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chemicals

Building
our future together



Agenda



1. Introducing Vencorex

2. Monomers and use

- HDI
- IPDI
- Other applications

3. Waterborne PU coatings: Easaqua™ range

4. Solventborne PU coatings : Tolonate™ range

- Standard grades : biuret vs trimer
- Focus on Tolonate™ HDB 75 MX
- Fast drying grades
- High solids/Solvent free PU systems
- Other applications : 1 K moisture systems for stone carpet/waterproofing membrane



A joint venture backed by two global leader



Vencorex is a JV created in 2012 between :

- **PTT Global Chemical**, Thailand's largest and Asia's leading integrated petrochemical and refining company,
- **Perstorp Group**, world leader in several sectors of the specialty chemicals market.



10%



90%





Vencorex

Facts & figures

A global player

- Leading manufacturer of **high specialty Isocyanates**
- **3** manufacturing sites : France (Grenoble), USA (Freeport, Tx), Thailand (Rayong)
- **1** R&D center in France, **1** application lab in China (Shanghai)
- Global commercial presence
- Committed to Safety, Environment and Sustainable Development
- Shaped by a culture of **INNOVATION**
- Supported by **multicultural** and **international** teams (604 employees)
- Gold Medal at **Eco Vadis for Corporate Social Responsibility** Assessment in 2016



Vencorex's Portofolio



- 3 different product ranges:

- **Monomers: building blocks for resin synthesis**

- Tolonate™: crosslinkers of **Solvent-Based** PU formulations

- Easaqua™: crosslinkers of **Waterborne** PU formulations

} = derivatives

Monomers and Use



Vencorex 's IPDI key benefits



Hardness

- Rigid cycloaliphatic structure leading to high glass transition temperature adducts



Specific reactivity

- 2 isocyanate functions of different reactivity enable selective chemical reactions (in PUD manufacturing)



Easy to handle

- Easy to handle vs HDI (both are toxic but IPDI has a lower vapor pressure)

Vencorex 's HDI key benefits



Flexibility

- Building block for PUD for leather & textile coating
- Building block for prepolymers



Light fastness

- Non yellowing foams
- Building block of polymers for outdoor exposure

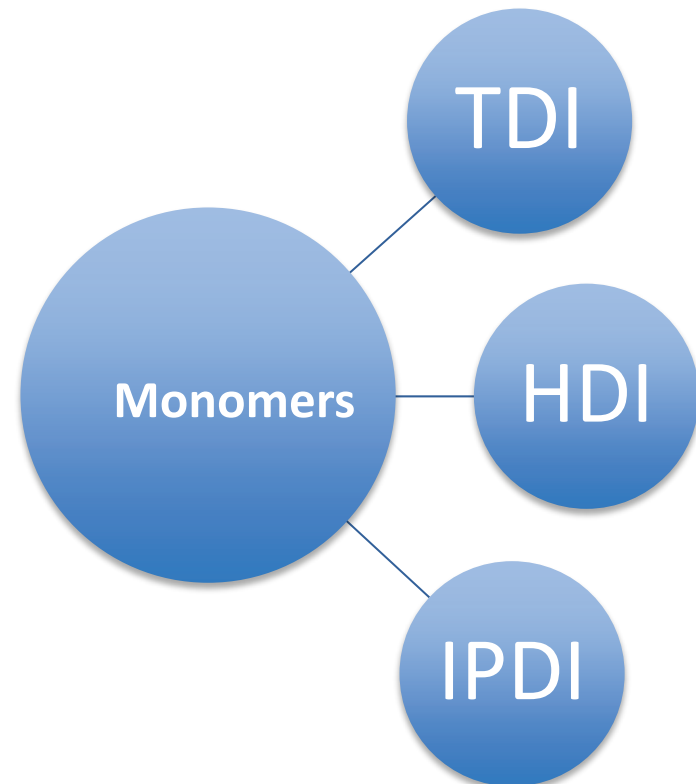
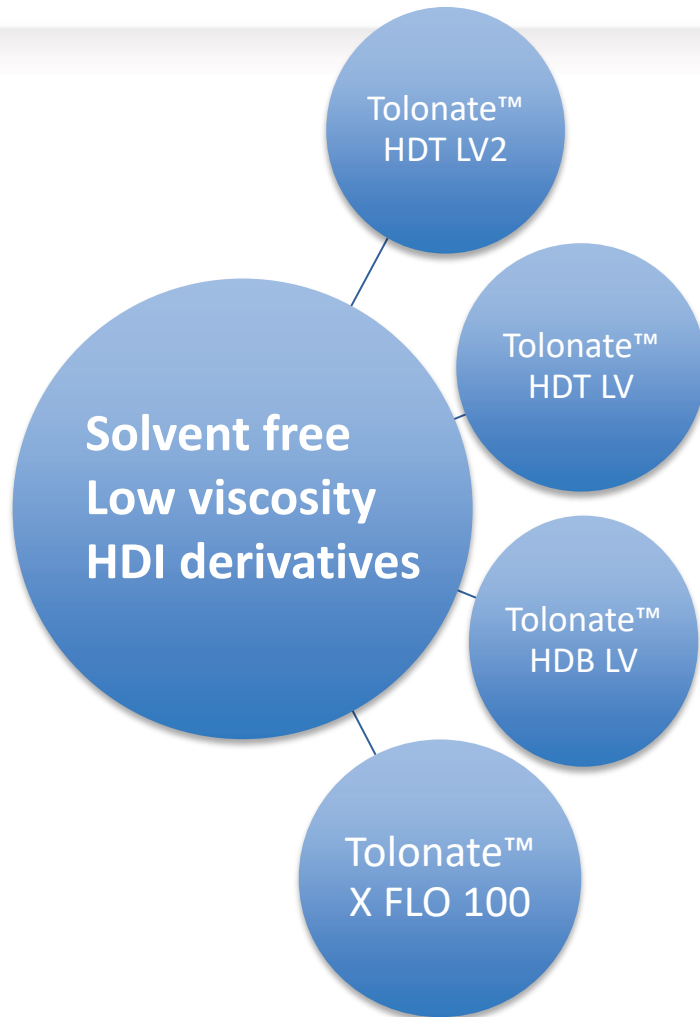


Low viscosity

- Building block for PUA

Our offer

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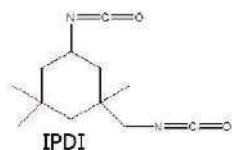
Isocyanates

Vencorex monomer Offer

30-50%
dry wt

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- IPDI :**



Mostly used for PUDs production, due to good hardness, suitable reactivity:

- ✓ Better control of the reaction during chain extension → less problem of gelification
- ✓ Also, the lower reactivity of secondary NCO groups minimizes side reaction with water
- ✓ Lower viscosity can be obtained with IPDI

- HDI :** soft, increase flexibility to PUDs



Low viscosity

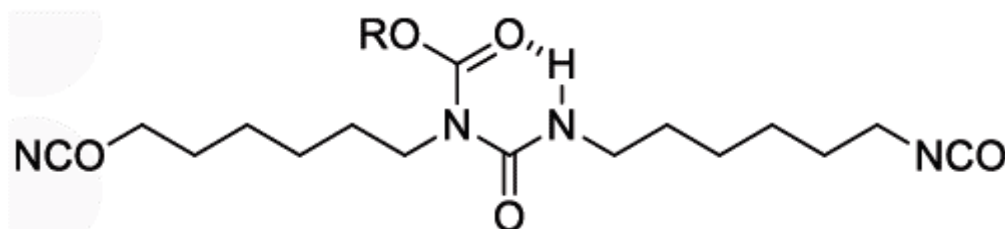
IPDI < IPDI/HDI < HDI

High viscosity



Tolonate™ X FLO 100

- **Partially bio-based**, aliphatic isocyanate polymer
- Based on Hexamethylene Diisocyanate (HDI)



