping - ColourFalZerø

Impact:

- Waste
- Mis-tints
- Regular cleaning required

Solutions:

- Mechanical - drip catching pads
- Chemical - regulated viscosity for stop and flow

Drip/Drying Demo

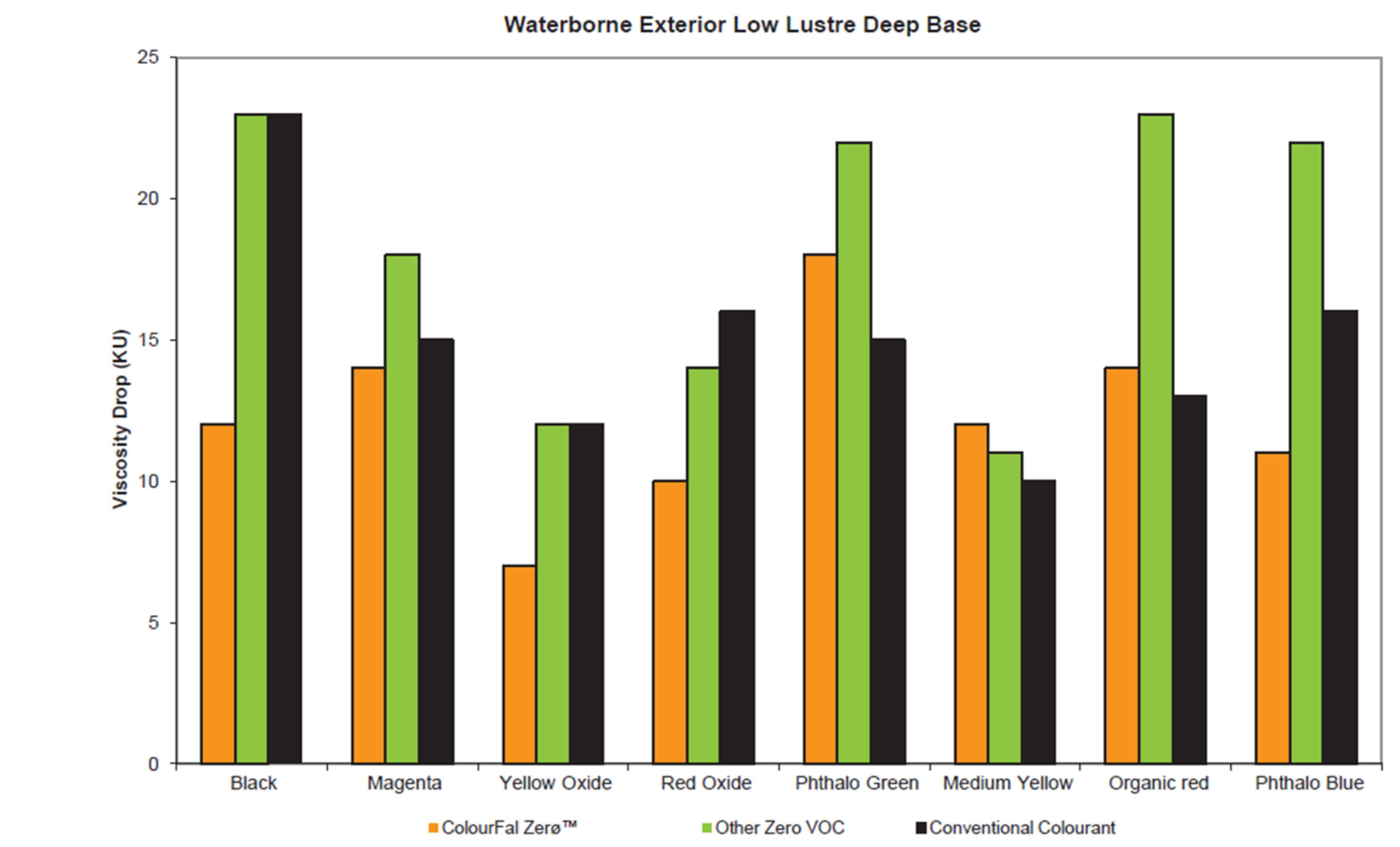
http://www.youtube.com/user/FalconChemicals

