Water-borne polyurethane coatings with outstanding resistance to disinfectant

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Biology under control | “Ramspec” for Coatings
11th November 2020

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Our new **vision**

“We will be fully circular”

Circular solutions to cover three relevant cycle phases

Coatings, Adhesives and Specialties

Alternative raw materials

- Bio-based products
- CO_2-based products
- Waste-based products (LT)

Use phase

- End product's performance & durability

End-of-life

- Circularity enabling solutions
- Mechanical & chemical recycling technologies

Collaboration

- CE needs & challenges
- Technology development
- Industry wide partnerships

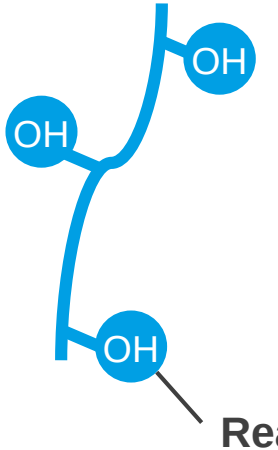
More relevant in our daily life than ever

Surfaces are cleaned and disinfected more often: Higher chemical resistance required
Waterborne Polyurethane coatings are the low emission key to this challenge!

Polyurethanes: High-performing and sustainable systems

Polyurethane reaction

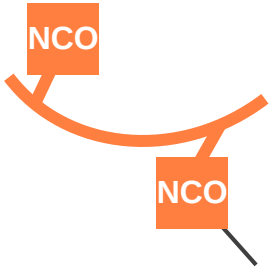
Polyol



Reactive hydroxy group

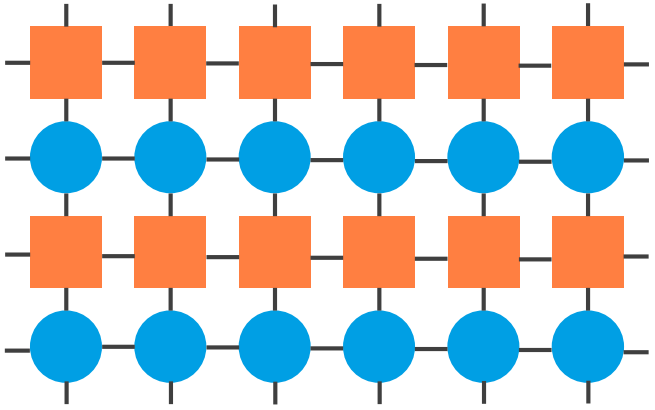
+

Polyisocyanate



Reactive isocyanate group

Fully Cured PU Coating

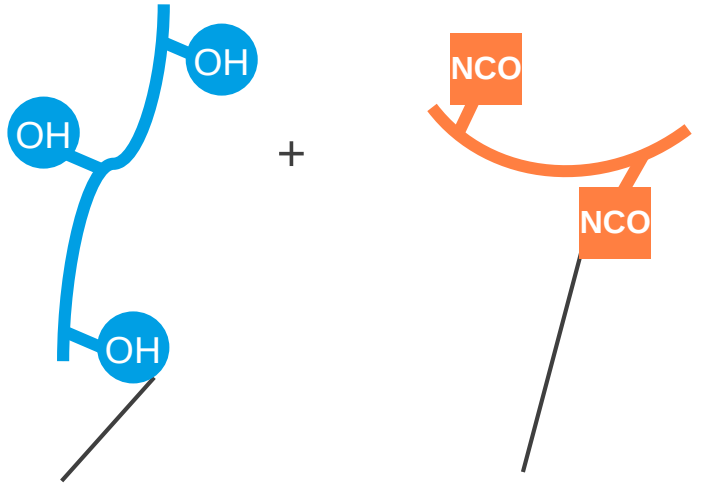


2K polyurethane: high class systems

The most “natural” shift from SB to WB coatings

Polyol (component A)

Polyisocyanate (component B)



Reactive hydroxy group

Reactive isocyanate group

Desmophen®

Desmodur®

Solventborne 2K polyurethane systems:

- high-class coatings
- highest chemical resistance
- reliable and robust processing
- no investment required

