

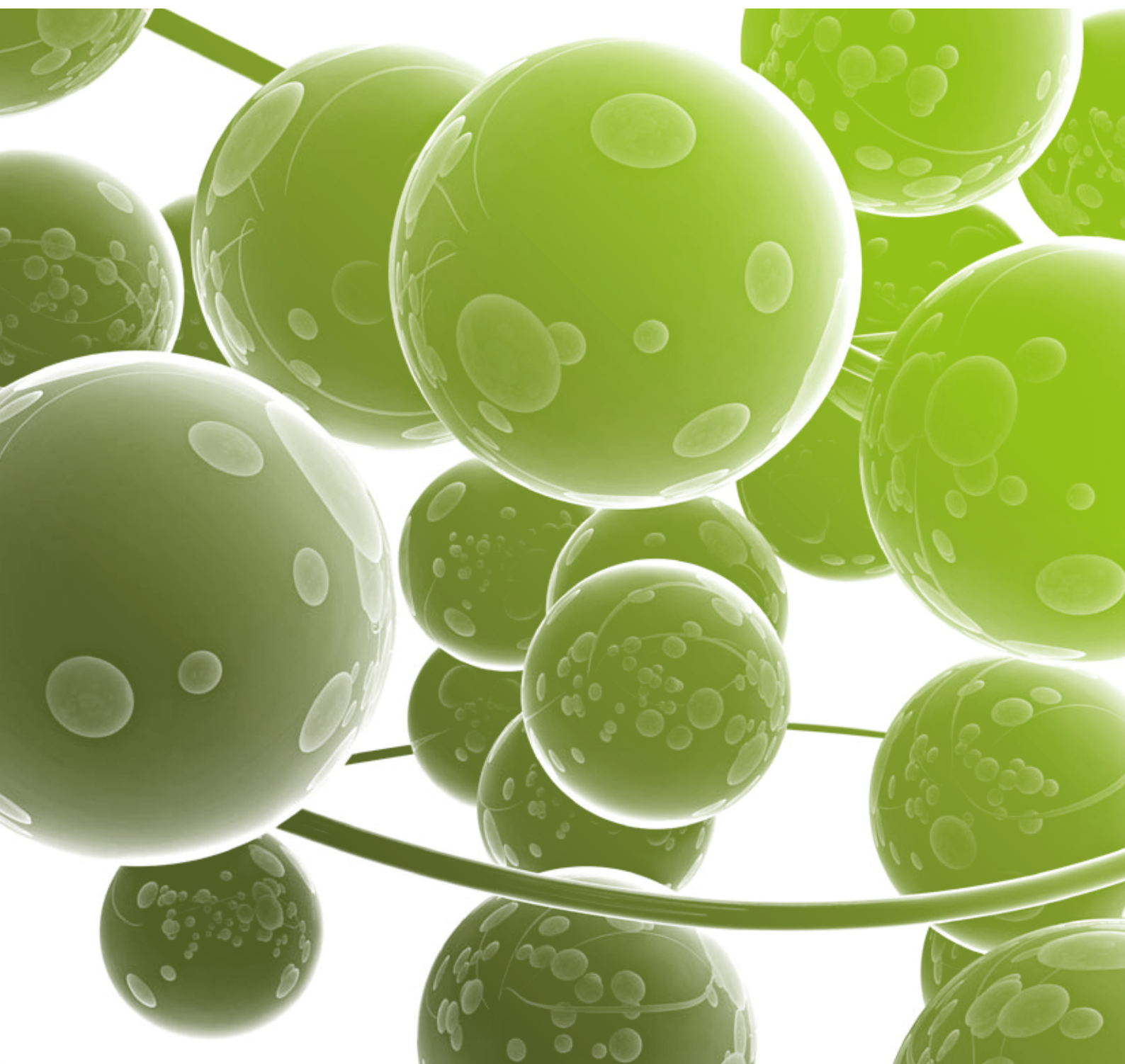
# Bindzil CC in waterborne coating applications

Silane modified colloidal silica – uses and benefits



**AkzoNobel**

Tomorrow's Answers Today



# Product overview

Bindzil CC colloidal silica water dispersions enhance a number of important properties in pigmented and clear coatings, thus providing strategic product benefits for you as a manufacturer. Bindzil CC products are unique water-based epoxy silane modified colloidal silica dispersions. Bindzil CC products are stable and compatible in most waterborne coatings.

