

# Raw Materials for Paints and Lacquers

[www.worlee.de](http://www.worlee.de)

## Alkyd Resins - today and tomorrow

Pacific Northwest  
Society for Coatings  
Technology

January 14<sup>th</sup> - 18<sup>th</sup>, 2013

Dr.ir. Toine Biemans



## Current Status of Alkyd Resin Development

### Solventborne:

Traditional

Low VOC (High Solids)

Hybrids: blends  
chemical hybrids

### Waterborne:

Soluble

Externally emulsified

Internally emulsified

Hybrids: blends  
chemical hybrids

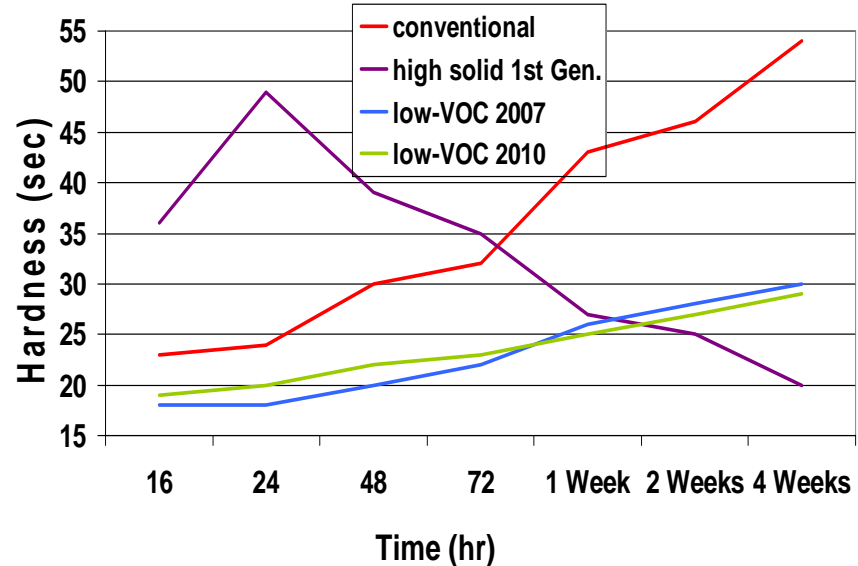
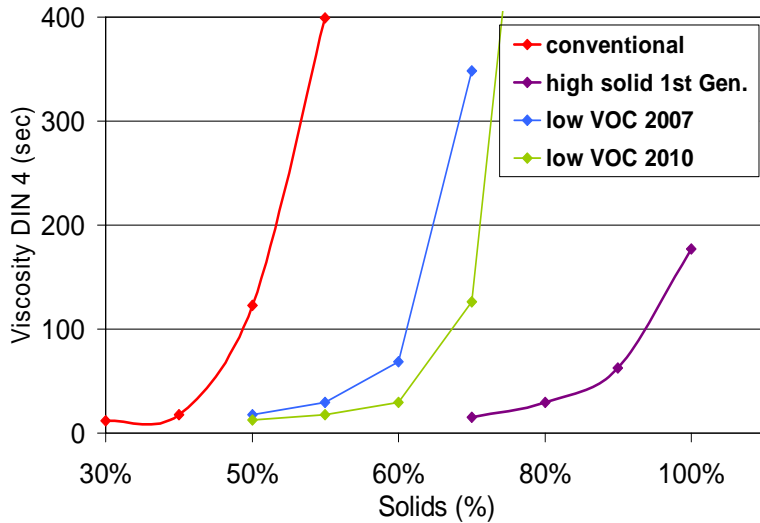


# Solventborne alkyds: Low VOC developments

**Initial goal for „low VOC“: less solvent, same viscosity**

Approaches:

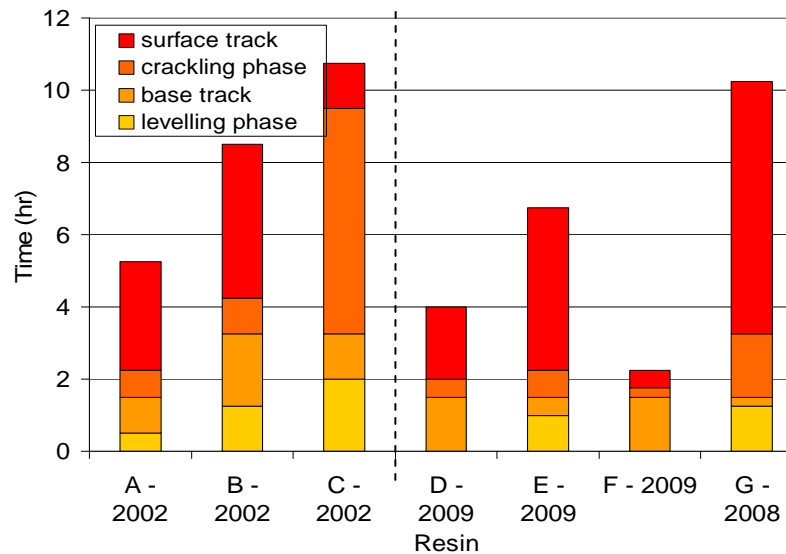
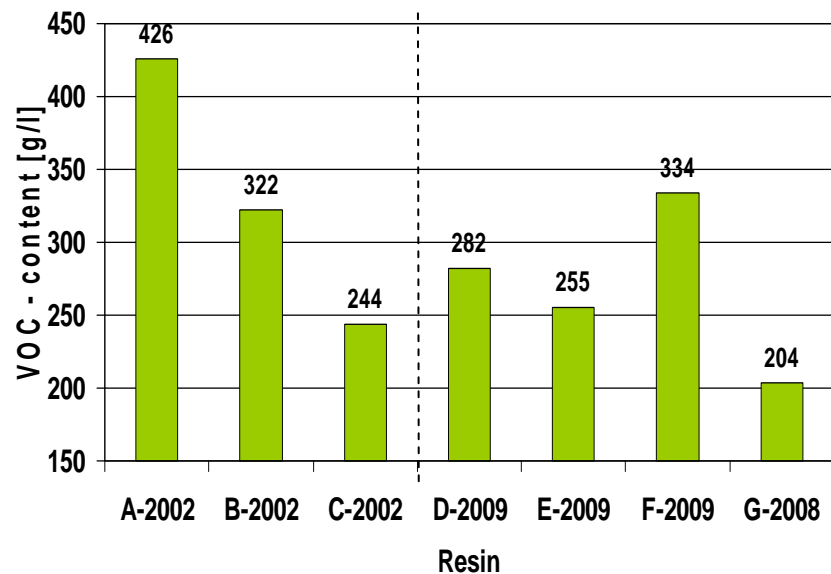
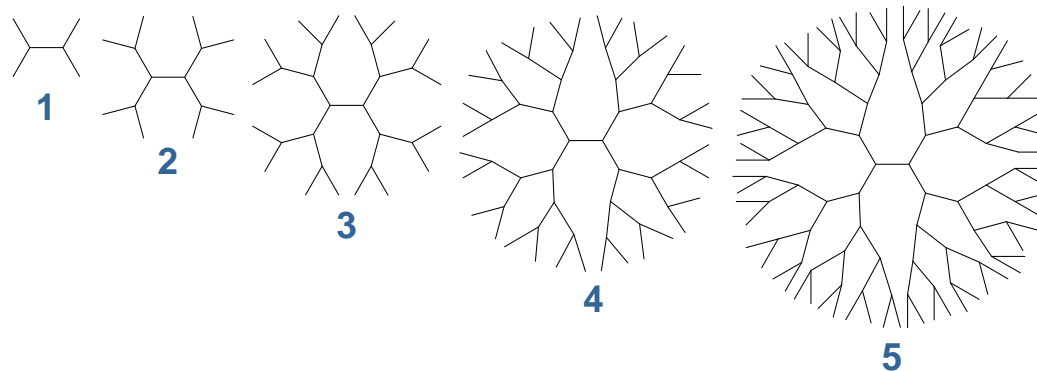
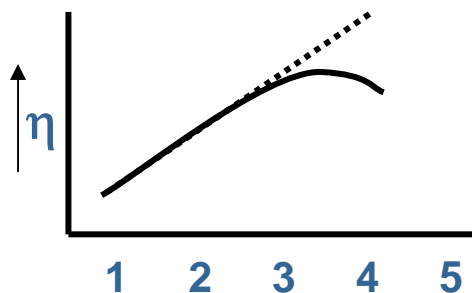
- 1) Solvents with better solubility power
- 2) Reactive diluents
- 3) Change molecular structure