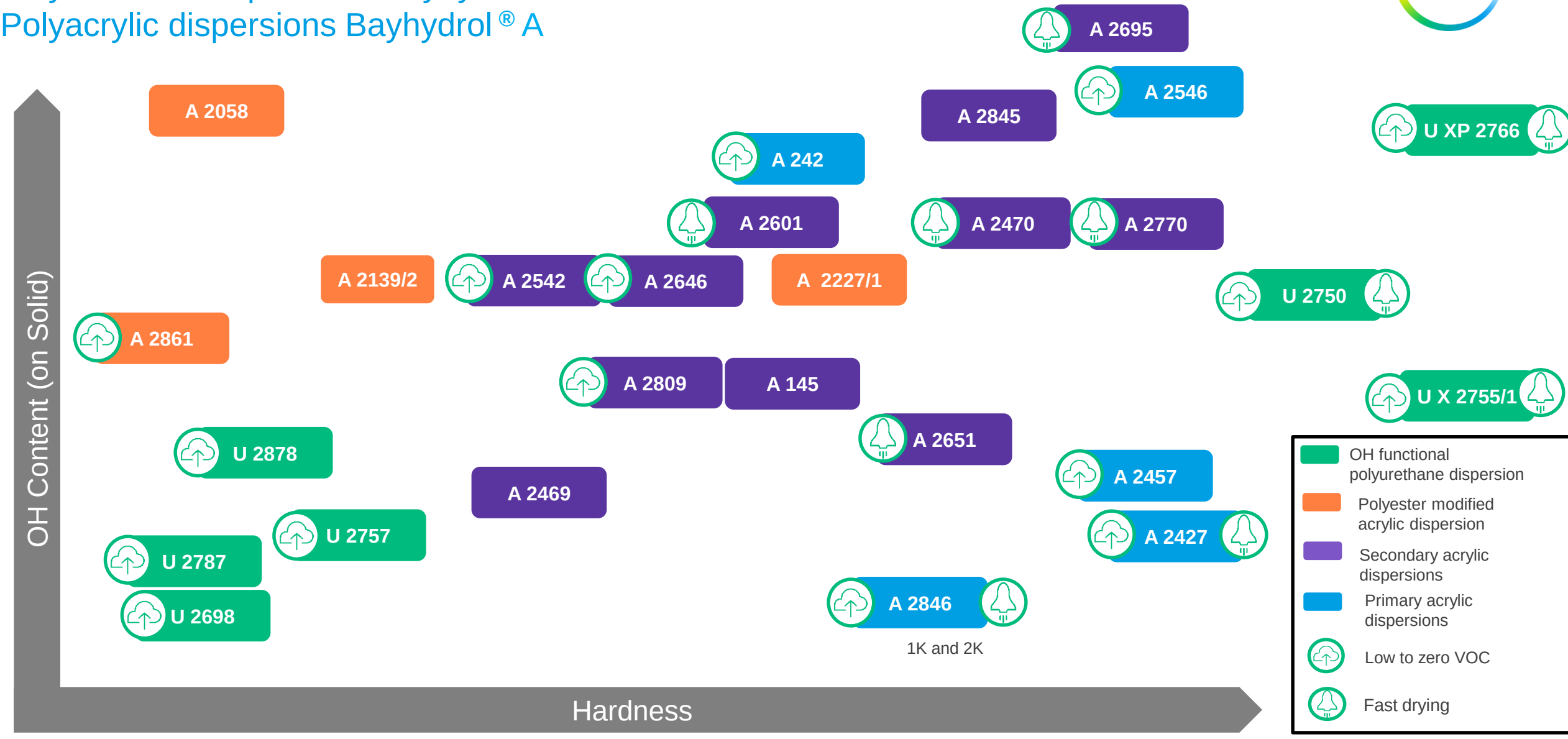
the easiest way to waterborne coatings

Waterborne 2K polyurethane systems:

- high-class coatings
- low to zero VOC technology
- light fast, non-yellowing
- just slightly more demanding in formulation and application
- no special equipment required