- Solvent free, **extremely low viscosity (140 mPa.s)**
- **Low functionality slightly > 2.**

APPLICATIONS:

- Polyurethanes, polyureas elastomers
- Solventborne, waterborne coatings
- Moisture cure systems
- Solvent free coatings
- Polyurea coatings
- Building block

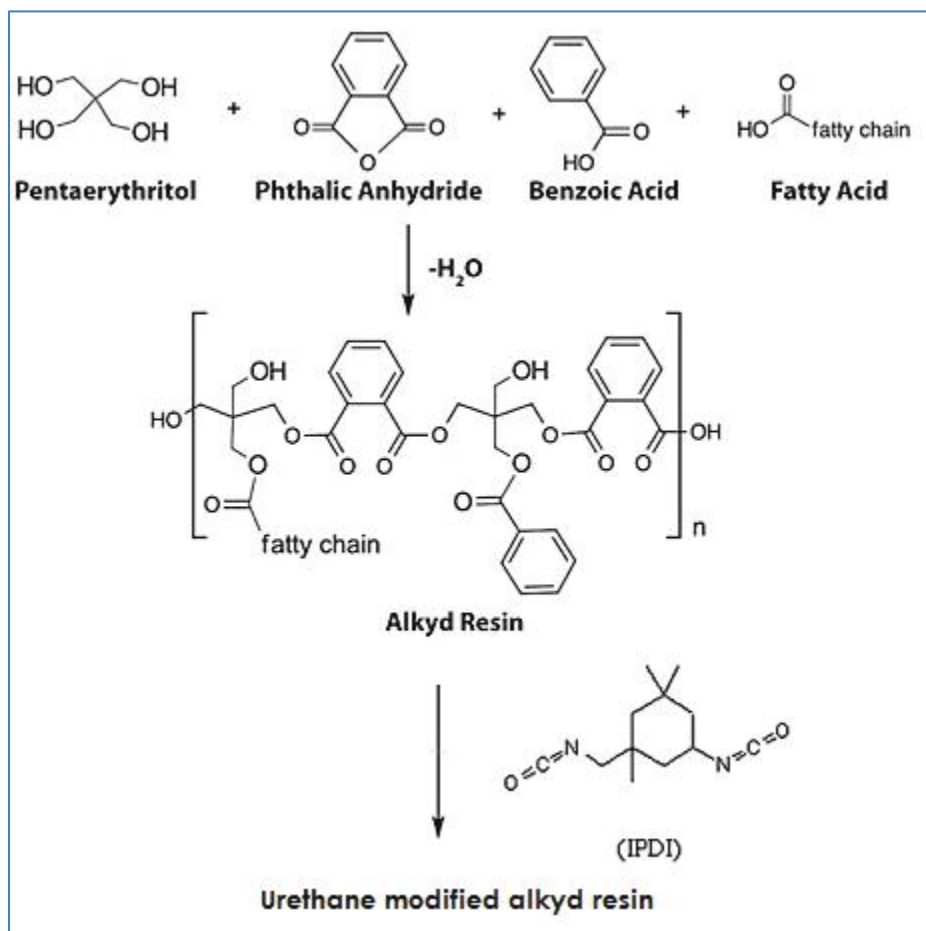


Use of monomers – Other applications



Urethane Modified Alkyds

Binder for wood coatings, protective coatings, ...

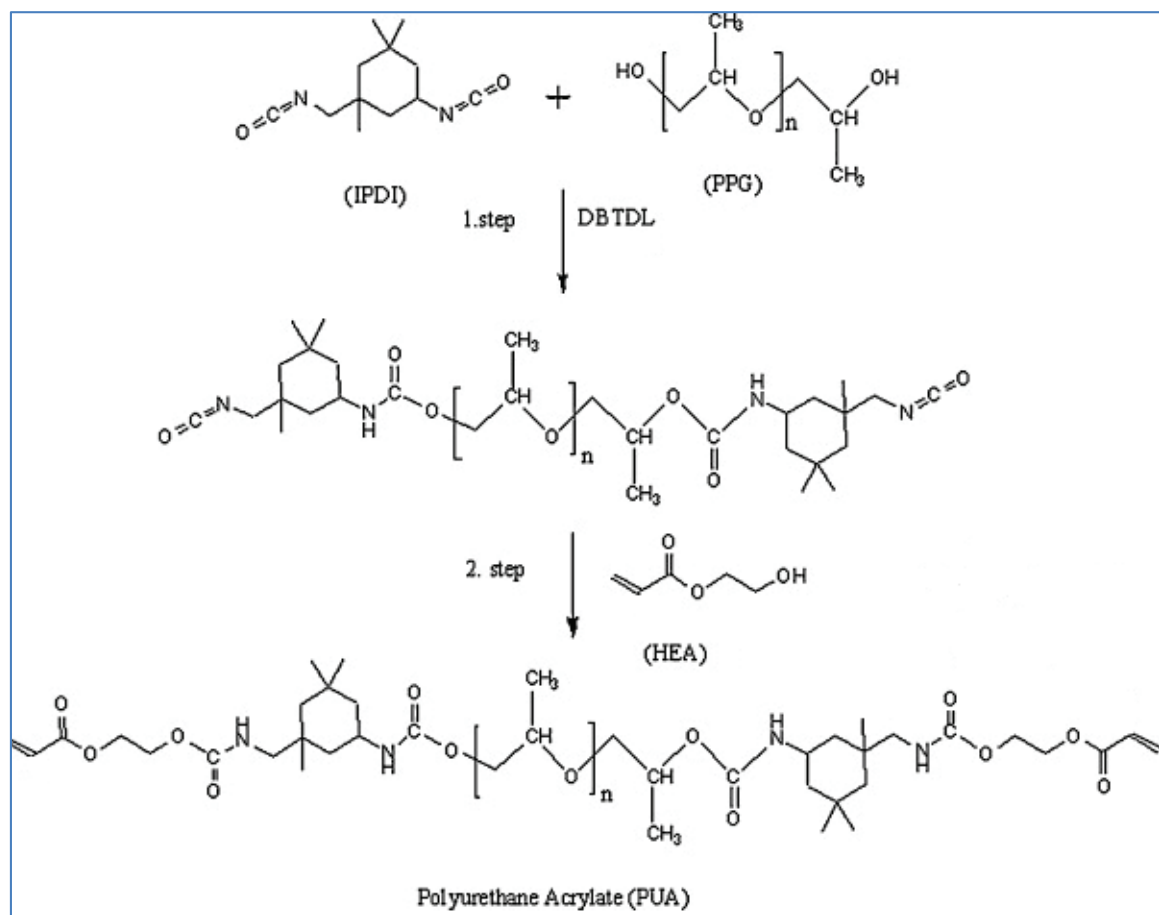


Superior properties than conventional alkyds:

- ✓ Shorter drying time
- ✓ Abrasion resistance
- ✓ Chemical resistance
- ✓ UV resistance (IPDI)

Urethane Acrylate

UV curing binder for printing inks, wood parquet / furniture, plastics...