## Application recommendations

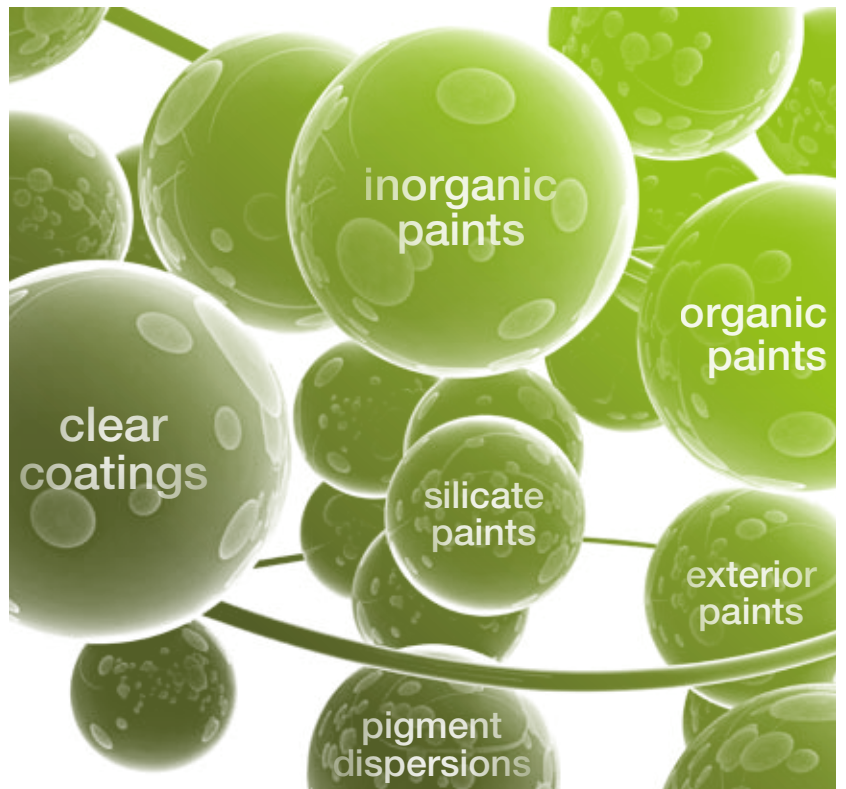
- Clear coatings
- Pigment dispersions
- Silicate paints
- Pigmented coatings

Bindzil CC301, Bindzil CC302 and Bindzil CC401 are specially developed and designed for use in waterborne 2-pack and UV-curable coatings. Bindzil CC products offer good stability and binding properties in most 2-pack and UV-curable coatings and enhance mechanical properties, adhesion and anti-blocking with no change in gloss or haze.

The Bindzil CC151 HS is specifically designed for use as a dispersant for inorganic pigments such as titania when a surfactant-free pigment paste is desirable.

Bindzil CC301 is designed for use in silicate paints to reduce dirt pick-up and to improve the water resistance (hence weather resistance).

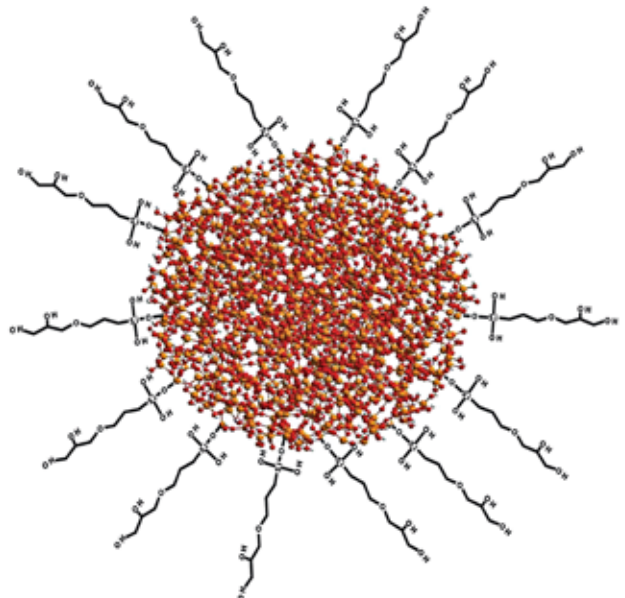
Bindzil PC300 can be used to enhance antisoil properties/ reduce the dirt pick-up in waterborne deco paints.