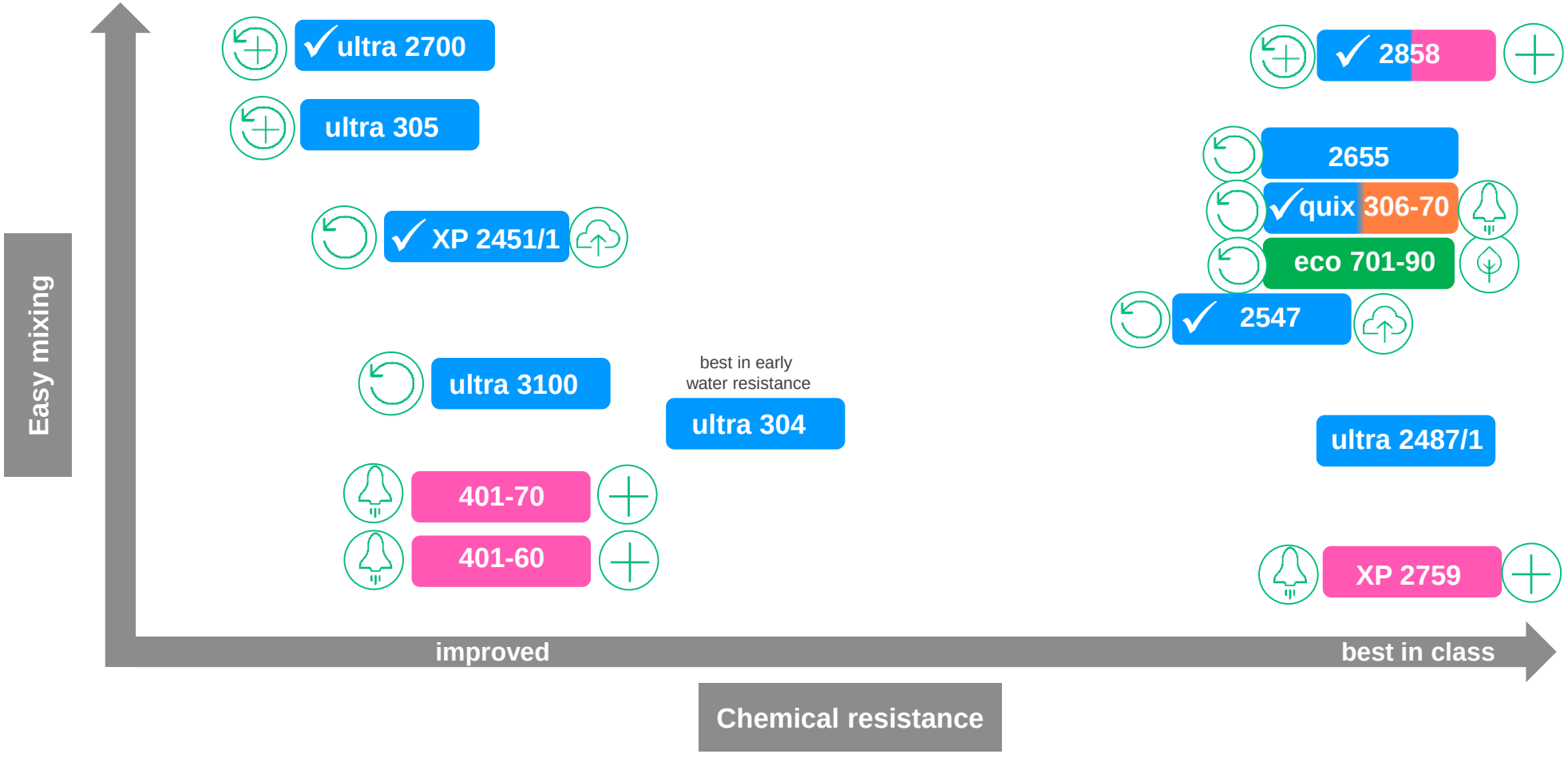
OH- functional dispersions (for 2K wb PU)