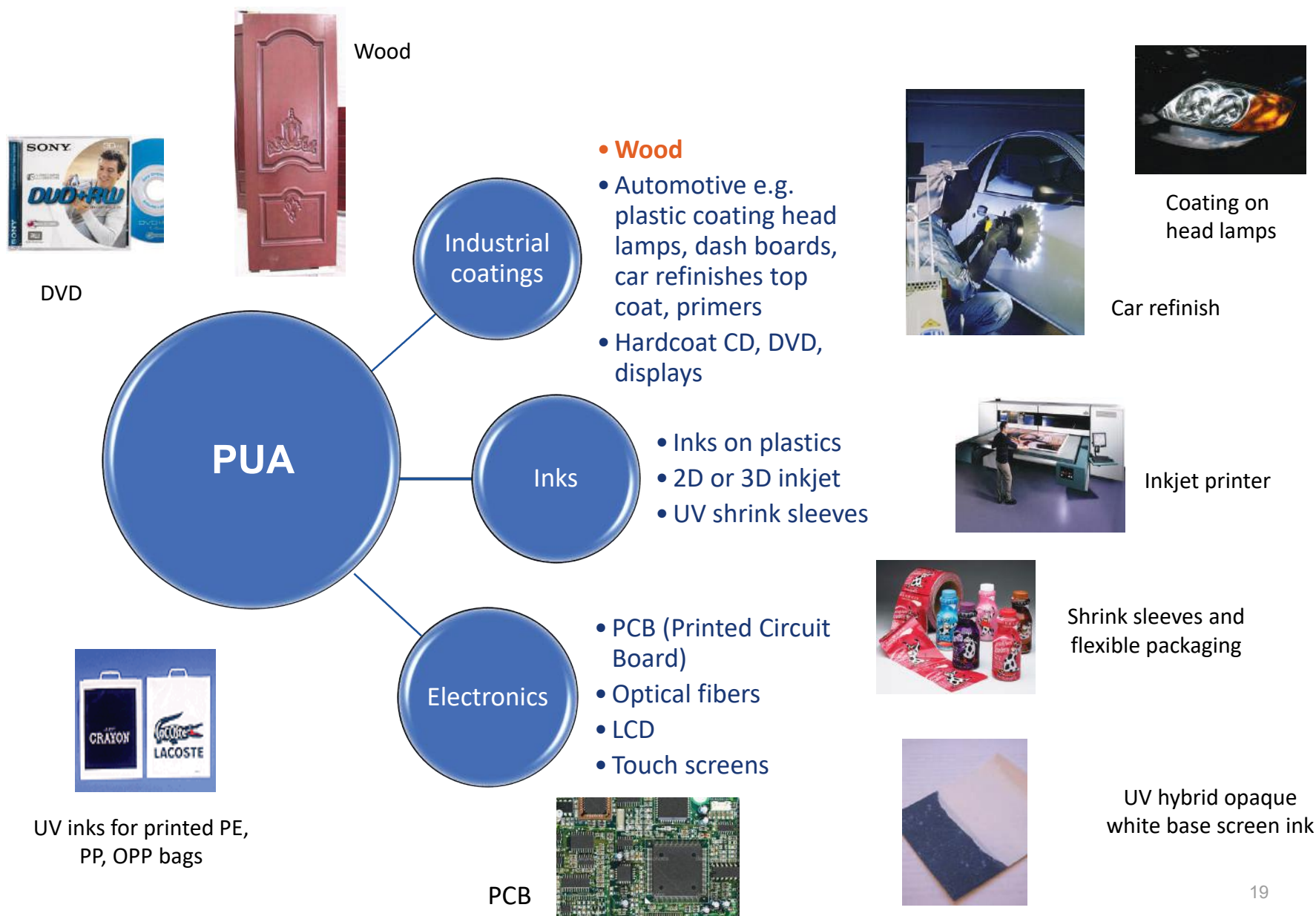


Superior properties than epoxy or polyester acrylates :

- ✓ Good toughness
- ✓ Chemical resistance
- ✓ Adhesive properties
- ✓ Abrasion resistance
- ✓ Flexibility
- ✓ UV resistance (IPDI, HDI)

PUA - Main applications

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Waterborne PU coatings : Easaqua range



Market trends: switching to waterborne technology



• Addressing consumers' expectations for sustainable developments

- Nike moving to waterborne adhesives for sport shoes produced in Asia

• Answering principals' requests for eco-friendly products

- European railway companies requesting trains painted with waterborne coatings
- London Olympics organisers requesting biodegradable and environmental friendly coatings

• Providing safe and easy-to-use products to end-users

- Especially for small companies, not well equipped to deal with solvents, in the leather, wood & plastic industries
- Easy handling, less storage constraints, less odour

• Meeting regulations on VOC reduction

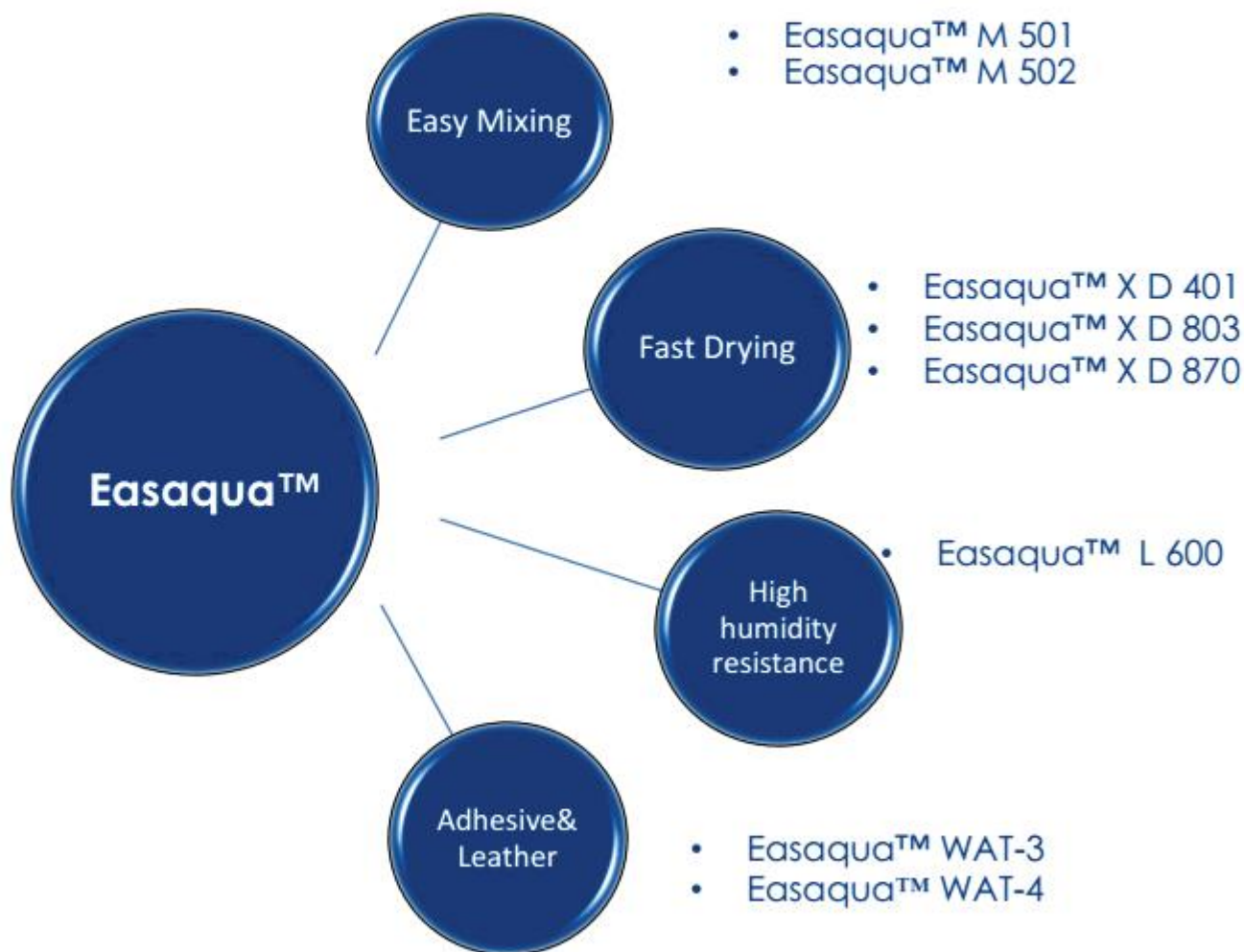
- European directives 1999/13/CE and 2004/42/CE