## Available Bindzil CC products

**Non-aggregated particles with many surface groups for interaction with resin**

- 
- Bindzil CC151 HS: TS: 15%, Dp: 5 nm
- 
- Bindzil CC301: TS: 30%, Dp: 7 nm
- 
- Bindzil CC302: TS: 30%, Dp: 7 nm
- 
- Bindzil CC401: TS: 40%, Dp: 12 nm
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- Bindzil PC300: TS: 30%, Dp: 7 nm
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Bindzil CC301, model structure

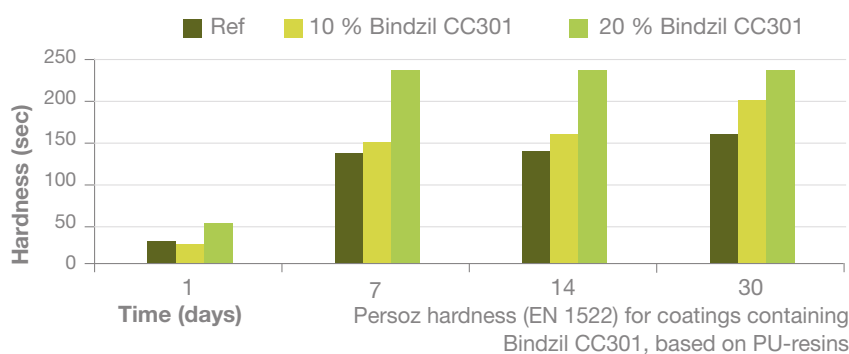
# Clear coatings

## Benefits of Bindzil CC Colloidal Silica in waterborne 2-pack and UV-curable lacquers

The enhancement of mechanical properties when Bindzil CC products is incorporated into the coating is due to the formation of a silica network/structure in a resin matrix which can act as a reinforcing skeleton in such a matrix. Furthermore, the strong interaction between the many surface groups on the silica particles and substrate surfaces improves properties such as adhesion. Finally, since Bindzil CC products can be described as small and very hard glass-like particles, enhancement of anti-blocking properties is also possible.

### Improved mechanical properties

Persoz Hardness. Resin: PU dispersion, TS: 35 %, pH 8, 2-k system



### Formulation proposal FP 9150, based on Alberdingk® U 9150

Pos.	Raw material	Amount	Product	Supplier
1	Alberdingk® U 9150	80.40	Polyurethane dispersion	Alberdingk Boley
2	Bindzil CC301	13.50	modified silica	EKA Akzo
3	Dowanol DPM	9.50	co-solvent	Dow Chemical
4	Water (deion.)	9.40		
5	Tego Foamex 845	0.60	defoamer	Evonik Tego Chemie
6	Tego Airex 904W	0.40	defoamer	Evonik Tego Chemie
7	Ceraflour 920	1.00	matting agent	BYK Cera
8	Acematt TS 100	0.50	matting agent	Evonik
9	Ultralube 816 D	1.00	wax dispersion	Keim Additec
10	Byk 346	0.30	substrate wetting agent	BYK Chemie
11	Rheolate 212	0.50	reheology modifier	Elementis
<b>TOTAL</b>		<b>117.10</b>		(Premix Pos. 3+4 before use)

### Improved scratch resistance



Reference



Ref. +10% Bindzil CC301

Systems	Scratch resistance (g)
<b>Reference</b>	
PU1	1600
PU2	1700
PU3	1700
<b>10 % Bindzil CC301</b>	
PU31	2000(*)
PU11	1900
PU21	2000(*)

(\*) Maximum load has been applied on the needle without cutting through the coating films

### Typical properties formulation FP 9150

Pendulum hardness after 7d RT:

ca. 80s (according to Koenig)

Abrasion resistance: ca.: 10mg

Chemical resistance:

Ethanol: 5 (1h)

Ammonia: 4-5 (1h)

Fatty acid: 4-5/4 (1h/16h)

Water: 5 (16h)

Red wine: 4 (16h)

Coffe: 3 (16h)

5 = best / 0 = worst

**2K clear lacquer based on formulation FP 9150**

Add 10% Bayhydur 305 (65% in Proglide DMM)