Polyurethane dispersions Bayhydrol® U
Polyacrylic dispersions Bayhydrol® A



Aliphatic hydrophilic polyisocyanates

Bayhydur® / Bayhydur® ultra*



High gloss with manual stirring

Low shear stirring

Fast drying

Longer potlife

Partially bio-based

Low viscous, for near zero VOC

Ready-to-use

HDI

IPDI

HDI/IPDI

PDI

HDI/TDI

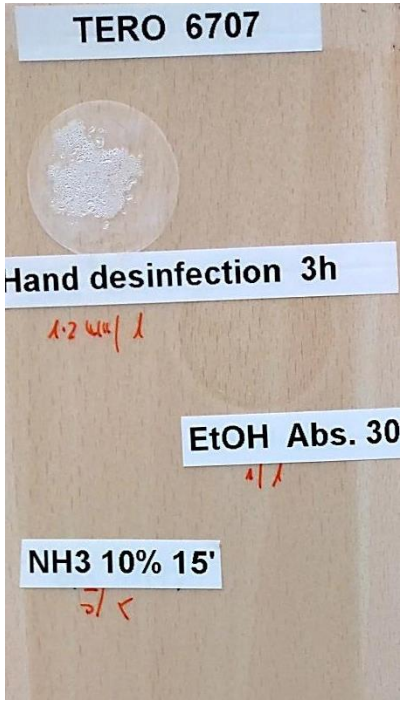
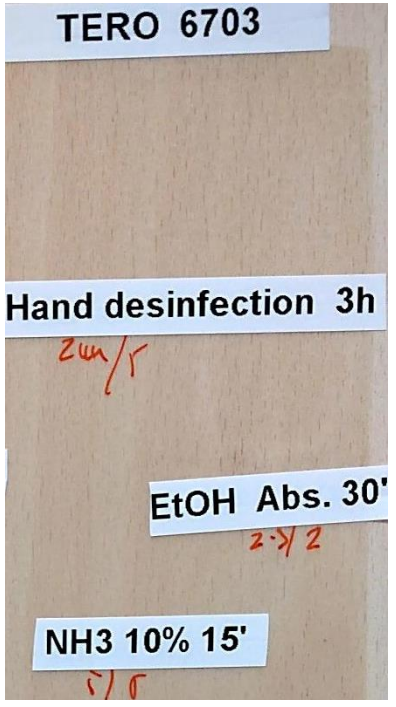
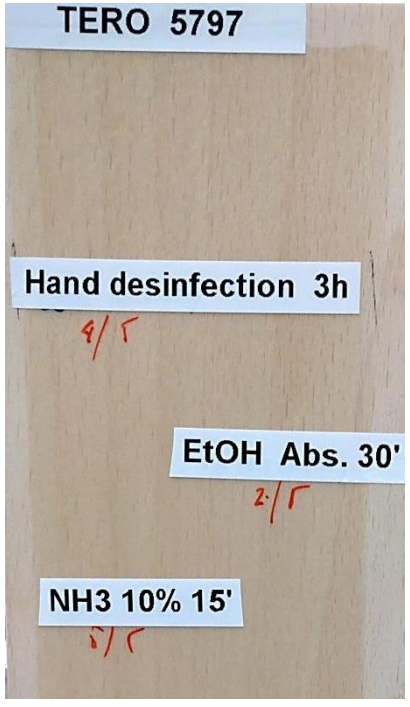
* < 0.1 % residual monomer content

Wooden substrates

Polyurethane systems demonstrate better resistance against cleaning and sanitizing agents

Standard acrylic dispersions in the market				Bayhydrol® A 2846 1K Formulation	Bayhydrol® A 2846 + 5 % Bayhydur® 2655	PAC 4 + 5 % Bayhydur® 2655
PAC 1	PAC 2	PAC 3	PAC 4	TERO 0200 1C	TERO 0200 2C Comp. B 5%	PAC 4 2C
Hand desinfection 3h	Hand desinfection 3h	Hand desinfection 3h	Hand desinfection 3h	Hand desinfection 3h	Hand desinfection 3h	Hand desinfection 3h
EtOH Abs. 30'	EtOH Abs. 30'	EtOH Abs. 30'	EtOH Abs. 30'	EtOH Abs. 30'	EtOH Abs. 30'	EtOH Abs. 30'
NH3 10% 15'	NH3 10% 15'	NH3 10% 15'	NH3 10% 15'	NH3 10% 15'	NH3 10% 15'	NH3 10% 15'

Bayhydrol® UH 2874 offers a 1K alternative without sacrificing high performance properties

Bayhydrol® A 2846 1K Formulation	STD PUD 1K Formulation	STD PUD + 10% Bayhydur 305	Bayhydrol® UH 2874 1K Formulation
			

Bayhydrol® A 2846

Bayhydrol® A 2846	
Solid content	approx. 40%
Viscosity (23ºC)	approx. 50 mPa·s
%OH on solids	approx. 1,5%
pH	approx. 7

When versatility and performance matter: Self-crosslinking acrylic dispersion for 1K and 2K wood coatings

- Product useful both for 1K as well as 2K coatings, giving maximal **flexibility** and **versatility** to formulators and painters
- Self-crosslinking mechanism present in its structure provides enough resistance to the polymer to deliver **high performance also in 1K coatings**
- **Fast drying** with long pot-life
- More **economical** and simpler 2K systems possible

Bayhydrol® UH 2874

	Approx. value
Solid content	40 %
pH	8
Viscosity	300 mPa·s
Biobased content*	49 %
Elongation	130 %
Tg / MFFT	45 / 40 ºC

1K partially bio-based polyurethane dispersion for wood coatings with 2K performance

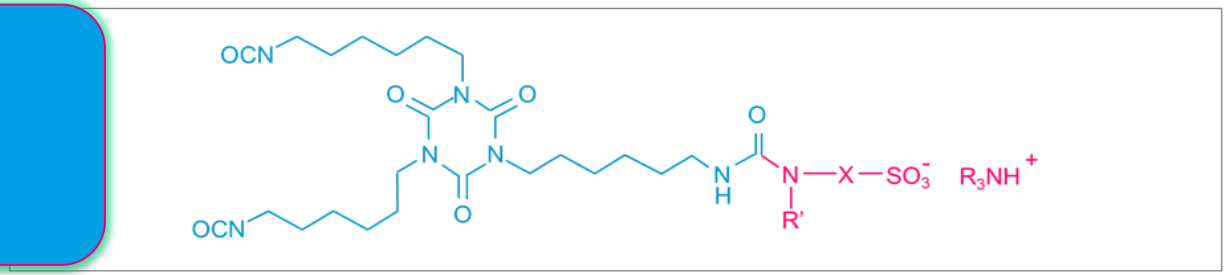
*^{14}C/total C, confirmed by ^{14}C-Measurements according to ASTM D 6866:2008.