Settling

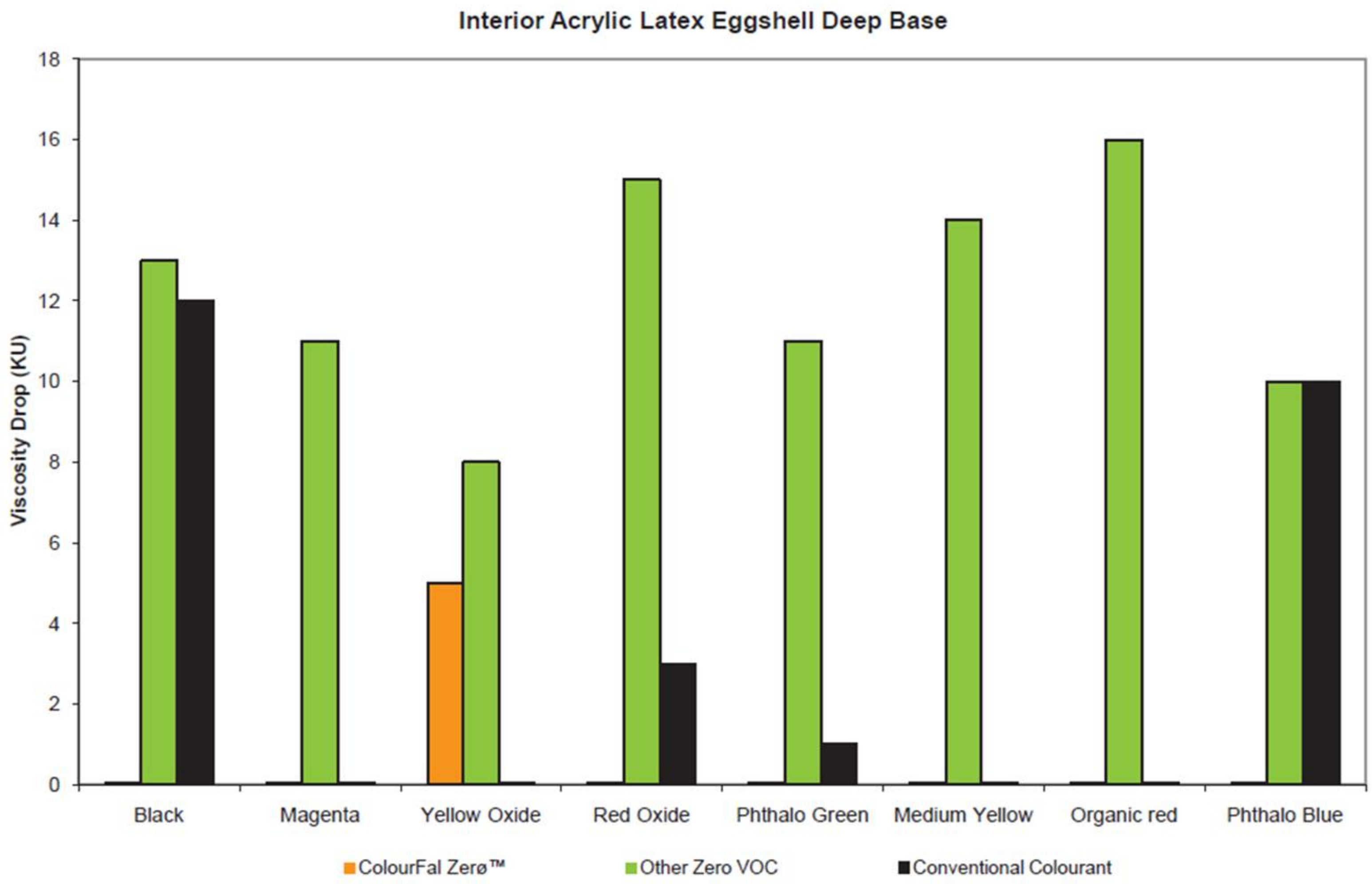
Automation

Corob, Italtinto, Hero, Fast & Fluid etc.