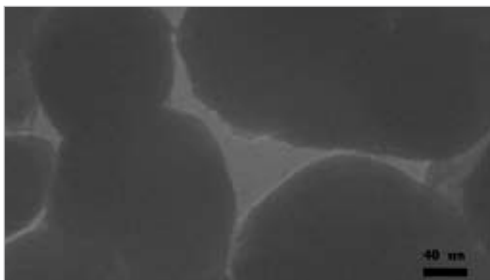
# Pigment dispersions

## Benefits of Bindzil CC as dispersant of inorganic pigments

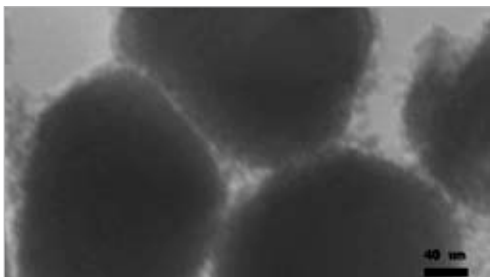
- Surfactant-free pigment paste
- Improved chemical resistance in coatings
- Easy to use and not shear-sensitive
- Additional benefit in paint: reduced dirt pick-up

### How it works

The small size of colloidal silica particles allows for it to be used as a dispersant in some applications. The particles adsorb, or accumulate, onto the surface of the suspended material to be dispersed and act as a physical spacer to help keep the dispersed material separated. This is particularly useful to formulate highly concentrated, long-term stable, surfactant-free dispersions of pigments.



Titania pigment dispersed by Dispex N-40

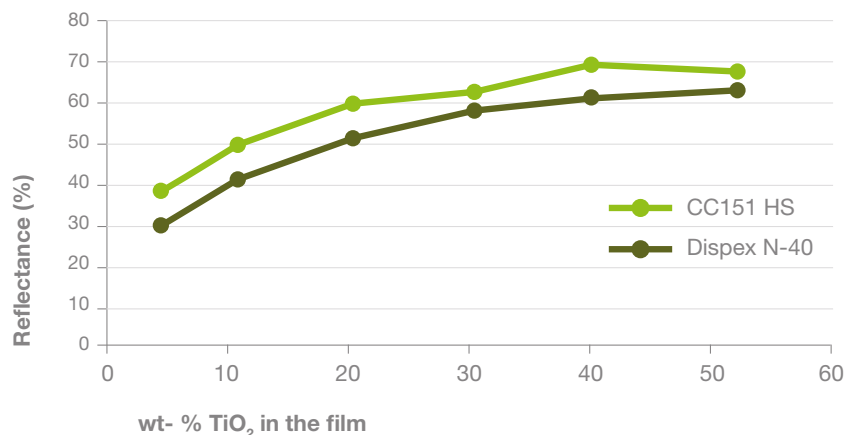


Titania pigment dispersed by Bindzil CC151 HS



### Improved pigment efficiency

Reflectance versus wt- % TiO<sub>2</sub> in an Acrylic Coating



# Silicate paints

## Benefits of Bindzil CC in silicate paint

- **Stable 1-pack compositions are possible**
- **Low alkali content:**  
pH typically about 11.2
- **Good water resistance (depending on molar ratio)**
- **Good dirt pick-up resistance**

### How it works

Colloidal silica is used in inorganic paint like silicate paint and can easily be formulated with potassium silicate as the main binder. In silicate paints, colloidal silica reduces the alkalinity and water absorption and improves the anti-soiling properties. It also helps reduce internal stress by reducing the shrinkage in the coating. Surfaces that can benefit from these coatings include all forms of natural stone and masonry.



### Improved dirt pick-up resistance (DPU)

The silica particles in colloidal silica dispersions have fully hydroxylated surfaces (many surface hydroxyl-silanol groups) and are very hydrophilic. When such materials are deposited onto or incorporated into a surface, the result is that it inherits the hydrophilic nature and thus making it harder for the dirt to adhere to the surface. An additional benefit is that the surface is easily maintained by either rainfall or simple cleaning as the dirt rinses away from the surface.