- Significant content on renewables
- Outstanding chemical resistance
- Outstanding BHMR and scratch resistance
- Very fast physical drying
- Very good blocking resistance and sandability

Bayhydur® 2655

Anionic aliphatic polyisocyanate

- easy mixing in the waterphase
- top chemical resistance



- **very easy-mixing** is possible with most of dispersion grades
  - no special 2K spray equipment is required
  - broad application frame: no change in chemical resistance and film appearance under different mixing processes
  - high gloss and low haze easily achieved
  - also as blending partner to improve mixability of other hardeners
- **excellent chemical and stain resistance**
- excellent UV resistance

Bayhydur® 2655 **Approx. product data of supply form**	
NCO	20,8%
Functionality	3,2
Viscosity @ 23°C	3.000 mPa·s
Solid content	100%

Metal Substrates

High resistance against ethanol and disinfectant

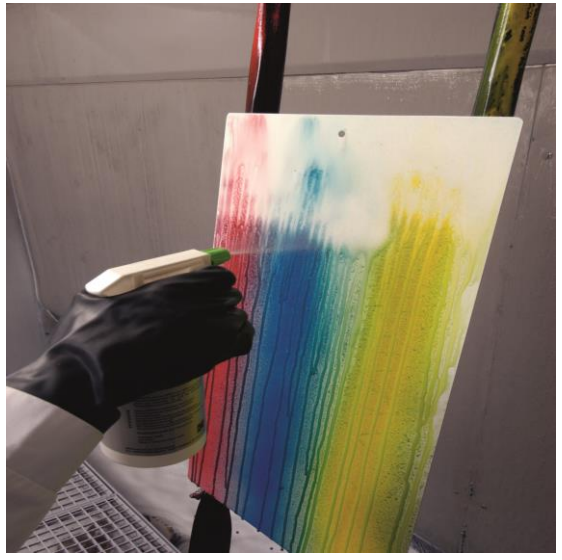
2K formulations based on Bayhydrol® A 2695 and Bayhydur® ultra 304/ Bayhydur® 2655

Bayhydrol® A	145	2470	2695
OH content on solid	3,3 %	3,9 %	5 %
Ethanol (98%)	Top coat (white) with Bayhydur® ultra 304 (NCO:OH 1,5:1)		
10 min	3	1	**0**
20 min	3	3	**0**
30 min	4	3	**1**

Assessment according to DIN EN ISO 4628-1
(0 = no noticeable change - 5 = paint completely destroyed or very strong change)

Bayhydrol® A 2695

Bayhydrol® A 2695	
Solid content	approx. 41%
Viscosity (23ºC)	approx. 2800 mPa·s
%OH on solids	approx. 5%
pH	approx. 8



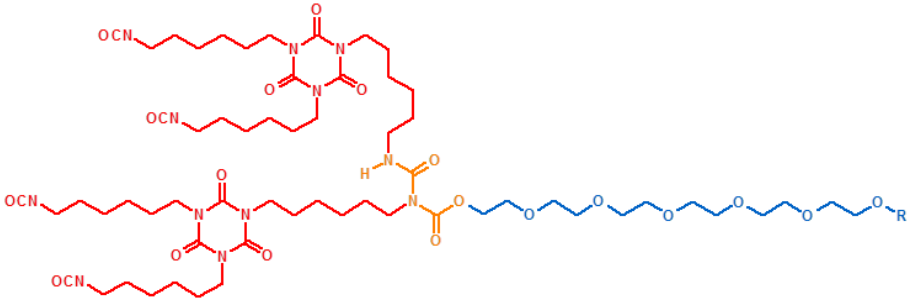
High performance and outstanding resistance properties for 2K waterborne coatings

- Originally developed for railway coating systems with outstanding resistance properties against aggressive graffiti removal agents
- This excellent polyacrylic dispersion boasts an unparalleled level of resistance to solvents and chemicals in combination with low-viscosity Desmodur® or hydrophilized Bayhydur® hardener
- Bayhydrol® A 2695 is suitable for high-quality metal, plastics and wood coatings