• Taking advantage of a very attractive driver to innovate and differentiate

- Focus on niche, added-value formulations

Easaqua™ Product range

- Just as Tolonate™, Easaqua products are used as crosslinkers with polyols (polyacrylics, polyester, polyether)
- But they are also particularly suitable with aqueous dispersions as **polyurethane dispersions (PUD)**





Each application has its Easaqua™ solution !



Metal



Wood



Plastic



Flooring



Leather
finishing



Adhesive



1- METAL COATINGS



1- Metal coatings



Automotive
OEM

Car Refinish

General
Industry &
ACE

Transportation

Aerospace

Military



1-2 Car refinish

1-2 Car Refinish

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REQUIREMENTS

- Low VOC emission for body shops
 - Ease of mixing
 - Fast film drying
- High aspect properties, robustness of film formation
- Excellent mechanical properties and durability



NEEDS

- VOC reduction
- Faster drying



Waterborne solution:

Easaqua™ X D 401
(hydrophilic HDI/IPDI hybrid)



**1-3 General industry/
ACE**

General Industry / ACE

REQUIREMENTS

- Corrosion resistance
 - Mechanical properties
 - Chemical resistance
- Weathering resistance



NEEDS

- VOC reduction
 - Improved performances
- Faster drying

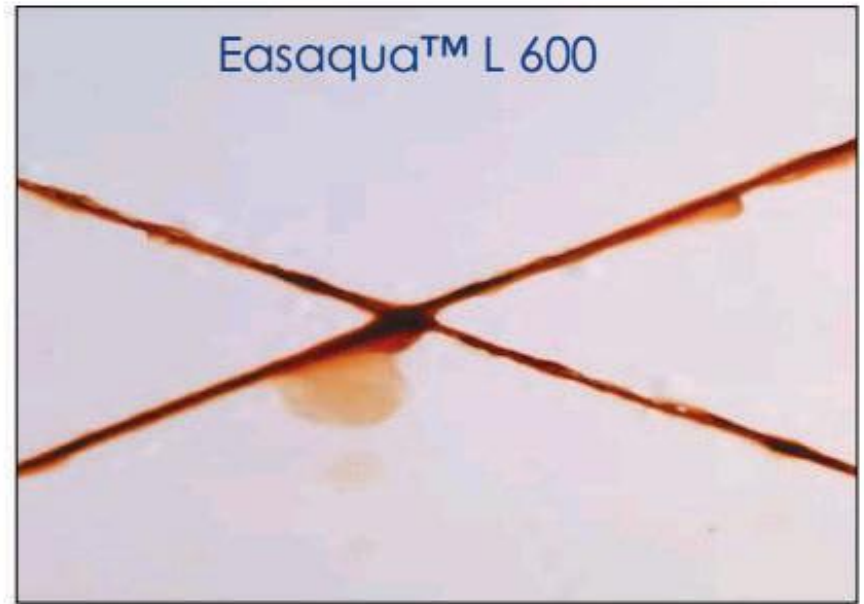
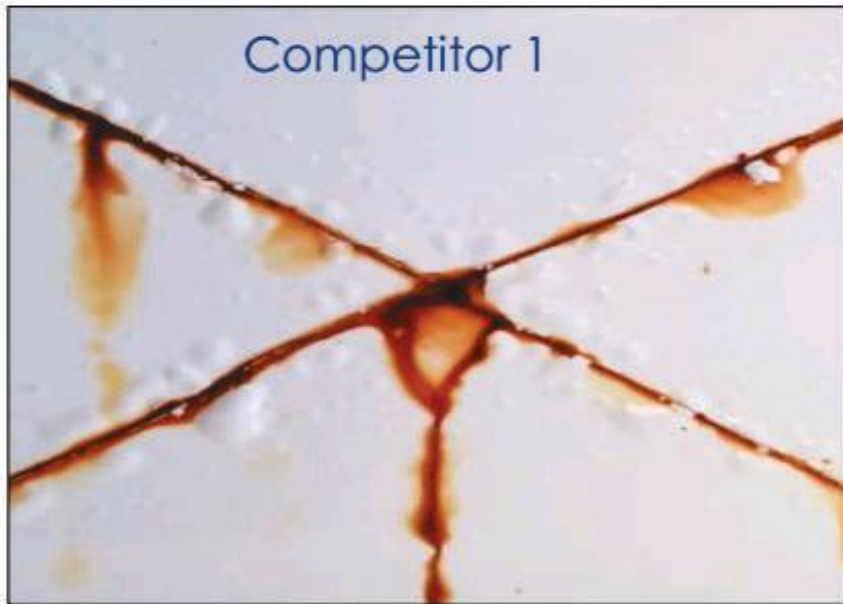
Waterborne solutions:

Easaqua™ X D 401

Easaqua™ L 600

Easaqua™ L 600 for high humidity resistance

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With **Easaqua™ L 600**: superior resistance to corrosion after 350 hours salt spray test



1-6 Military

Military - CARC coatings

REQUIREMENTS

- Chemical warfare agent resistance
- Flexibility
- Extremely low gloss



NEEDS

- 2K Waterborne PUR: ability to apply forced drying
- PUR powder coating for 0 VOC



SOLUTION

2K PUR waterborne
with **Easaqua™ L 600** ,
Easaqua™ M 502



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3- WOOD COATINGS



Wood coatings – 2 major applications



Wood parquet flooring

Reduction of
smell coming
from Solvent
in « closed
environment »

Easier
products to
use for
applicators

Kitchen & office furniture and joinery

Meeting
regulations
on VOC
reduction

Provide
safer
products to
end users

• Typical technical requirements:

- Easy mixing and application
- Fast drying (stackability)
- Adjustable gloss and superior mechanical properties (abrasion)
- Chemical & stain resistance

Easaqua™ solutions for wood flooring

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Easaqua™ X D 803
Easaqua™ X D 401