System 1 (ref.)      System 2      System 3      System 4

### Improved water resistance

System: Silicate paint 20 parts silicate binder of 100 parts paint formulation	Absorbed water volume (ml) after 6 hours
System 1 (reference – potassium silicate)	> 20
System 2 (2 parts CC301 + 1 part silicate)	2.6 ± 1.08
System 3 (1 part CC301 + 1 part silicate)	2.7 ± 1.40
System 4 (1 part CC301 + 2 parts silicate)	2.7 ± 0.97

Systems	Y initial	Y final	r = Yfinal/Yinitial
System 1 (ref.)	77.32	30.19	0.39
System 2	85.55	81.22	0.95
System 3	84.00	44.58	0.53
System 4	82.33	47.91	0.58

The DPU has been estimated by applying an aqueous slurry of carbon black

# Pigmented coatings acrylic paints

## Benefits of Bindzil CC in acrylic paints

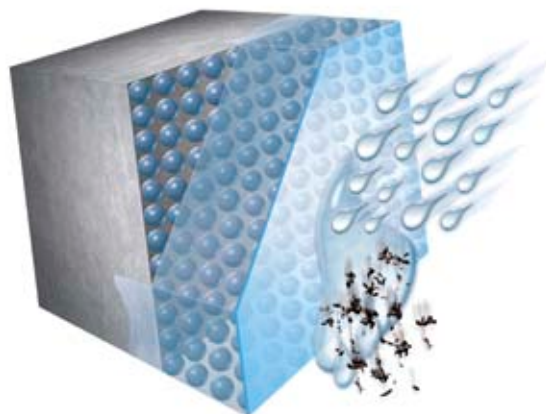
- Dirt pick-up resistance
- Increased hiding power

### Reduced dirt pick-up, acrylic paints with Bindzil CC301

Bindzil CC301 post-added



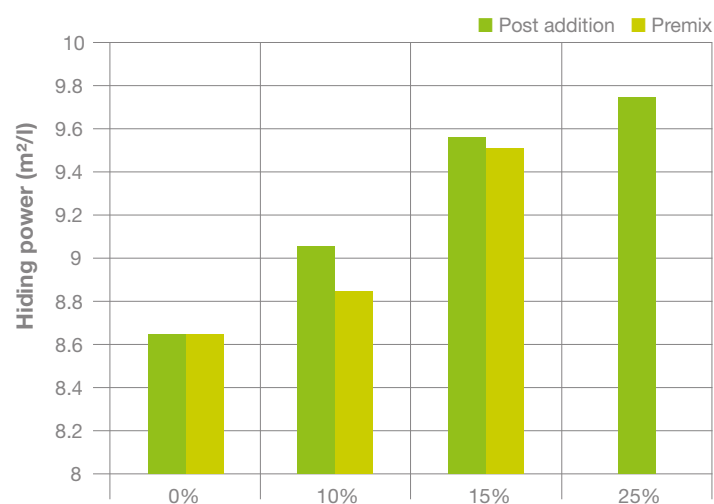
### Adhesion and reduced dirt pick-up



The colloidal silica particles are enriched at the interfaces enhancing adhesion and anti-soil properties. The surface of the coating is made hydrophilic, on which water will form a film and dirt will run off with the water. In addition the coating will maintain its appearance hence reducing the need for manual cleaning or recoating.