Bayhydur® ultra 304

Polyether allophanate modified polyisocyanate

- more hydrophobic vs Bayhydur® 2655
- higher NCO functionality



- **Ultra Line - high-performance isocyanates technology**
  - further improves industrial hygiene standards thanks to a residual monomer content of below 0.1 %
  - no additional efforts to comply with the proposed isocyanate use restriction (upcoming European Union (EU) legislation)
- **Easy-mixing** is possible with most of dispersion grades
  - high gloss and low haze easily achieved
  - also as blending partner to improve mixability of other hardeners
- **Excellent water, chemical and UV resistance**

Bayhydur® ultra 304 **Approx. product data of supply form**	
NCO	18,2%
Functionality	3,8
Viscosity @ 23°C	4.000 mPa·s
Solid content	100%

Architectural and Floor Coatings

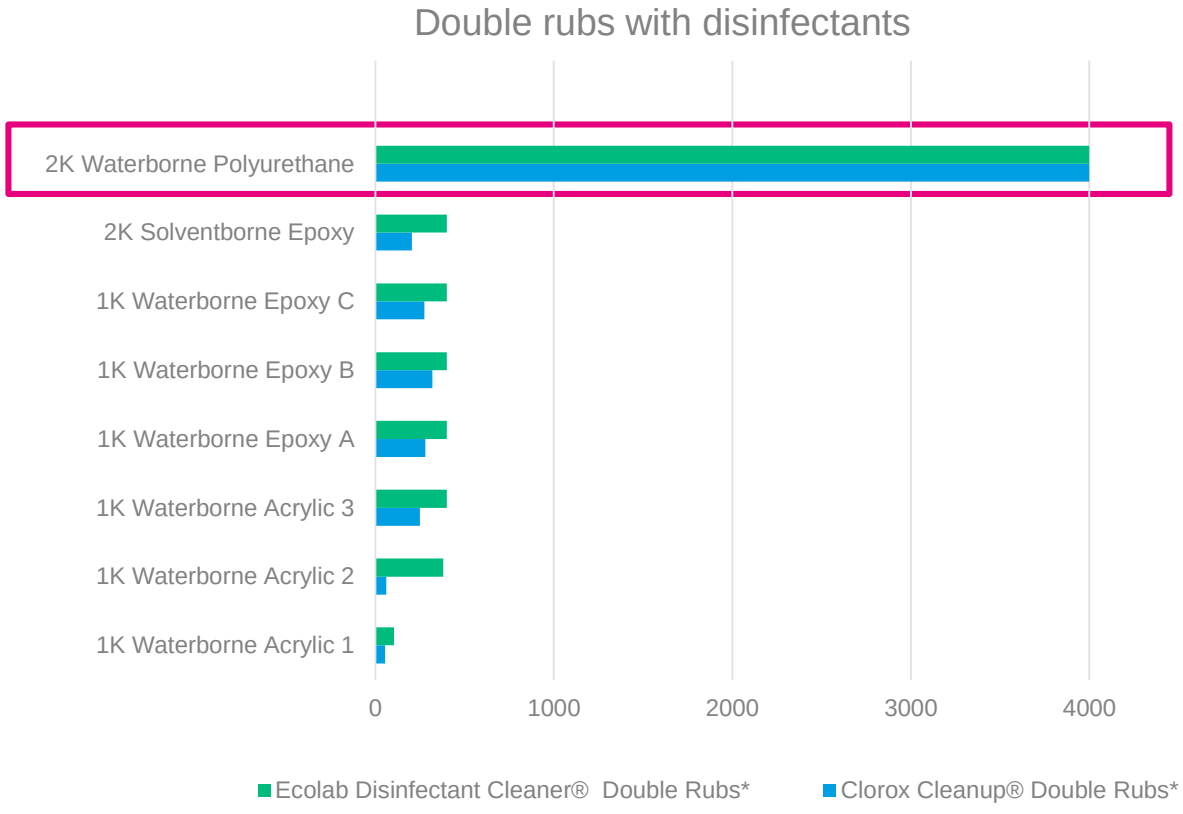
Also in architectural coatings:

Outstanding durability against typical disinfection chemicals can be achieved with 2K WB solutions comparing to standard 1K systems

Paint or Coating	VOC* g/l	Betadine® 1 hr. spot test**
1K Waterborne Acrylic 1	44	3
1K Waterborne Acrylic 2	40	2
1K Waterborne Acrylic 3	0	2
1K Waterborne Epoxy A	155	2
1K Waterborne Epoxy B	96	2
1K Waterborne Epoxy C	96	2
2K Solventborne Epoxy	169	2
2K Waterborne Polyurethane based on Covestro technology	8	1