- Fast drying
- Long pot life

Easaqua™ M 501



- Matt finishes

Easaqua™ M 502

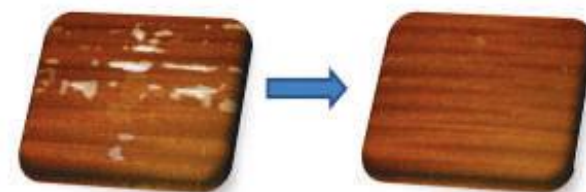


- High gloss

Easaqua™ L 600



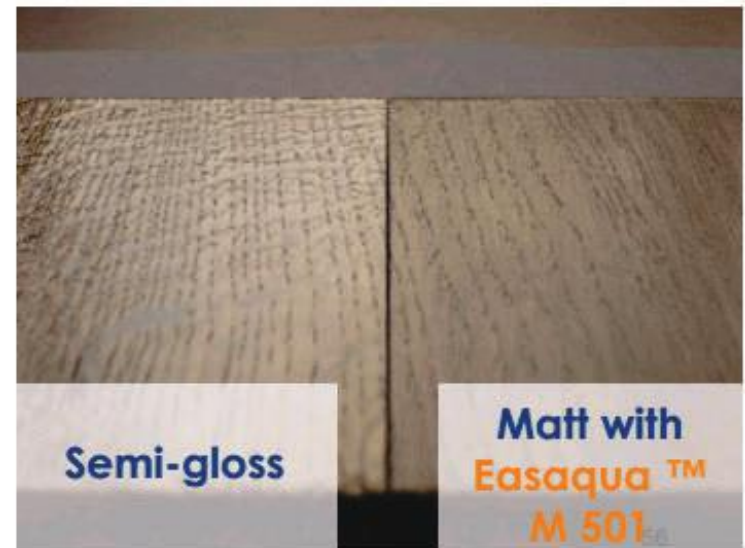
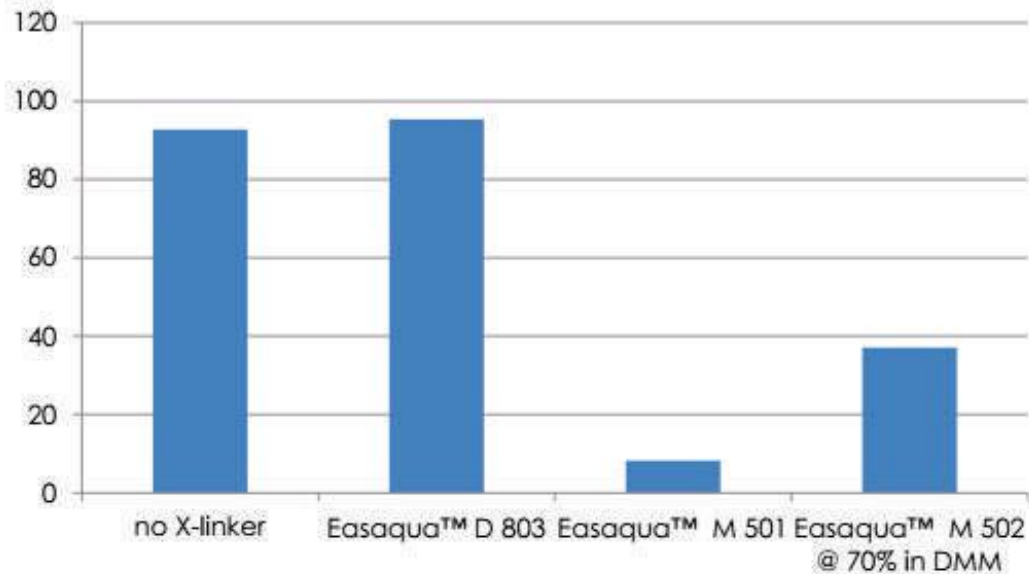
- Low VOC
- High gloss



Appearance

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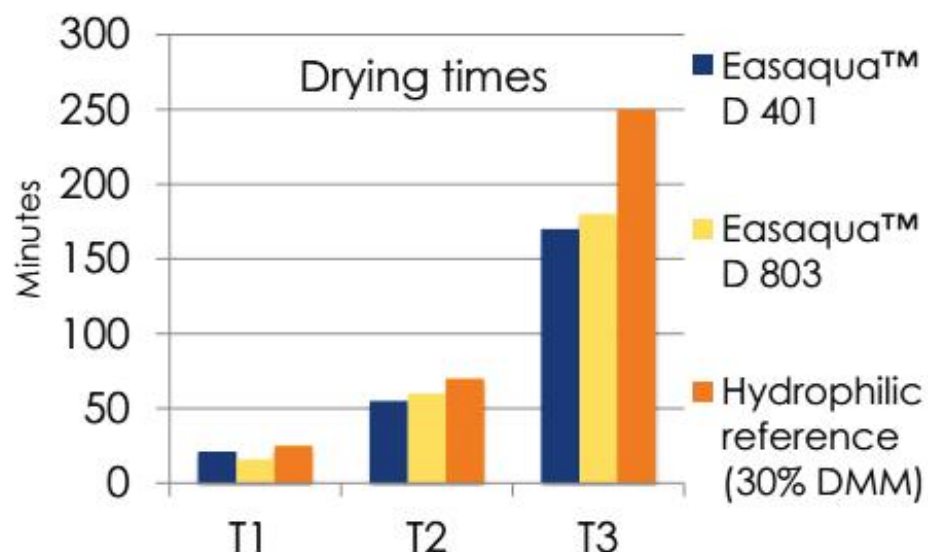
GLOSS at 60° on glass



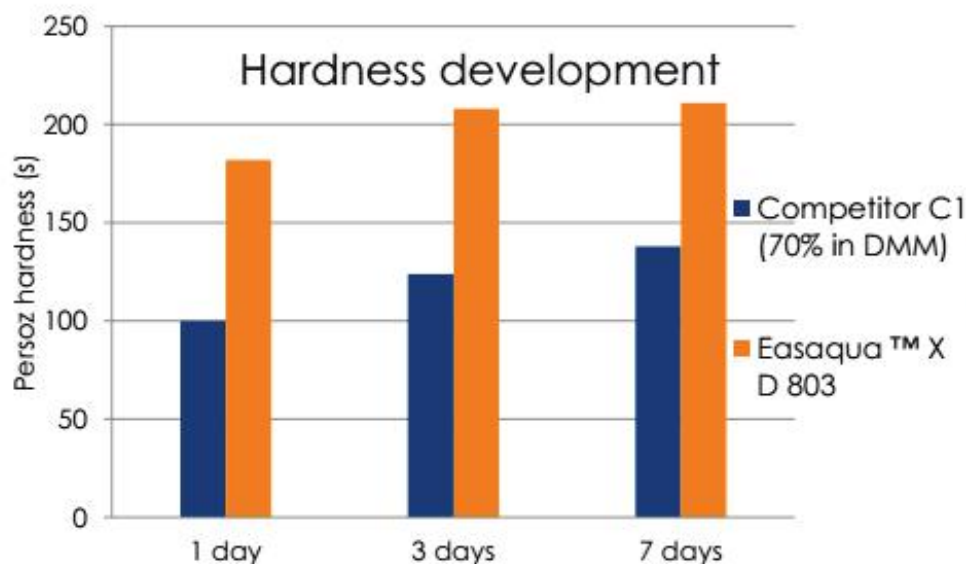
Different **Easaqua™** grades available

Fast drying grades for parquet

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**Fast drying with
our Easaqua 'D'
range**



Easaqua™ X D 803

- ✓ provides better hardness
- ✓ reduces dust contamination
- ✓ improves productivity

Fast drying grades for parquet



Easaqua™ X D 803
Easaqua™ X D 870
(low emission version)



- Fast drying
- Easy incorporation
- Good abrasion resistance



Easy to use

Industrial Wood : Recommendations



**High gloss, fast
drying and long
pot life**

**Easaqua™ X D 401
Easaqua™ X D 803
Easaqua™ X D 870**

**Glossy finishes
and higher
flexibility**

**Easaqua™ L 600
Easaqua™ M 502**

**Primers or matt
finishes**

Easaqua™ M 501



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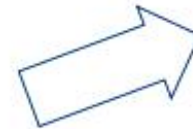
4- FLOORING APPLICATIONS

PU solutions for flooring



Outdoor & On site :

- Balconies
- Parks
- Industrial floors
- Walls...
- Sports flooring



Waterborne PU Concrete flooring



Waterborne PU Wood parquet flooring



Example of Easqua™ end-uses: 2K waterborne coatings for anti graffiti

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Coating of the San Miguel Library (California, USA)
Coatings producer: Steelcoat Products (Universal Resins)
Formulation based on a blend of Easqua™ X M 502 and
X D 401

Example of Easaqua application

Maintenance of buses and trams of TEC company – Charleroi (Belgium)



I want to
be new !!!!