### Hiding power, acrylic paint with Bindzil CC301

Bindzil CC301 added



### Exterior wall paint formulation with different amount of Bindzil CC301

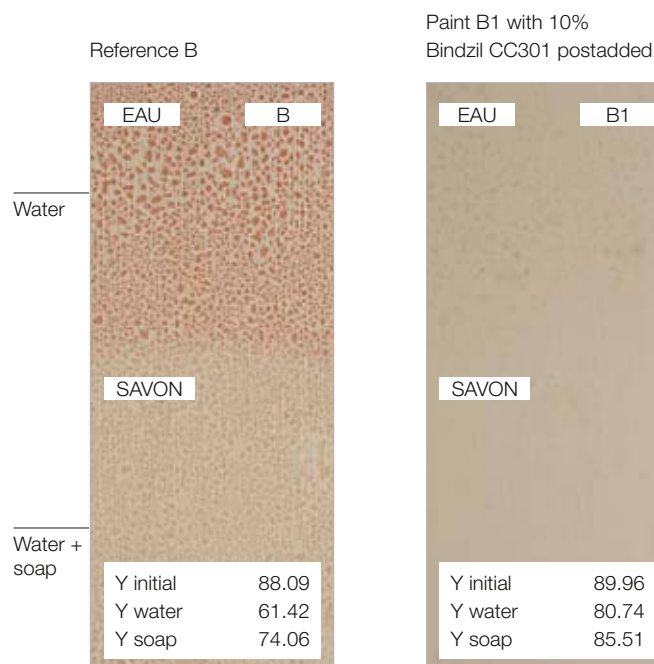
FP 2019/1	Wall paint, matt	Reference	+10%	+15%	+25%
	Product	Amount (g)	Amount (g)	Amount (g)	Amount (g)
1	Water	9.25	8.33	7.86	6.94
2	Orotan 731	1.30	1.17	1.11	0.98
3	Tego Foamex 810	0.10	0.09	0.09	0.08
4	Aquaflow NLS-205	0.40	0.36	0.34	0.30
5	Kronos 2190	23.00	20.70	19.55	17.25
6	Hydrocarb OG	5.60	5.04	4.76	4.20
7	Sillitit Z 89	3.40	3.06	2.89	2.55
8	Teago Airex 902 W	0.10	0.09	0.09	0.08
<b>Total</b>		<b>43.15</b>	<b>38.84</b>	<b>36.68</b>	<b>32.36</b>
9	Water	15.50	9.00	6.20	0.00
10	Dowanol DPnP	1.00	0.90	0.85	0.75
11	Alberdingk AC 2019 VP	31.70	28.53	26.95	23.78
12	<b>Bindzil CC301</b>	0.00	8.77	12.75	19.41
13	Aquaflow NLS-205	1.80	1.62	1.53	1.35
<b>Total</b>		<b>93.15</b>	<b>87.66</b>	<b>84.95</b>	<b>77.65</b>

# Pigmented coatings alkyd paints

## Benefits of Bindzil CC in alkyd paints

- Dirt pick-up resistance
- Increased hiding power
- Combined flexibility with hardness

### Reduced dirt pick-up, alkyd paint with Bindzil CC301

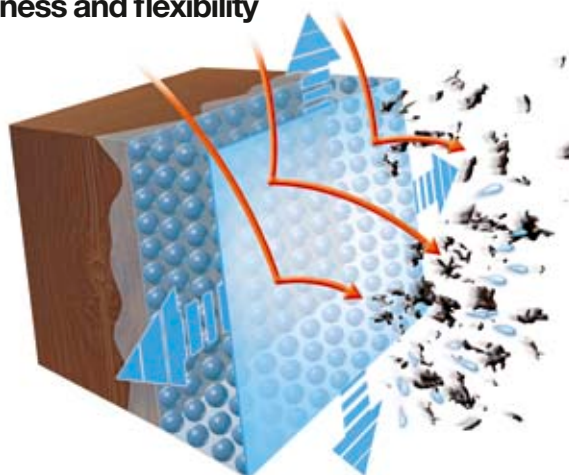


### Surface aspects after washing

Paints have been applied by means of brush on pine wood substrate in two layers (24 hours between the two layers). After 14 days of drying at room temperature, the surfaces have been contaminated with a water-based solution with red iron oxide. The contamination has been applied by means of a spray. The contaminated systems have been let to dry 24 hours at room temperature. The contaminated surfaces have been washed with water only and with soaped water.

<b>Paint B</b>	= Reference system
<b>Paint B1</b>	= 90 g paint B + 10 g Bindzil CC301

### Hardness and flexibility



The colloidal silica particles reinforce the coating system and make a tougher, more durable coating with a harder more hydrophilic surface while maintaining flexibility. This is important in a coating system based on alkyd resins where dirt otherwise may be integrated in the resin matrix during the early stage of drying and hence being impossible to remove. In addition a coating with good flexibility and low dirt pick-up properties, throughout the service life is the result.

### Products

Weight (g)

Grinding paste		
1	Water	202.50
2	Coadis BR95	15.00
3	Coapur XS22	22.50
4	Byk 093	6.00
5	KRONOS 2190	300.00
6	OMYACOAT 850 OG	195.00
Let-down		
7	Water	72.00
8	Aquaflow nhs 350	30.00
9	Coapur XS22	15.00
10	Ser Ad FA 179	4.50
11	SYNAQUA 4804	592.50

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