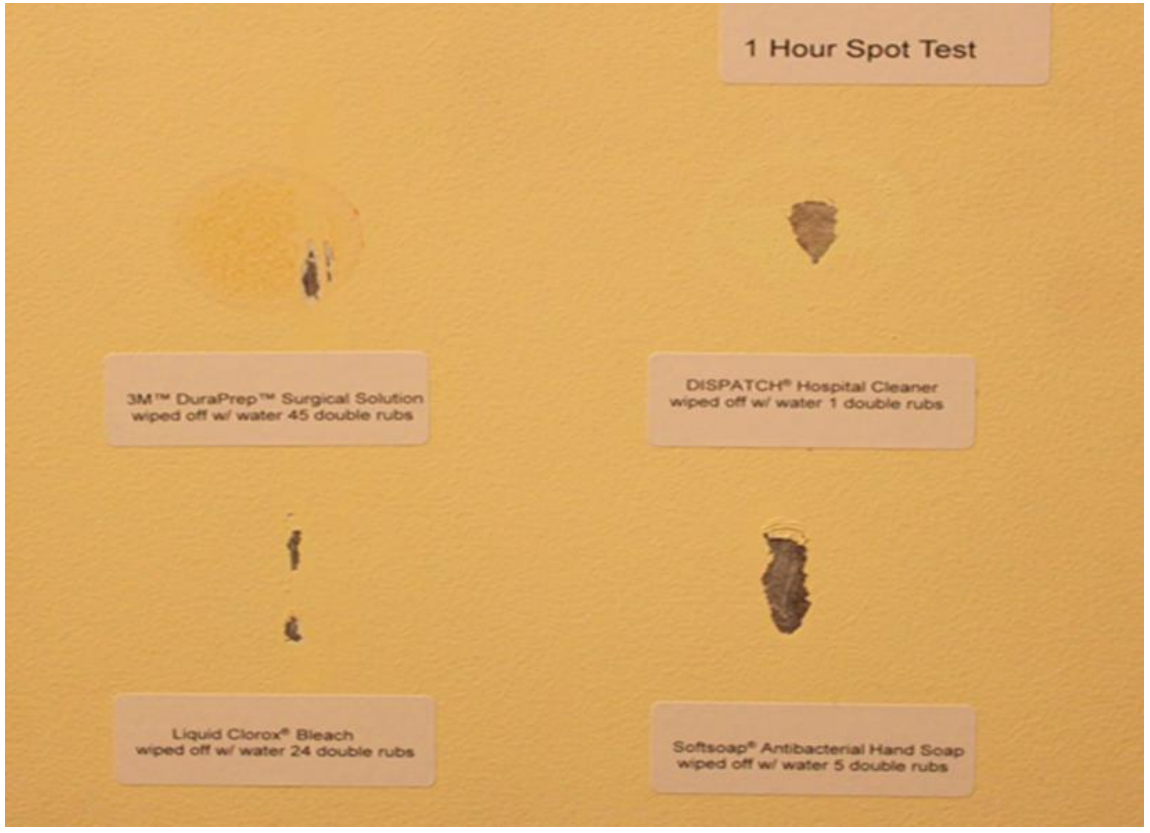
*Values are typical

**0= no stain
1= faint stain
2= yellow stain
3= brown stain

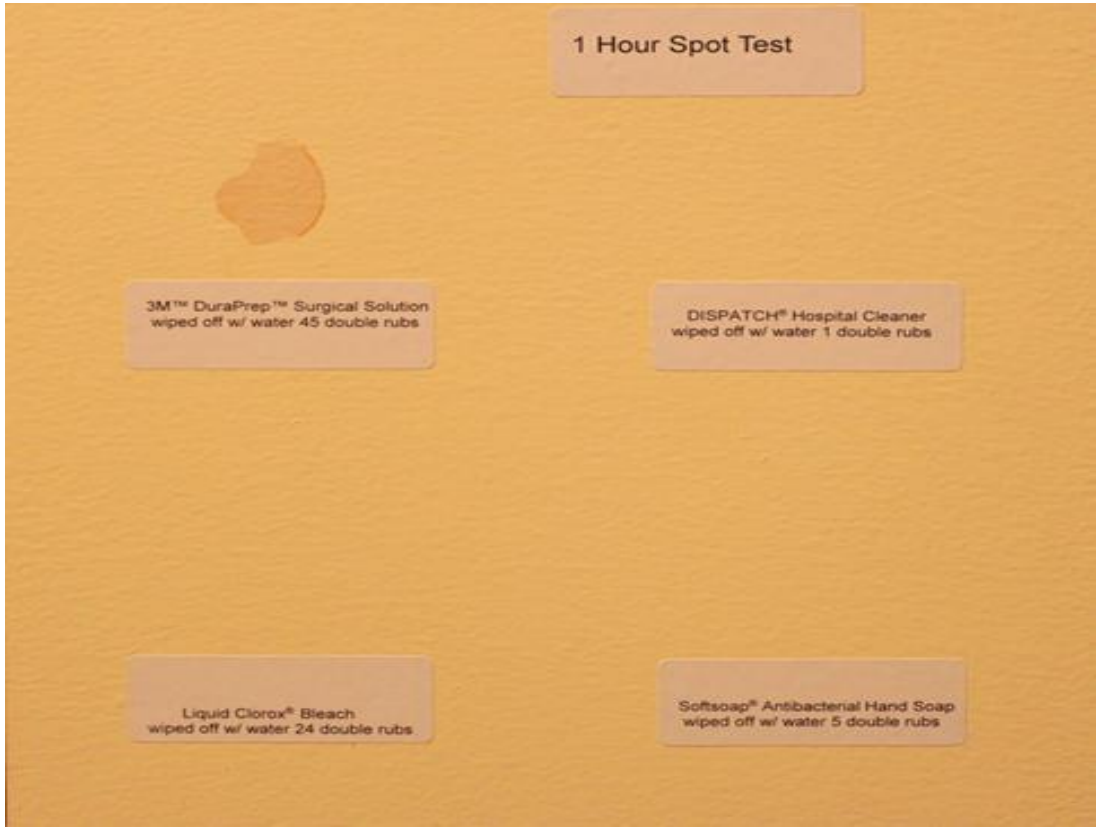


The differences are dramatic when tested using common chemicals

Typical water-borne acrylic



2K water-borne polyurethane

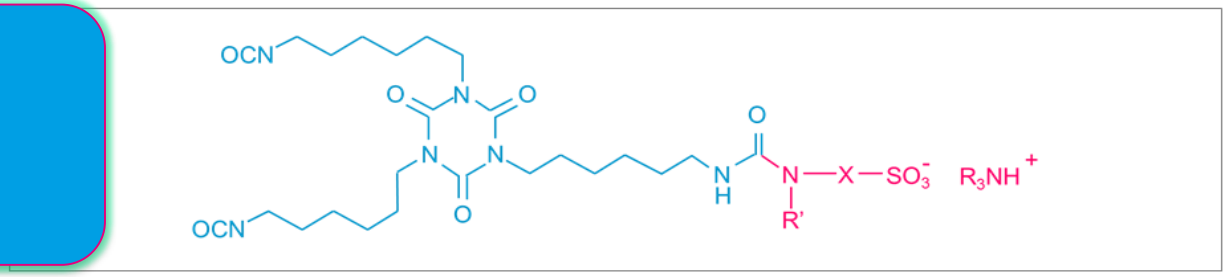


Bayhydur® 2547

Ready to use crosslinker for near zero VOC 2K-PU waterborne construction coatings

Anionic aliphatic polyisocyanate

- easy mixing in the waterphase
- excellent chemical resistance



- Bayhydur® 2547 is a low viscous, ready to use crosslinker especially designed for high performance indoor construction applications.
  - High hardness
  - Excellent water & chemical resistance
  - No compromise in color stability and working time
  - Easy mixability by hand at the construction site
  - Near zero VOC, AgBB (indoor air quality) compliant decorative topcoats

Main characteristics	
Solid content	100%
Viscosity @ 23°C	650 mPas (approx.)
NCO content	22,5% (approx.)
Color value (Hazen)	≤ 150
Monomeric HDI	< 0,5%

Bayhydrol A®

Reaction partners for Bayhydur® 2547 for near zero VOC construction coatings

Bayhydrol® A 2546

Anionic polyacrylate primary dispersion

Main characteristics (approx.)	
Non-volatile content	40 %
Viscosity @ 23 °C	35 – 250 mPas
OH-content (solid resin)	4,1
pH-value	7,5
Neutralizing agent	NH_3
Organic co-solvent content in supply form	0 %
MFFT	15 °C

Bayhydrol® A 2646

Anionic polyacrylate secondary dispersion

Main characteristics (approx.)	
Non-volatile content	50 %
Viscosity @ 23 °C	1000 – 3000 mPas
OH-content (solid resin)	3,8
pH-value	7,5
Neutralizing agent	Triethanolamine (TEA)
Organic co-solvent content in supply form	1 % (reactive diluent)
MFFT	< 0 °C

Take aways

Coatings with outstanding resistance to disinfectant

- Surfaces are nowadays being cleaned more often and with more aggresive chemicals
- Higher resistance of the surface coatings to those chemicals is required
- Comparing different coating technologies for wood, metal and concrete substrates, we could demonstrate that polyurethane technology offers advantages in resistance against cleaning agents and disinfectants

1K and 2K water-borne polyurethane as solution for durable coatings

Grazie per l’attenzione!

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