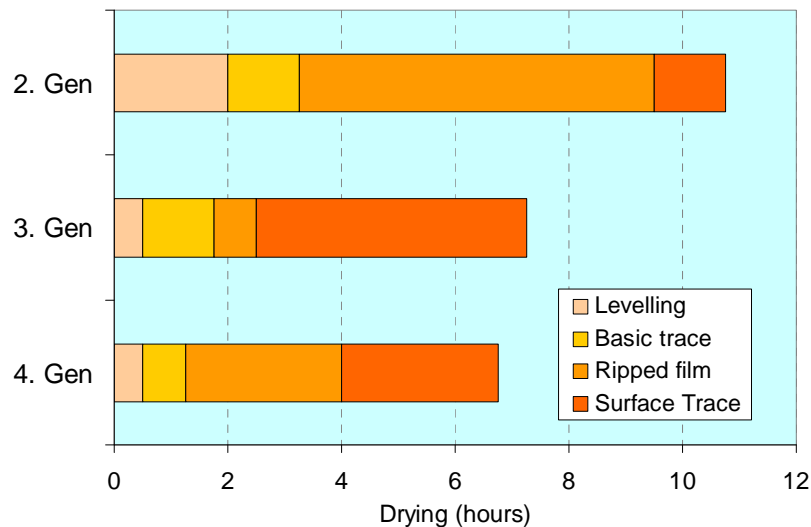
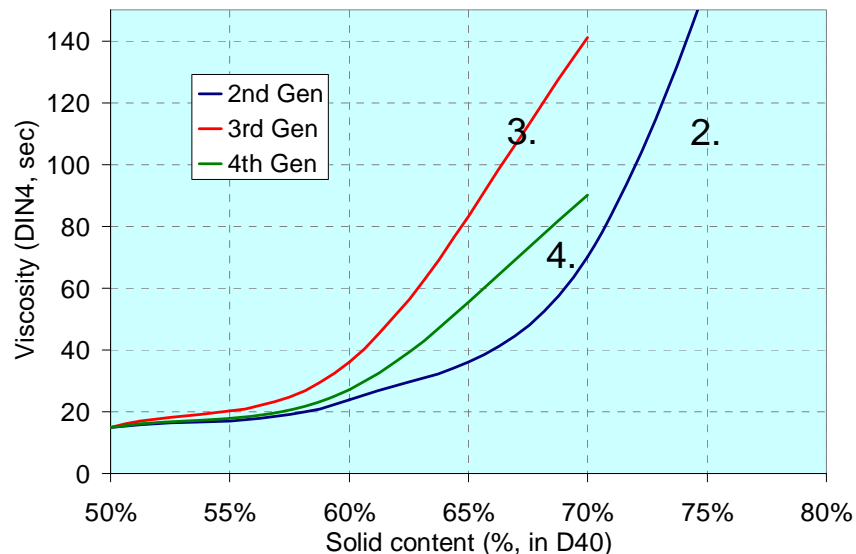


**Goal for „low VOC“: less solvent, same viscosity & similar properties**

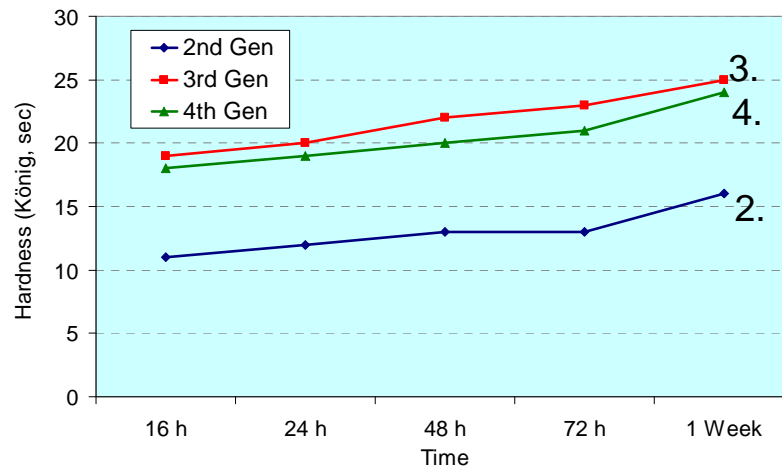
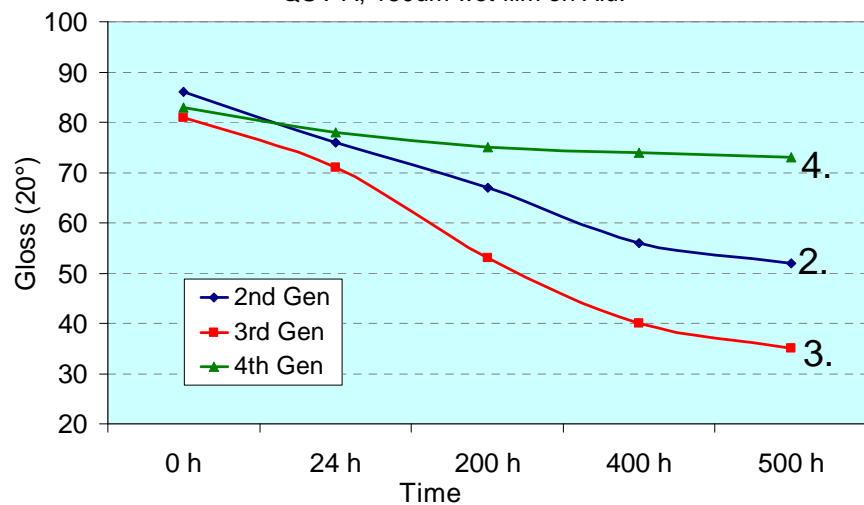


Ad. 3) *e.g.* a more spherical, compact structure could lead to a lower viscosity resin (at equal solid content) with similar drying times





QUV-A, 150um wet film on Alu.



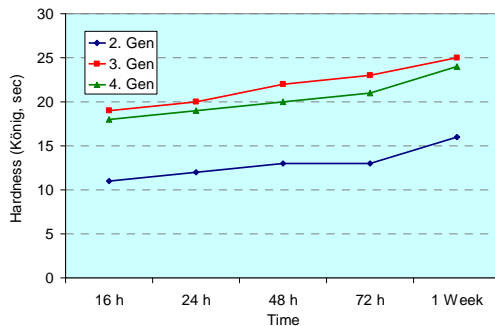
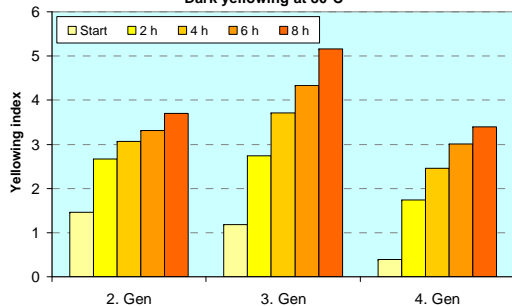
Standard white  
High Gloss systems



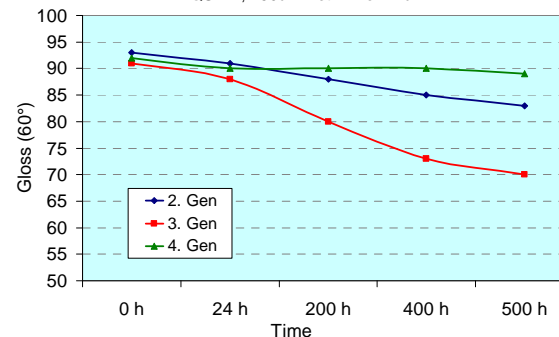
# Worlée 4<sup>th</sup> Generation low VOC Resins

- Good drying & hardness development
- Binder for:
  - Inside: yellowing resistance
  - Outside: outdoor weathering

Dark yellowing at 80°C



QUV-A, 150um wet film on Alu.