Viscosity Drop



Viscosity Drop



ColourFalZerø

Full range of Organic and Inorganic pigments

e.g. PY42, PY74, PY184, PBk7, PG7, PO73, PR101, PR122, PR188, PR254, PR255, PV 19, PV23, PB15:1, PB15:3, PW6, PG7, etc

Range of natural Iron Oxides (semi-transparent)

Summary

- Zero Voc
- Zero APEO
- Truly Universal Colourant system
- Freeze/Thaw stable
- Non-settling
- Non-drip
- Non-clog

End of Part 2

LORAMA STAIN TECHNOLOGY

Stain Technology

Sustainable Technology

- Intermediate Vehicle
- VOC Free technology platform
- Allows the formulation of superior water based Stains

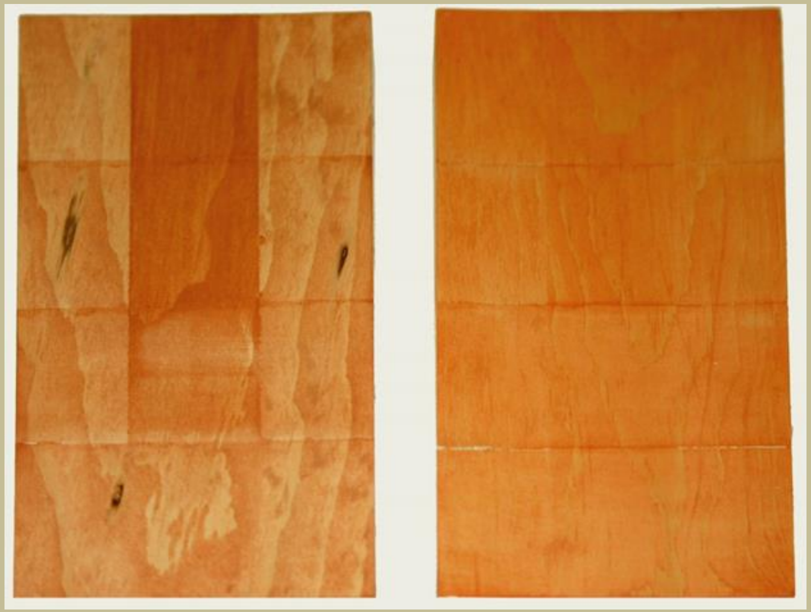
Stain Technology

- ***Enables solvent based stain performance***
- Emulsified non-volatile organic base in a water borne emulsion
- Interior or Exterior use
- 90% renewable resource base

Stain Technology

- Easy to apply
- Excellent penetration
- Longer open time
- No visible lap marks
- Re-wets for easy repair
- Better control of stain application
- Minimal grain raising
- Soap & water clean up

TEST FOR LAPPING



Competitor W/B Stain vs Lorama Stain

Stain Technology

Typical Stain Formulation

	% Wt.
Water	30 – 50
Thickener/Defoamer	
Lorama Stain Technology	**20 – 50**
Resin–optional	10 – 30
e.g. acrylic, PUD, alkyd	
Pigment Concentrate	2 – 10

Stain Technology

Non-volatile content	90%
Colourant Compatibility	Universal & w/b colourants (e.g. ColourFalZero)
Defoamers	No special recommendation
Thickeners	No special recommendation
VOC	Zero

Performance - Stain Technology

Dry Time/Lapping approx. 30 minutes
Recoat/Topcoat time 2 hours

QUV Data (1500 hrs) QUV-A	ΔE Control	ΔE Exposed	Difference
Lorama Stain (+ Acrylic⁺)	1.42	1.27	0.15
W/B Interior Stain*	1.72	2.49	0.77
W/B Exterior Stain*	0.98	1.09	0.11