Oh we are so nice thanks to
Easaqua X D 803 !



Example of Easaqua application

Agricultural Equipment, Ireland



Easaqua X D 401 for ACE
(agricultural equipment)
Pigmented topcoat


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Solventborne PU coatings : Tolonate range

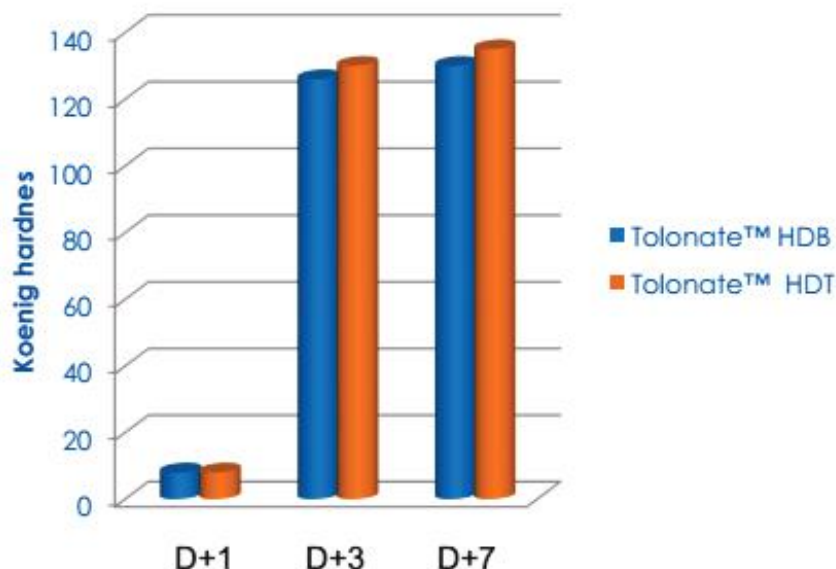


Comparison of HDI derivatives

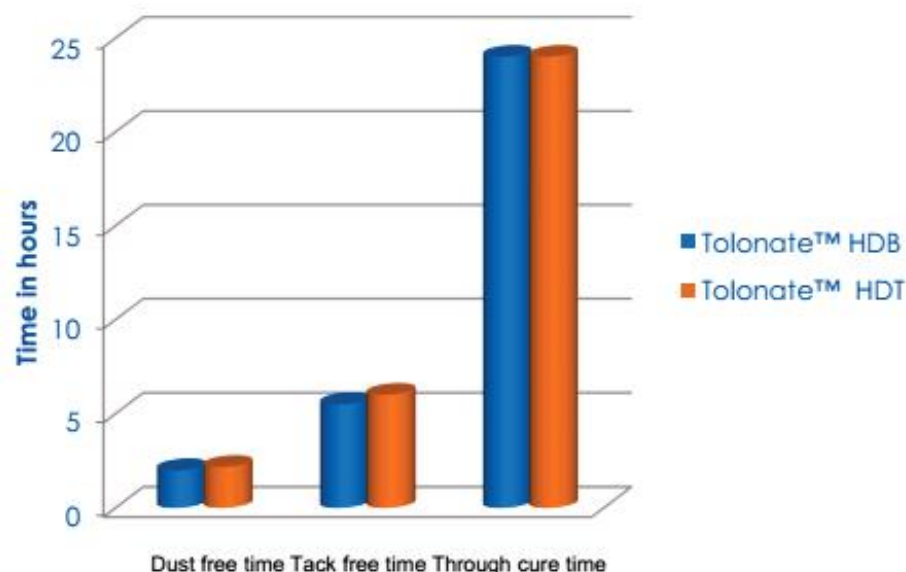


HDI Biuret or HDI Trimer ?

- Many PU formulations are still based on HDI biuret because this is the oldest product of the range (development during 80's)
- The final properties obtained with these two products will be very close:



Koenig hardness : clearcoat based on acrylic polyol 4,5 % OH 50µm DFT



Drying times clearcoats with acrylic polyol 4,5 % OH 50µm DFT

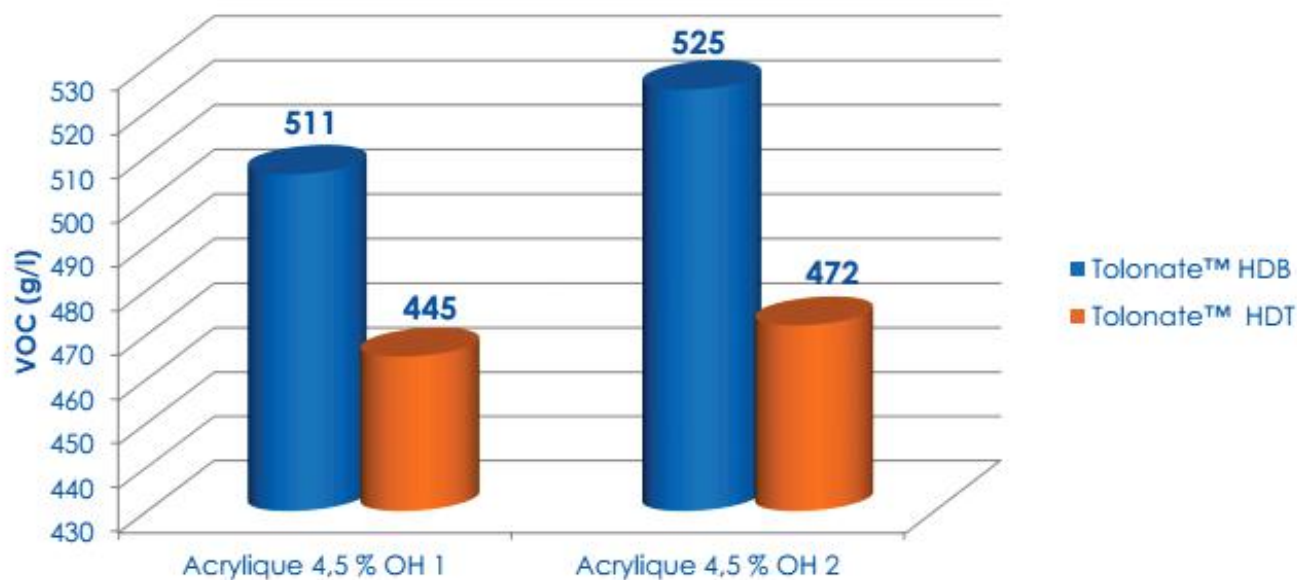


Comparison HDB/HDT



But HDI trimers present some advantages :

- A better **external** durability that makes it as a standard grade for automotive market : OEM and refinish
- A lower viscosity : VOC reduced