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          chemical hybrids

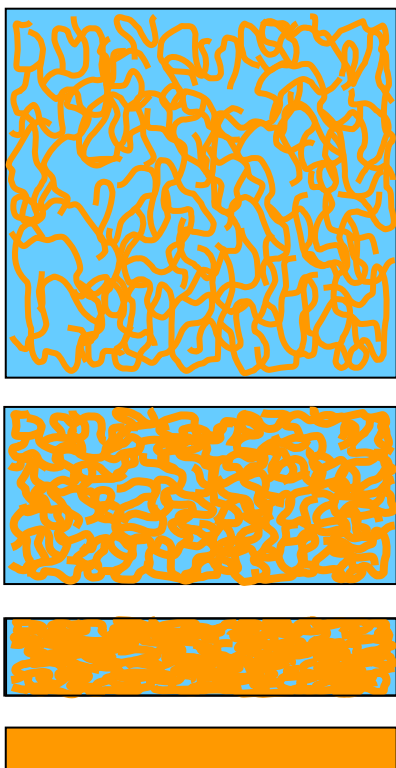
### Waterborne:

Soluble  
Externally emulsified  
Internally emulsified  
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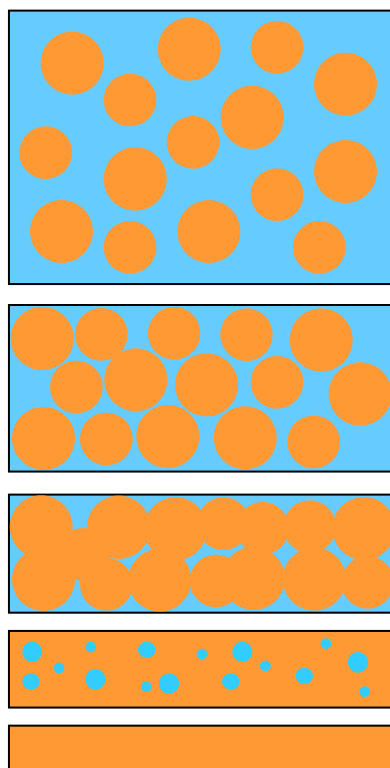


# Waterborne alkyds - Comparison

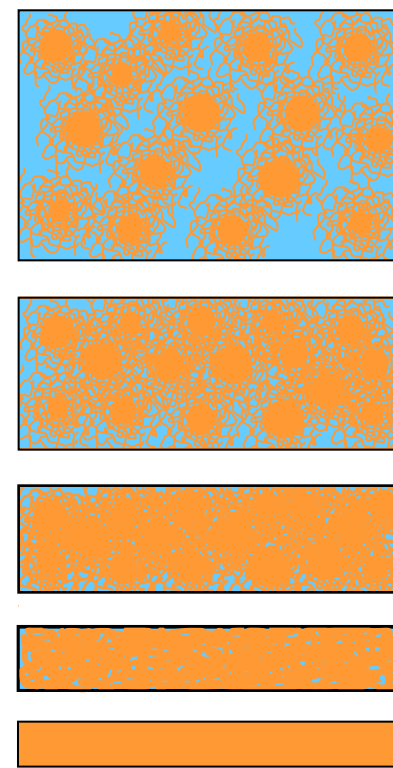
Soluble Alkyds



Externally Emulsified Alkyds



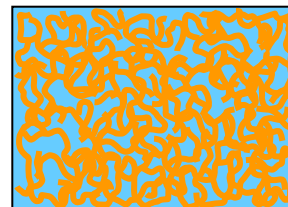
Internally Emulsified Alkyds





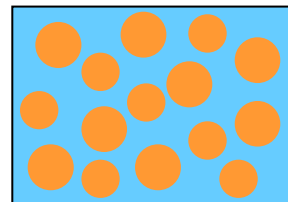
## Soluble alkyd resins

Relatively low molecular weight  
Acid value: 35-65 mg KOH/g resin  
Good for „open time“ & gloss



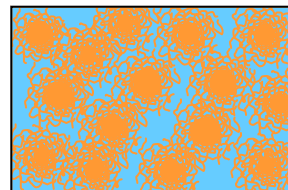
## Externally emulsified alkyd resins

Medium to high molecular weight  
External emulsifier  
High solid content  
Solvent free  
Good gloss



## Internally emulsified alkyd resins

(Very) high molecular weight  
Urethane modified  
Solvent free  
Shear stable



# Comparison of several waterborne technologies



Product group Properties	Acrylic Dispersion	Internally emulsified Alkyd Resin Emulsion	Externally emulsified Alkyd Resin Emulsion	Solvent based low VOC
Application (Alkyd-like)	+(+)	++(+)	++(+)	+++
Open time	+	+(+)	+(+)	+++
Drying	+++	+++	+	+
Through drying	+	+++	-	+
Gloss, flow	+(+)	++(+)	+++	+++
Dark yellowing	no	yes	yes	Yes
Adhesion	++	+++	+++	+++
Sandability	- -	+++	+	+++
Whiteness	+++	+(+)	+	-
Water resistance	+	+++	+	++
Weather resistance	++	+++	+++	+++
Insulating properties	- - -	+++	++	+++
Environment friendly	+++	+++	+++	+++
renewable content	-	++	+++	+
VOC-content (in g/L)	50 -100	< 50	< 50	< 350
	Drier & MEKO free	Drier & MEKO free	MEKO free	

## WorléeSol

**SE 420W**

Silicon

**E 530W**

Medium PU

**E 330W**

Primers / Anti-corrosion

**E 280W**

Low yellowing

**E 150W**

Universal

**E 927W**

High PU  
Parquet sealers

### New developments

**NW 410**

More film build

**NW 474**

Open time &  
wood coatings

**NW 521**

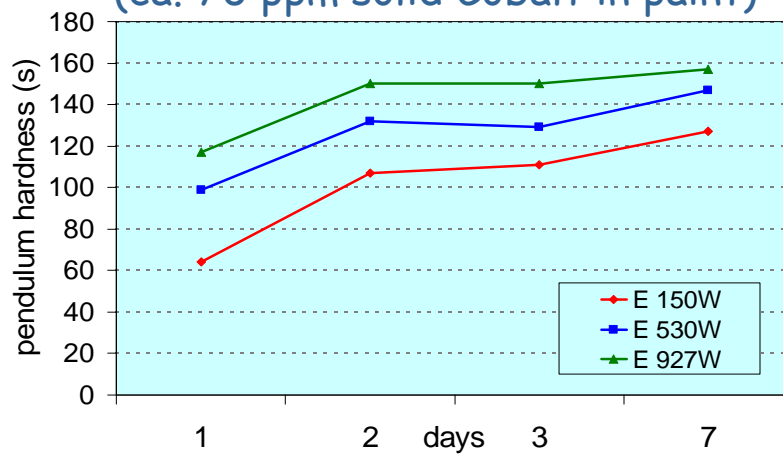
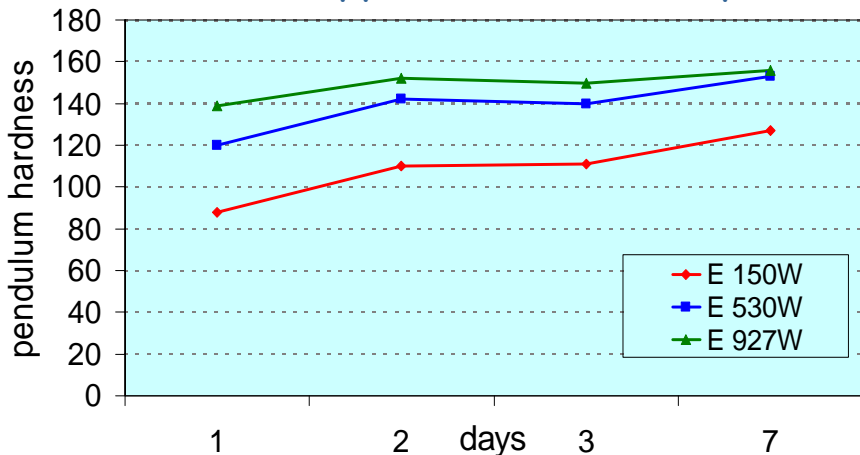
Cobalt free