*commercial products ⁺Carboset 510

Applications

- Wood
- Mulch
- Concrete/Cement
- Clay Plaster
- Porous surfaces
- Arts & Craft
- Wiping Stains
- Porch & Deck Stains
- Floors & Cabinets
- Log Homes
- Patios & Walkways

Organo-clays

Rheofal 101 – Preactivated for low/medium polarity systems

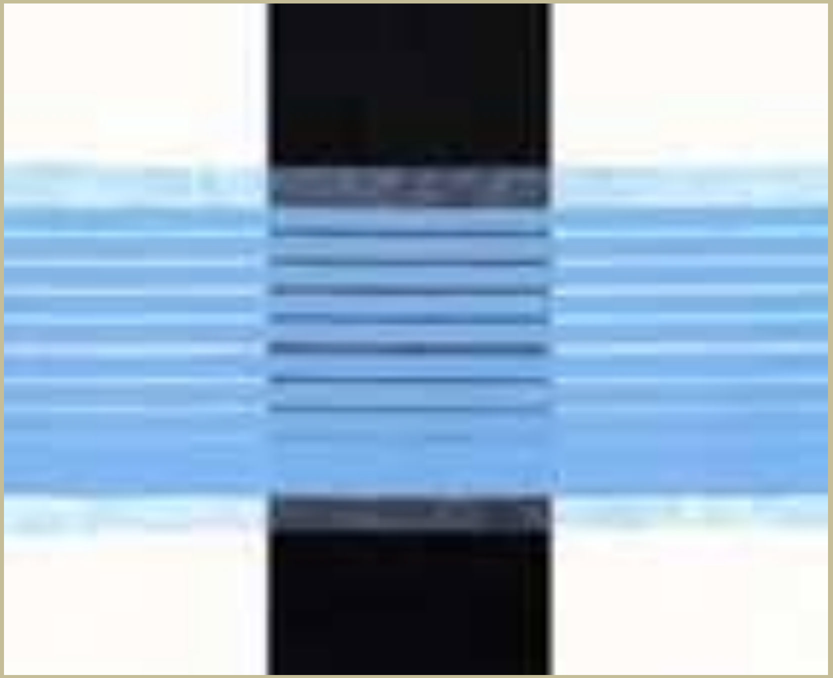
Rheofal 102 – Preactivated for high polarity systems

Rheofal 301 – Organo clay for w/b systems

- 1:1 replacement for existing organo clays; no change to formulation or procedures
- Paint properties remain the same; viscosity, dry time, sag resistance, gloss levels, gloss retention
- No need of activation solvents.
- Improved viscosity stability after mechanical shear

Rheofal 101

Control



Rheofal 101 @ 0.5% w/w 250µ

Rheofal 102

Control

Rheofal 102 @ 0.4% w/w
>600µ

Colloidal-clays

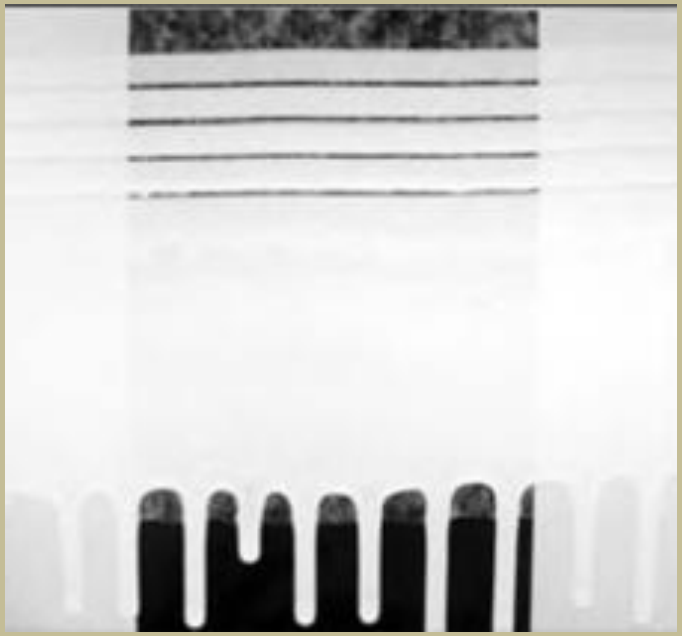
Falgel 60 - Colloidal clay for matt/semi-matt w/b paints