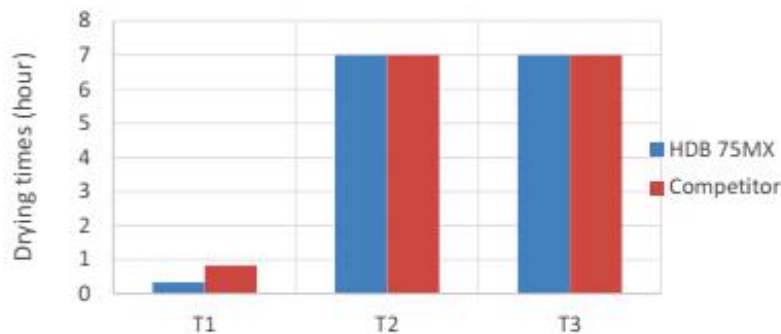
Clearcoats crosslinked at NCO / OH = 1.2

Drying times Tolonate HDB 75 MX

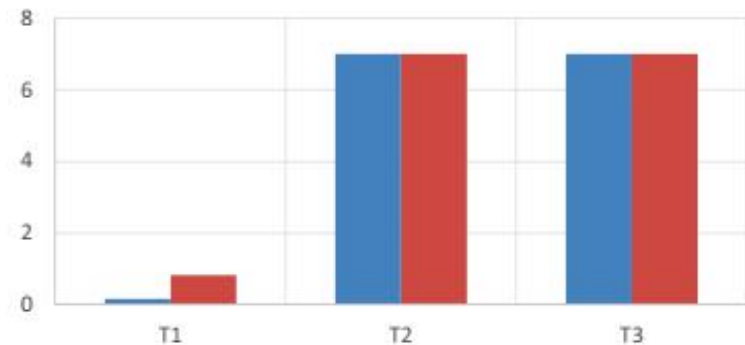


- In comparison with a competitor product Tolonate HDB 75 MX gives similar drying times.
- Tolonate HDB 75 MX can give faster dust free time with standard resins for refinish/GI

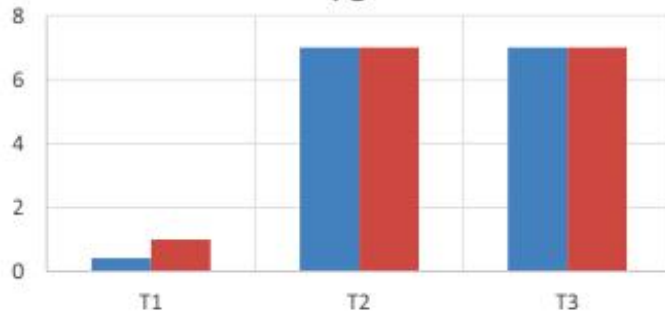
Macrynal SM 540/60X



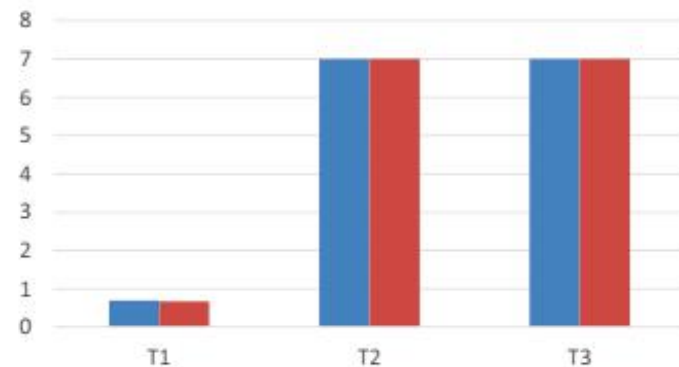
Setalux 1152xx-51/Setalux 1184ss-51



Setalux 1907BA-75/Setal 1603BA-78



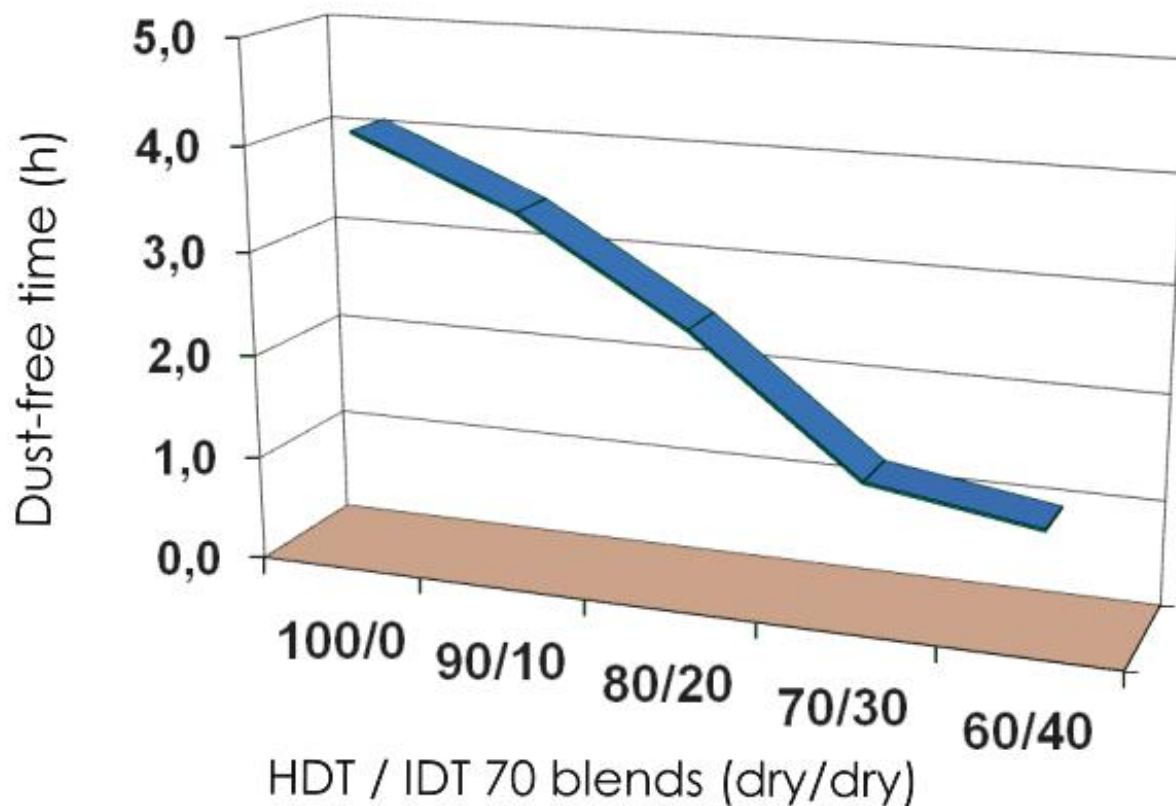
Synocure 851 S 60



Drying time shortened by using Tolonate IDT 70



Influence of Tolonate IDT content on dust-free time:



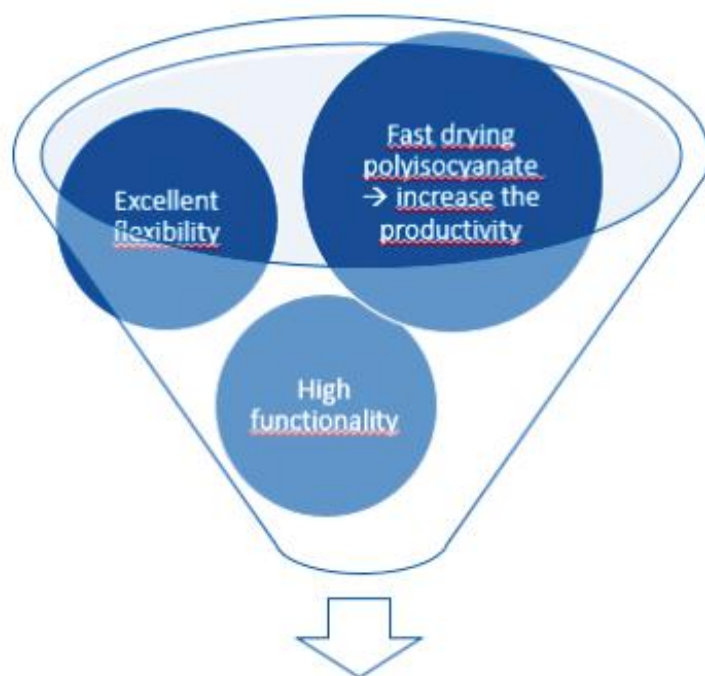
Clear-coat formulation based on Crodaplast 589 BAN (Cray Valley)
OH%: 4.9 - Solids: 75%
NCO/OH=1.05 Catalyst: DBTL = 0.025% (on solids)



Tolodate™ X FD 90B

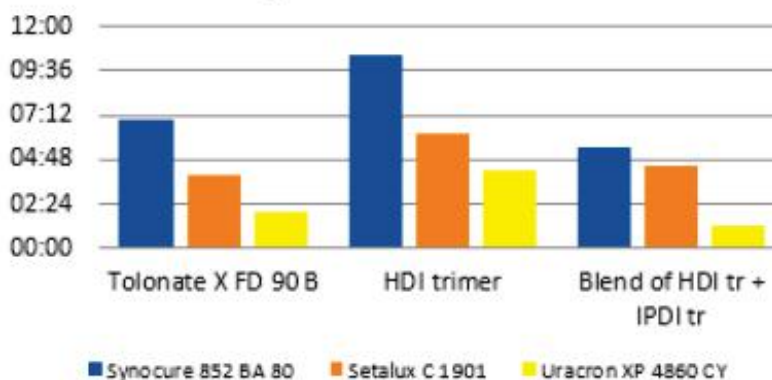


Tolodate™ X FD 90B will bring **Fast Drying** thanks to its high functionality while keeping excellent flexibility.

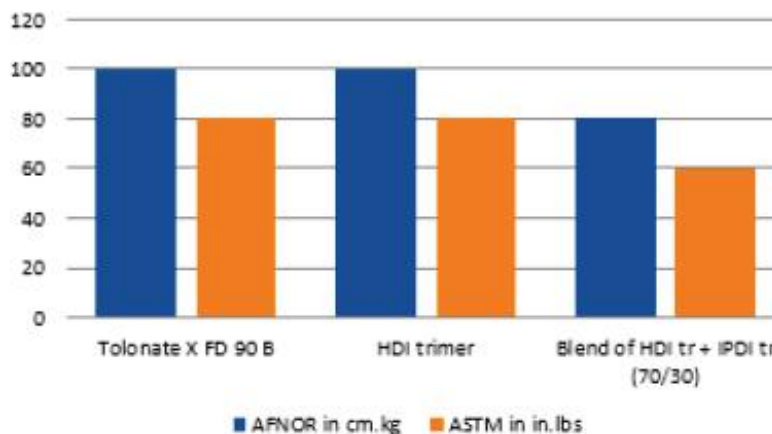


Tolodate™ XFD 90 B

Consequence on dust free time



Consequence on impact resistance





Tolonate™ X FD 90 B : Conclusions

- Faster drying than HDI Trimer
Particularly at low catalyst level and in air drying conditions
- Good chemical resistance right after curing
Thanks to a combination physical drying (slightly higher Tg) and higher crosslinking density (higher functionality)
- Excellent flexibility (equivalent to HDI trimer) : no need to blend Tolonate X FD 90 B with other polyisocyanate
- Excellent weathering resistance

Possible to combine Tolonate XFD 90 B with IDT 70 B to take advantage of the fast drying at the surface (physical drying) and the through drying (chemical drying).



Trends today : The Quest for low VOC's



- VOC are Volatile Organic compounds.
Their reduction is mainly pushed by legislation

EU "Paint Directive" 2004/42/EC defines a VOC as an organic compound having an initial boiling point lower than or equal to 250 °C at an atmospheric pressure of 101.3 kPa.

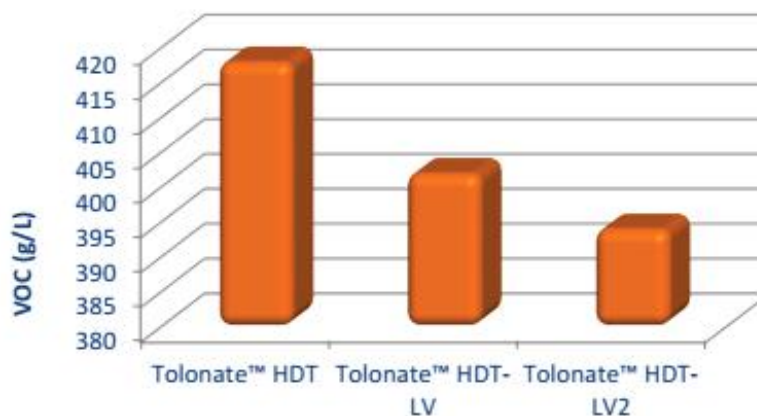
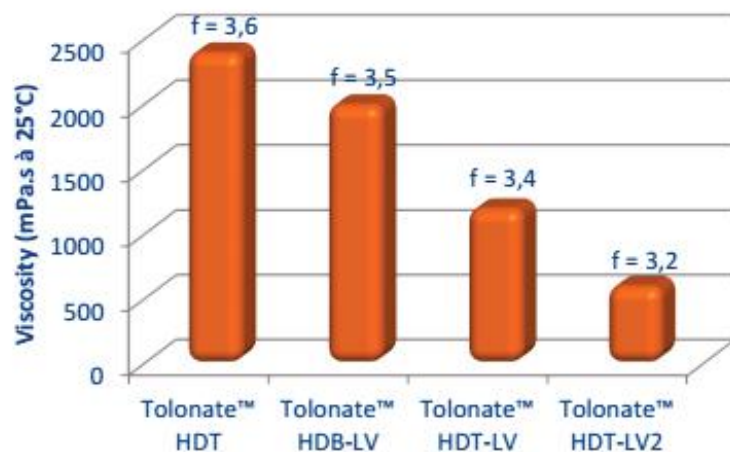
- Solutions

- ✓ High solids systems : reduction of solvents in formulation
- ✓ 100 % systems : no solvent at all, VOC free
- ✓ Low viscosity polyisocyanates as cross-linkers in all cases enable solvent reduction
- ✓ Water borne systems :(solvent is replaced by water)

Tolodate™ technology : Low viscosity range



- Low viscosity Tolodate™ still have a functionality $f > 3$ so they will give similar end-use properties
- The decrease of viscosity has a direct impact on VOC level of the final coatings



Conclusion



Low VOC / high solids PU

- Tolonate™ HDT 100% HDT trimer 2400 mPa.s
- Tolonate™ HDT-LV Low viscosity 100% HDI trimer 1200 mPa.s
- Tolonate™ HDT-LV2 Low viscosity 100% HDI trimer 600 mPa.s
- Tolonate™ HDB-LV Low viscosity 100% HDI Buriel 2000 mPa.s
- Tolonate™ X FLO 100 Extremely low viscosity di-functional HDI polymer



A dynamic splash of water in shades of blue and white, creating a sense of movement and freshness. The water droplets and bubbles are captured in mid-air, adding a lively texture to the background.

Thank you
for your attention!

Any questions??