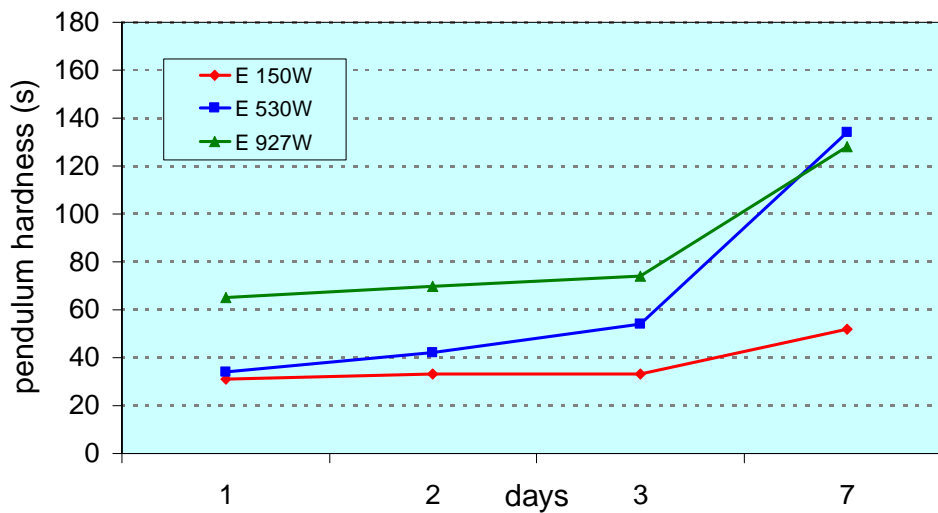
# Internally emulsified alkyd resins: hardness development

0,1% solid Cobalt on solid resin  
(ca. 240 ppm solid Cobalt in paint)

0,03% solid Cobalt on solid resin  
(ca. 70 ppm solid Cobalt in paint)



0% Cobalt



Pure binder

# WorléeSol E 150W

## Application possibilities

### Wood:

- Primers
- Pre-coatings
- Semi gloss
- High gloss
- Clear coats
- Stains

### Others:

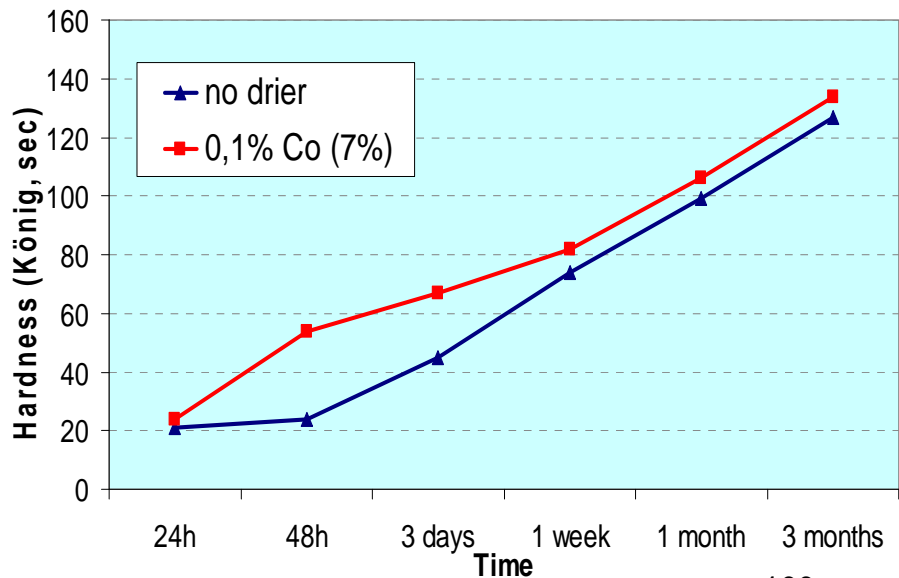
- Anti-corrosive primers
- Industrial topcoats
- Stoving enamels
- Insulating paints

## Property profile

- Low VOC
- Good drying performance  
(also under adverse conditions)
- Good brush application
- High gloss & good gloss stability
- Low dark yellowing
- Hardness development  
(also Co-free)
- Early water resistance
- Weathering resistance
- Insulating properties