Falgel 90 - Colloidal clay for gloss w/b paints

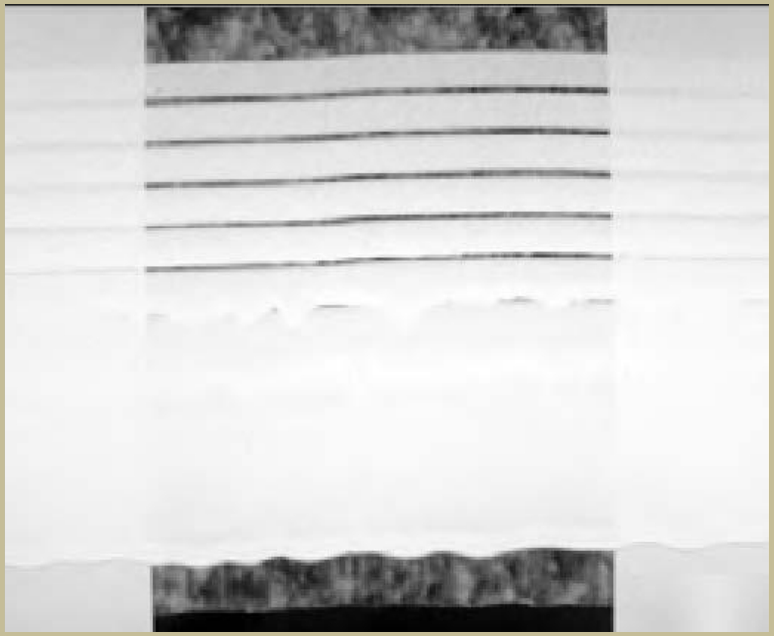
- Work best in conjunction with cellulosic thickeners
- Improved sag resistance
- Excellent syneresis control
- Effective anti-splatter characteristics for roller application
- Sag resistance even after dilution with water
- Cost effective

Falgel 60

Falgel 60



Control diluted 60% with water



0.5% Falgel 60 added then diluted 60% with water

Falamine Plus - pH Stabiliser

Proprietary alkanolamine blend

- 1:1 replacement for existing pH stabilisers e.g. amines, ammonia, NaOH and KOH
- Low odour
- Longer pH stability
- Improved scrub resistance vs ammonia/NaOH/KOH
- No effect on colour acceptance of the tinting system.
- Improved formaldehyde scavenging properties vs other amines (Formaldehyde free, low odour emulsions)
- High performance

Additives

LAF 121 - Silicone free anti-foam for s/b systems

LDA 100 - Pigment dispersant for organics and inorganics

LDA 154 - Pigment dispersant for organics and inorganics
Lower acid value than LDA 100

LDA 160 - Pigment dispersant for organics and inorganics, anti-settling agent

LDA 320 - Pigment stabiliser, anti-settling agent, colour developer

Customer Service & Support

Partner by-your-side approach by

- Joint technical exchange
  - Lehvoss, Lorama and customer
- Transition support
- Training of personnel (production/store)
- Trouble shooting
- Logistics support
- Regular business/planning reviews

LORAMA GROUP

Lorama & REACH

Our commitment to our environment is strong and we are pleased to announce that:

LPR76, InkRes33 and our similar polysaccharide resins are exempt from REACH regulation.

These polysaccharide resins are classified as Hydrolyzed starch, EINECS No. 232-436-4. This classification can be found in the exemption from the obligation to register list contained in Annex IV of REACH regulation (EC No 1907/2006). Therefore these substances do not need to be registered.

LORAMA GROUP

Thank you