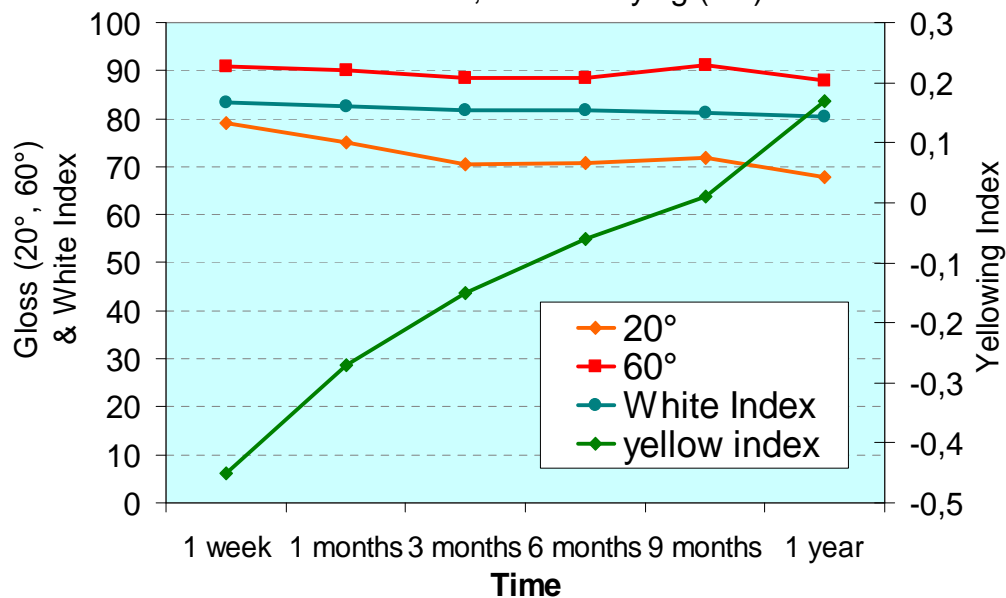


WorléeSol E 150W

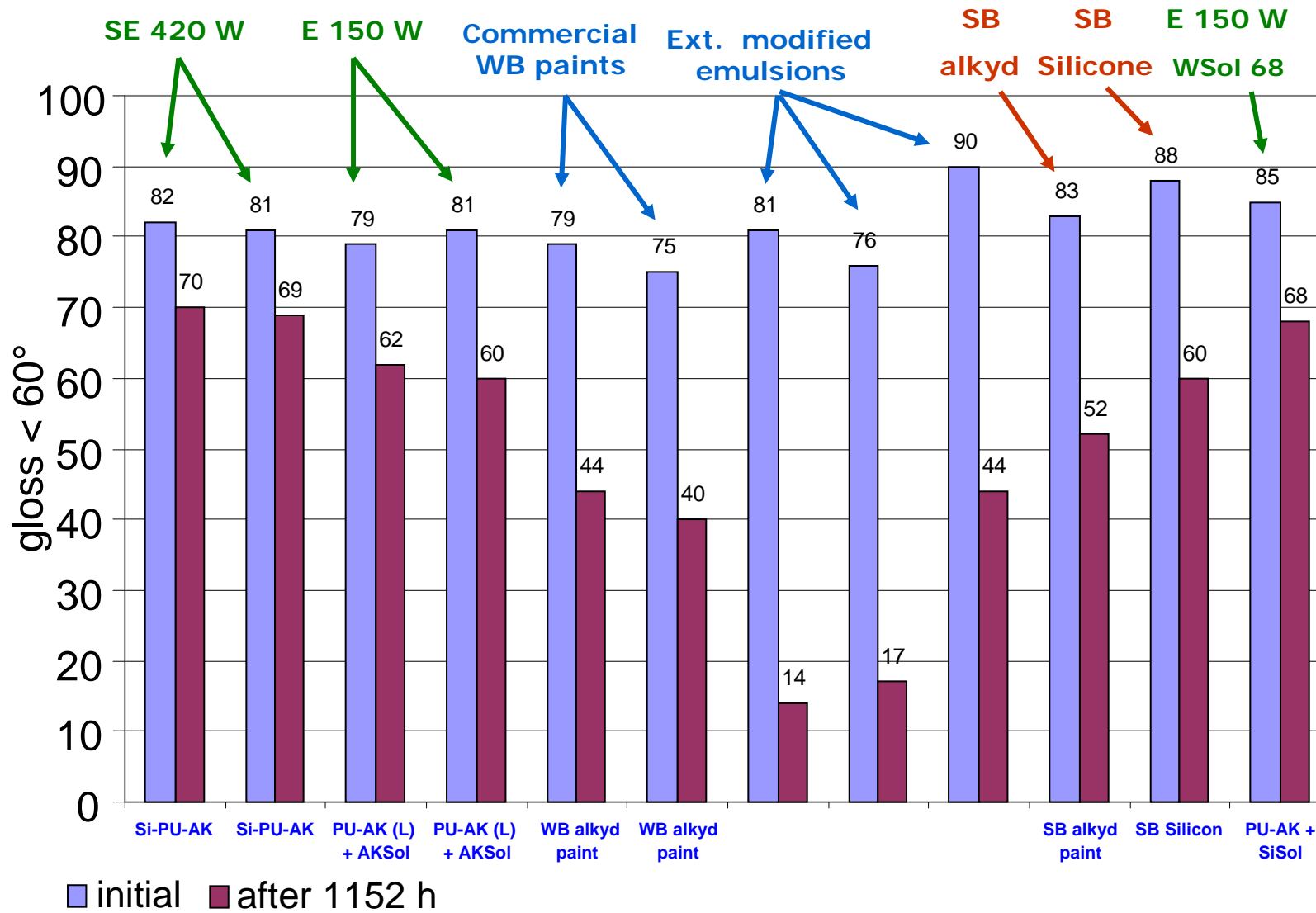


**Standard white**  
**High Gloss systems**  
**No drier**

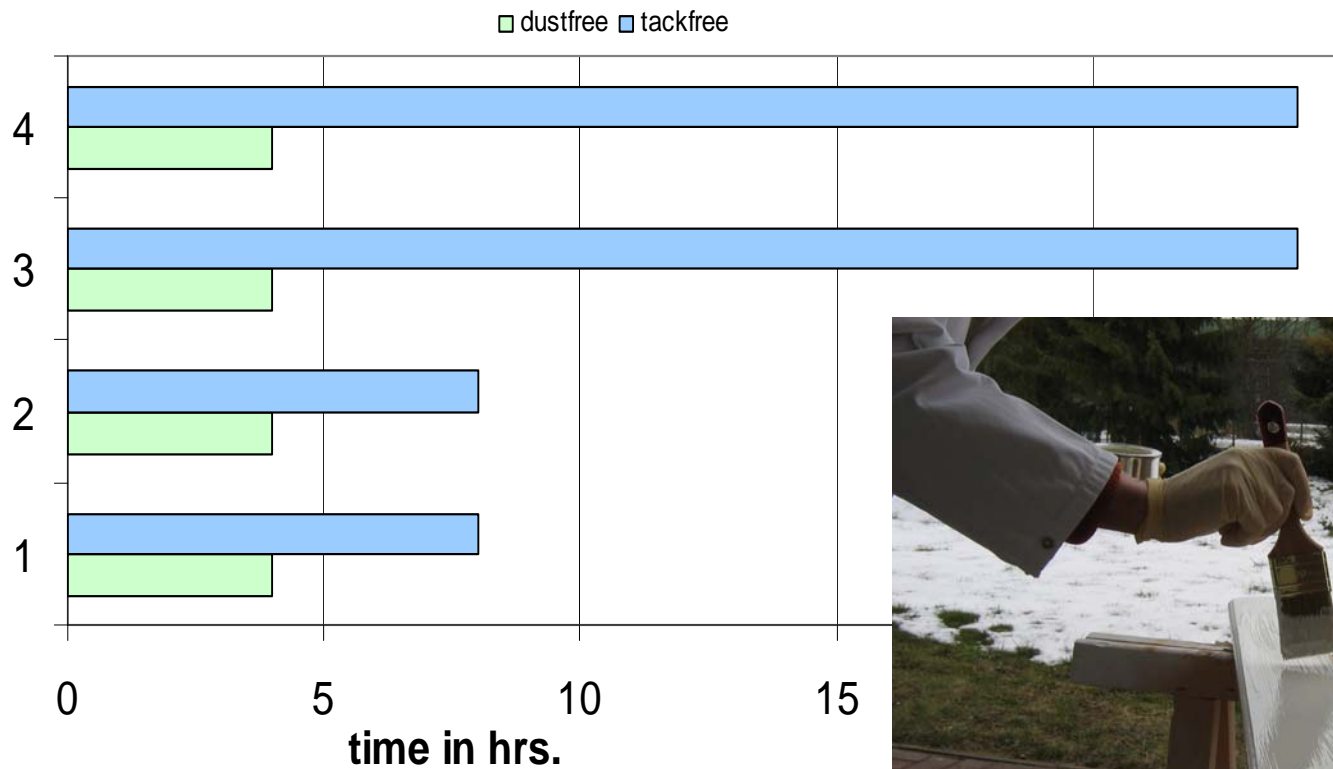
WorléeSol E 150W, no drier  
100um wet; 1 week drying (RT)



### QUV-A-test of decorative paints



## Drying under bad conditions 2°C (35°F) / 100% RH; sunny morning



- 1: WorléeSol E 150W based paint
- 2: Comm. paint WorléeSol E 150W based

- 3: Comm. paint ext. emulsified
- 4: Solvent based paint



## Important aspects of formulating with a Worlée E-type emulsion.

- **Neutralization is not necessary.** pH between 7,0 - 7,5.
- 3-5% Butyl glycol or Propylene glycol + EFKA 4550 in the grind to obtain the highest gloss - **WorléeSol emulsions are shear stable.**
- Pigments and extenders: careful with impurities e.g Blanc fixe micro.
- The mill base must have the right viscosity - this is very important! Too low viscosity will cause foam and reduce the dispersibility.
- Driers: suitable driers are Octa Soligen Co 7 aqua, Nuodex Drycoat
- Viscosity (too thin) can be adjusted by adding a PU-thickener.
- Additives: **anti-skinning agent is not necessary.** Defoamers: (only for dip-, brush-, and airless application) W'Add 626.
- Packaging: tins and drums have to be interior coated.
- Machineries and application equipment can be cleaned with water. Already set dry paint can be removed with solvents.



## Starting Point Formulation 3.6467-06

Water thinnable high gloss decorative paint, white  
Meets MPI #157

1	Water	8.10	
2	DSX 2000	1.00	Cognis
3	DSX 1514	0.30	Cognis
4	Byk 024	0.10	Byk
5	Disperbyk 190	1.25	Byk
6	Kronos 2190	24.00	Kronos
7	Water	2.90	
8	<b>WorléeSol E 150 W</b>	60.00	Worlée
9	OS Co 7 aqua	0.10	Borchers
10	<b>WorléeAdd 626</b>	0.50	Worlée
11	Propylene glycol	0.40	
12	Water	1.35	
		100.00	

Technical Data		
Viscosity, 20 °C		110 - 120 KU (adjust with max. 10.00 water if necessary)
pH-value		7.0 - 8.0
Density, 20 °C		approx. 1.24 g/cm <sup>3</sup>
VOC-content	excl. water	approx. 50 g/l
	incl. water	approx. 20 g/l
100µm on glass		
Dust free		approx. 15 min
Tack free		approx. 2 h
Gloss < 60°		approx. 90 GU

Add 1 - 6 in listed order while stirring and disperse at high speed for approx. 20 min, Add 7 for rinsing, 8 - 12 letdown, add while stirring



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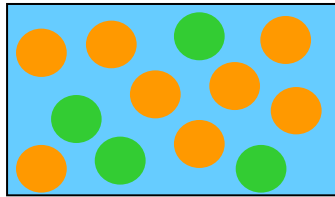
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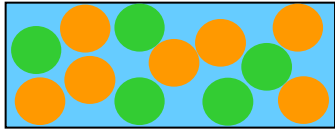
# Hybrids

Blends: „cold“ mixing of alkyd emulsion and acrylic dispersion

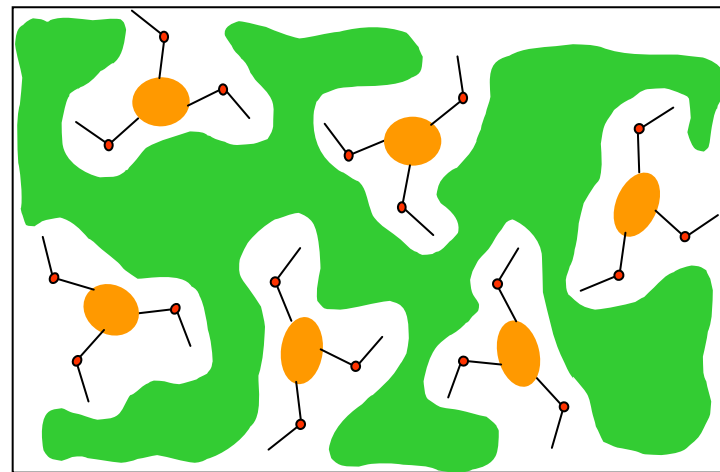
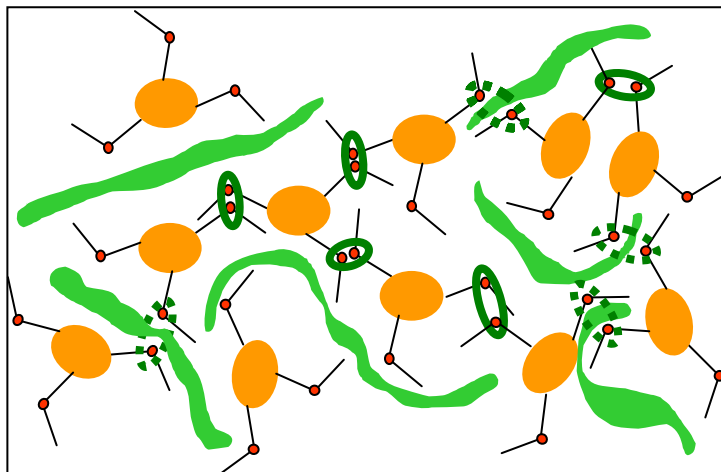
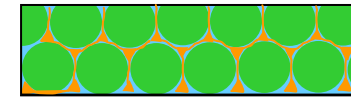
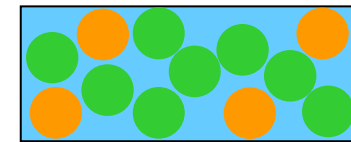
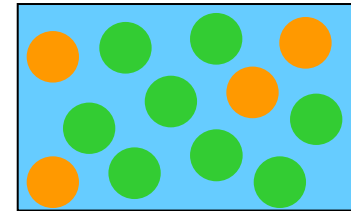
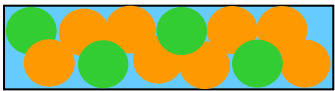


● : Soft (e.g. Alkyd)

● : Hard (e.g. Acrylate)



The presence of acrylic dispersion droplets prevents some oxidative drying of the alkyd because of steric hindrance



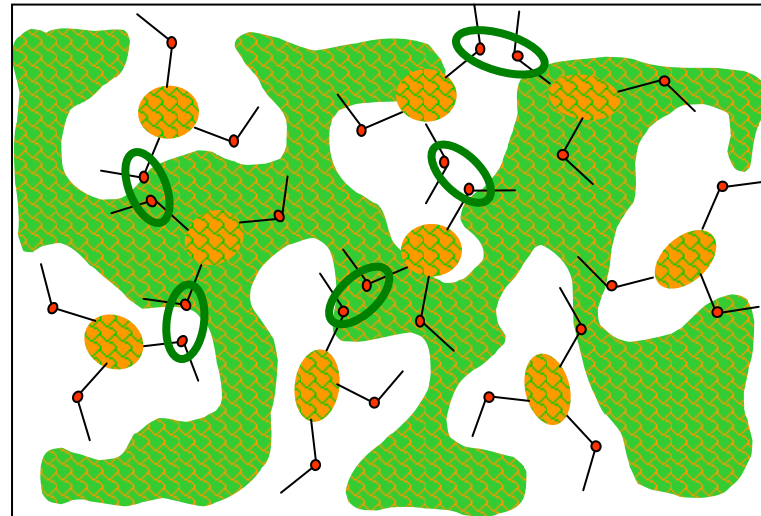
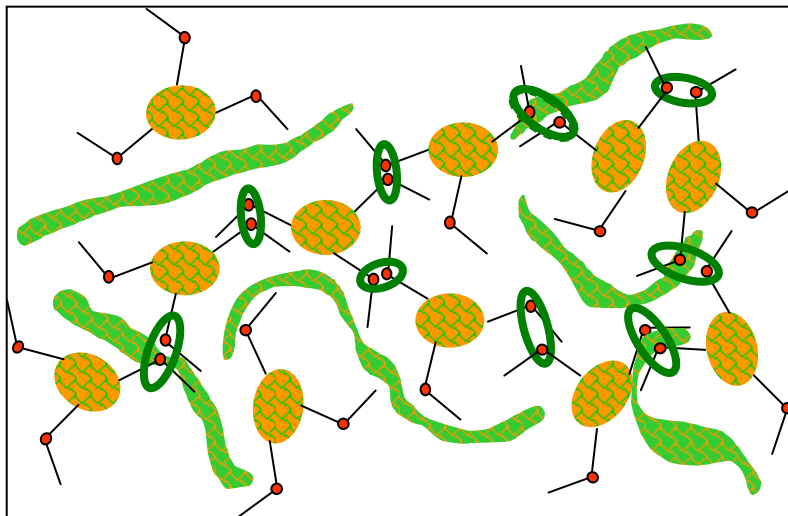
# Hybrids

Increase compatibility: mixing of alkyd and acrylate on a molecular level

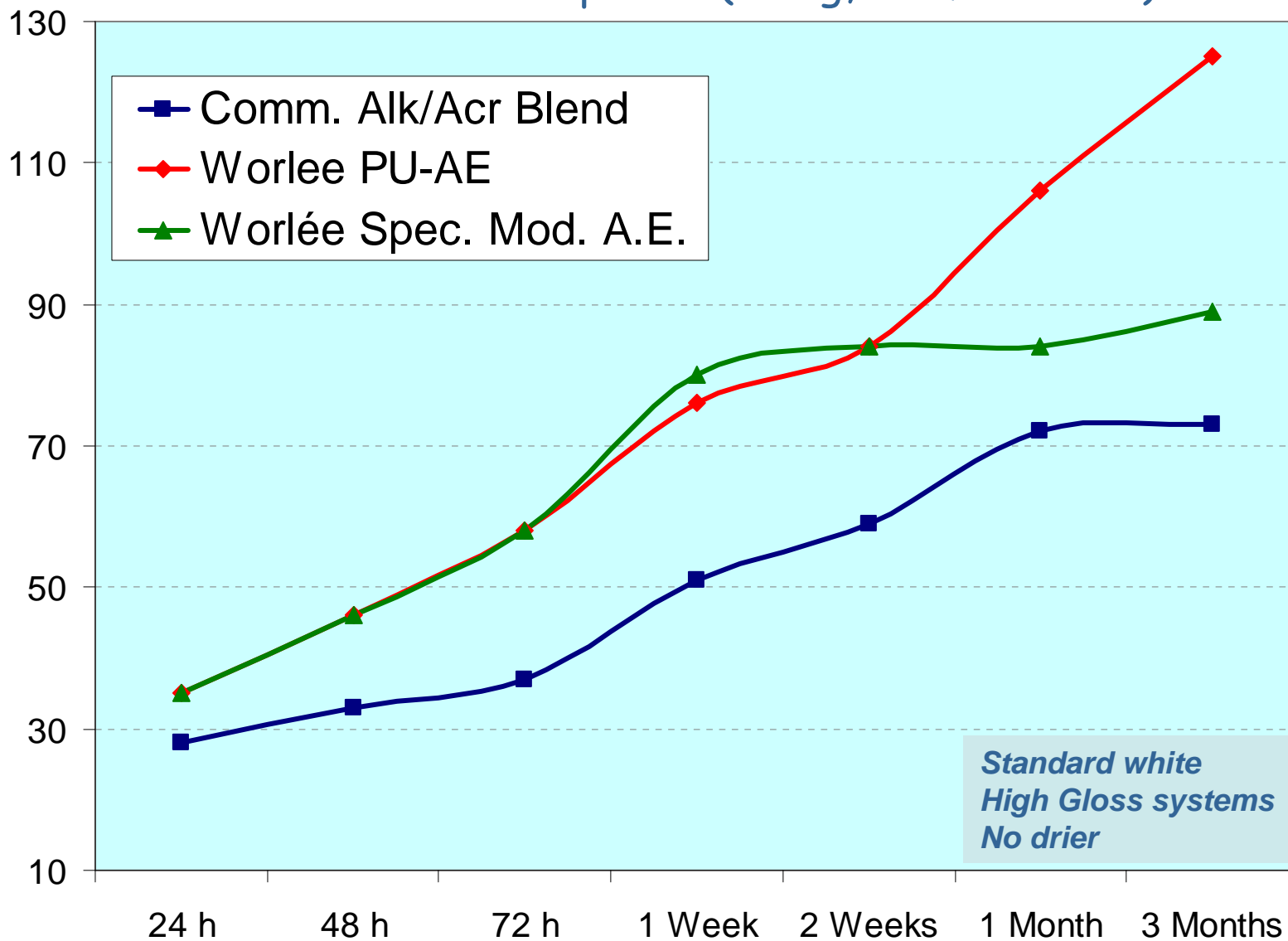
Making an alkyd and acrylate more compatible or tuning the individual alkyd and acrylate structure towards compatibility

Ideally: The alkyd and acrylate part are chemically or covalently bonded

- Allowing more double bonds to come in closer contact (better drying).
- More film homogeneity and better film formation (increased gloss / reduced haze).

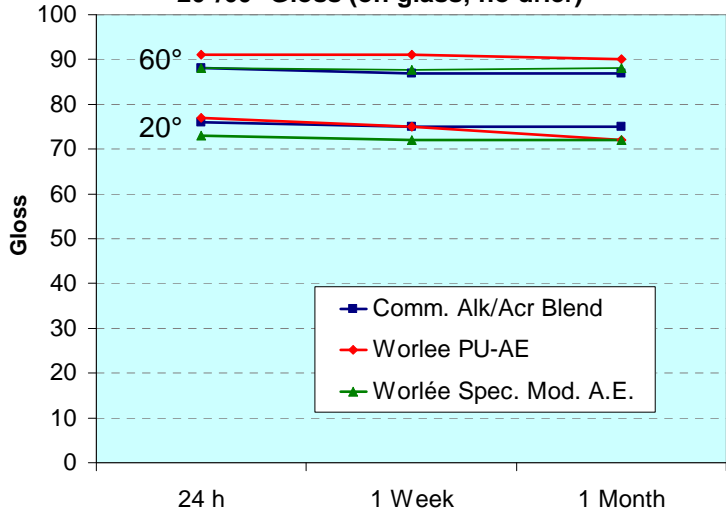


## Hardness development (König, sec.: no drier)

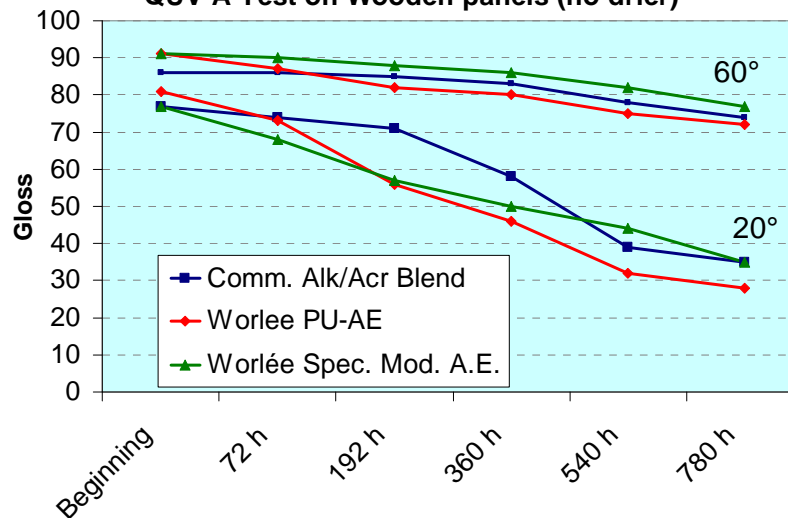




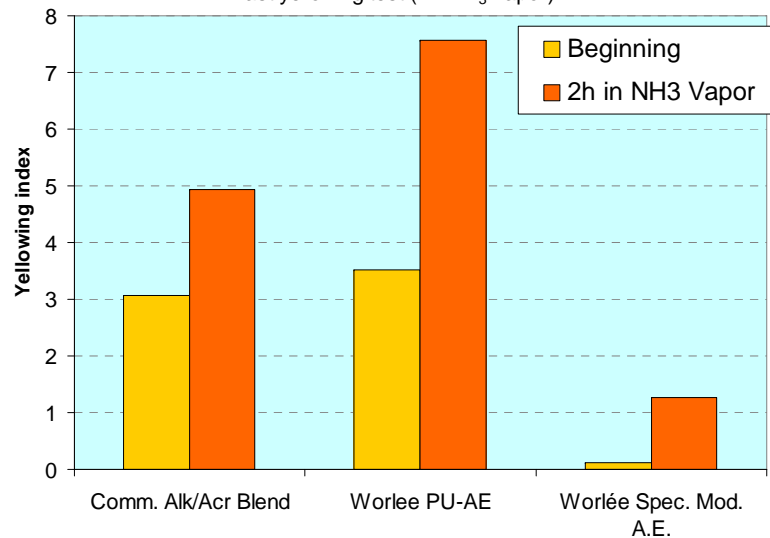
20°/60° Gloss (on glass; no drier)



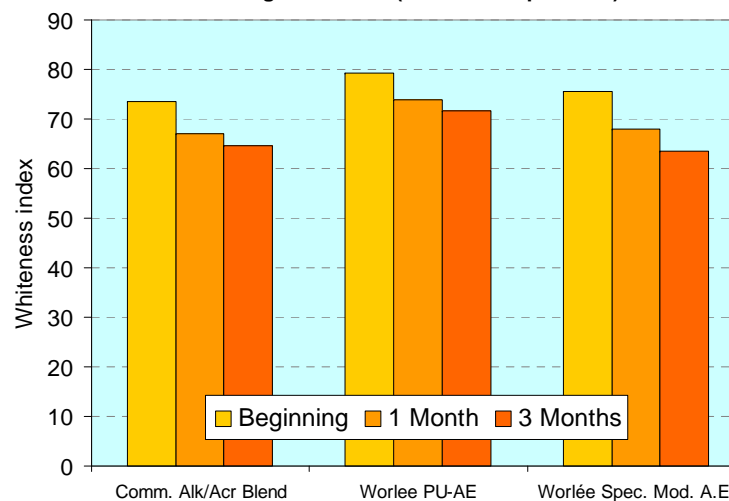
QUV-A-Test on Wooden panels (no drier)



Fast yellowing test (2h NH<sub>3</sub>-vapor)



Yellowing in the dark (ambient temperature)

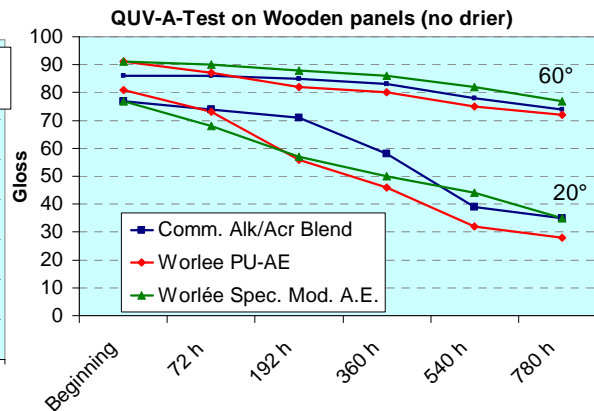
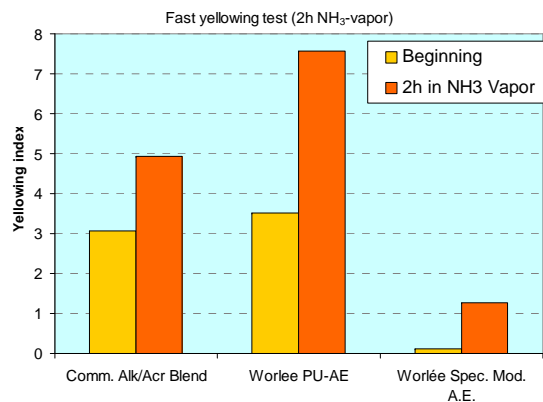
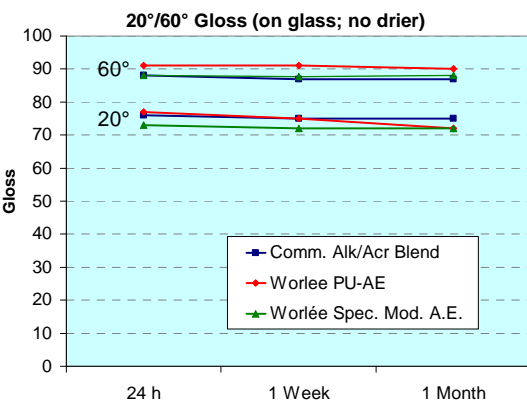


**Standard white  
High Gloss systems  
No drier**

# Worlée Spec. Mod. Alkyd Emulsion

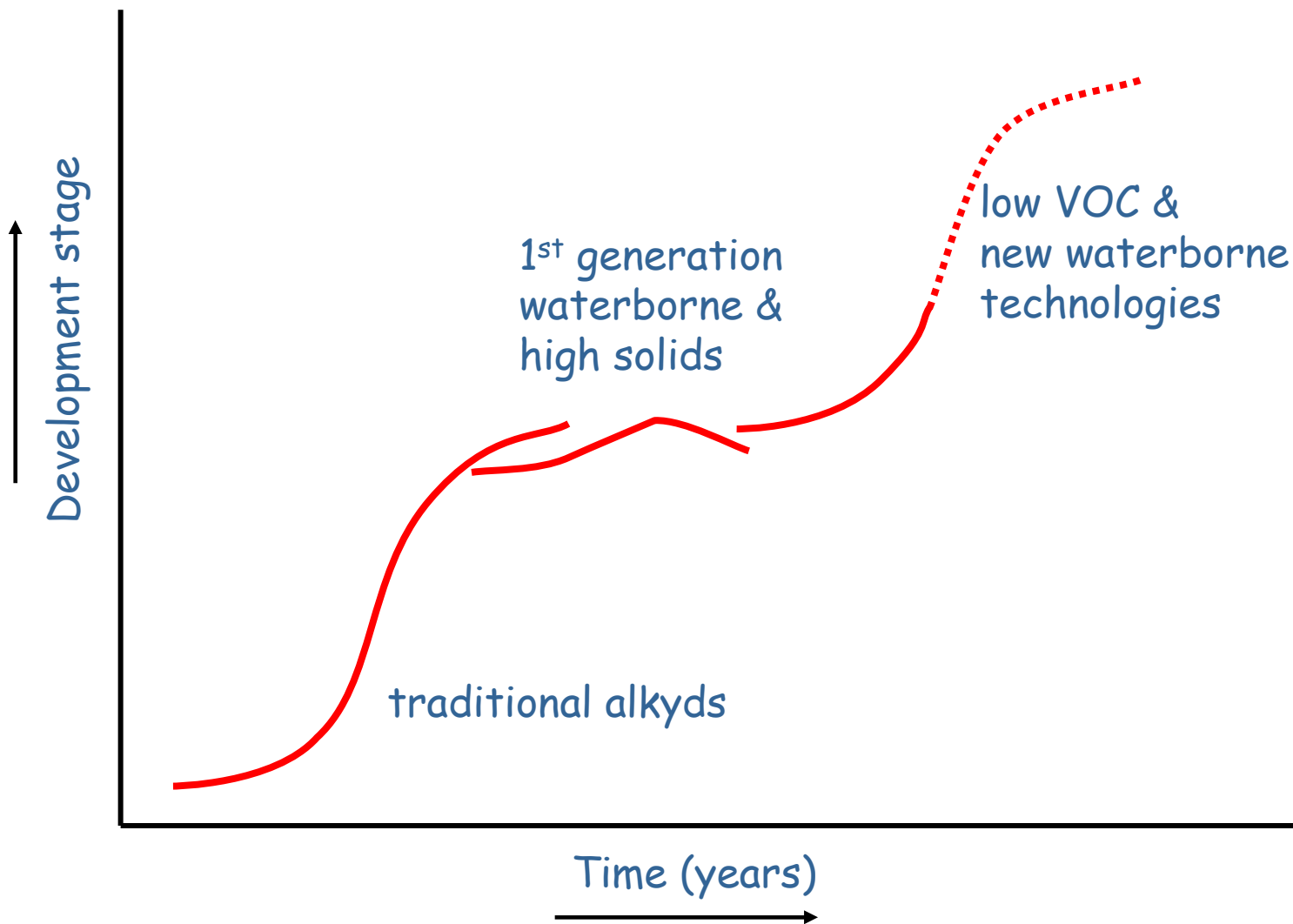
Binder for:

- Cobalt free formulation
- Inside: odour/smell, yellowing resistance
- Outside: outdoor weathering

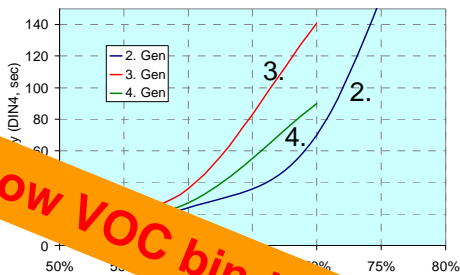




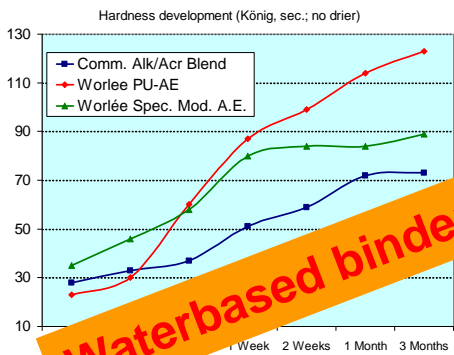
# Summary of alkyd resin development



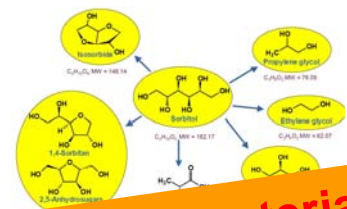
# Worlée for your alkyds of today and tomorrow



**Low VOC binders**



**Waterbased binders**



**New raw materials**



**Renewable materials**



**New chemistry & technology**



## Acknowledgement

### The Tryline Group

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