

# Oxygenated Solvents

Efficiency Meets Responsibility



Indovinya is the global specialty chemical and surfactants division of Indorama Ventures. We are the leading EO producer in the Americas, with operations across 10 countries and 15 manufacturing locations.

Indovinya is rooted in chemistry, powered by people, driven by innovation, and guided by sustainability and community impact.

**#1**  
nonionic surfactants  
producer in the  
Americas

**#1**  
Supplier of Home  
Care Ingredients in  
the Americas

**#1**  
Leading supplier  
in crop solutions in  
the Americas

**AMERICAS**

- Brazil
- Mexico
- USA
- Uruguay


**APAC**

- Australia
- China
- India

**EMEA**

- Belgium

 Industries Units

 R&D and Tech Centers

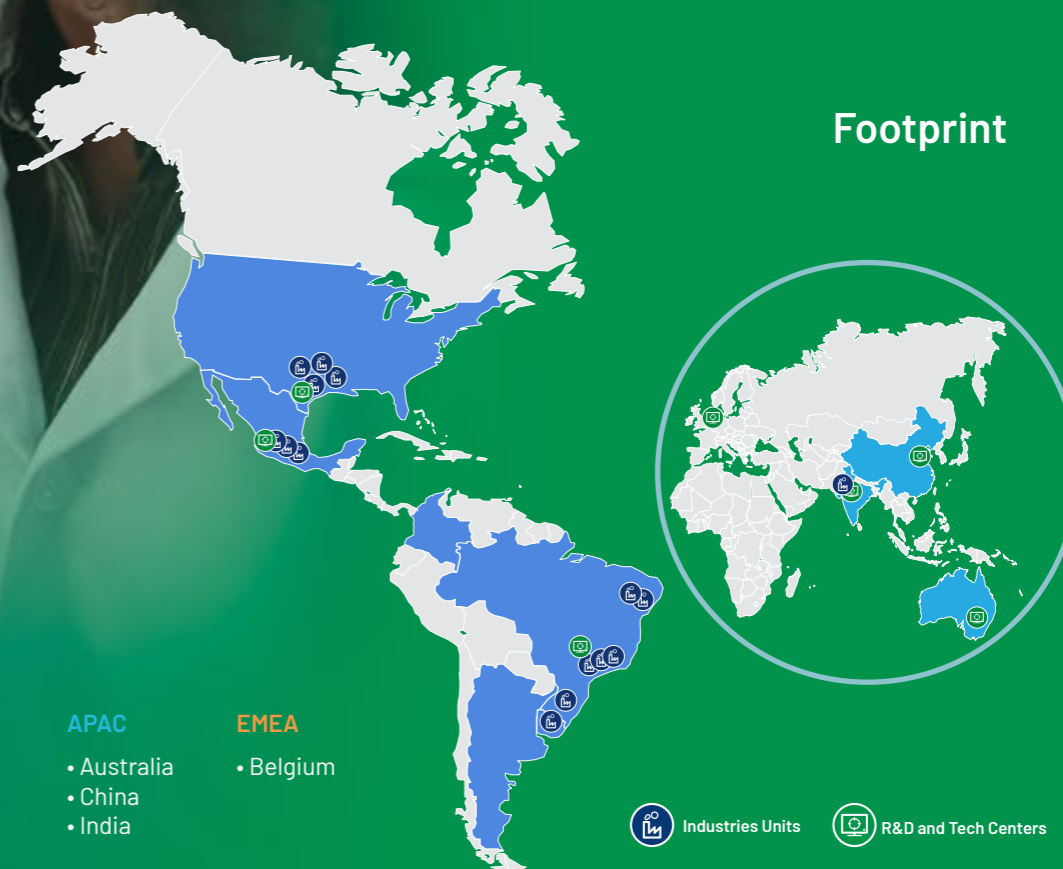
 **15** Industrial Units

 **7** Global R&D Centers

 Presence in **10** Countries

 Approximately **3,000** Employees

**Footprint**



# Oxygenated Solvents for Coatings: Performance, Sustainability, and Formulation Expertise

Oxygenated solvents are a class of organic compounds containing oxygen atoms—typically in the form of alcohols, esters, ketones, or glycol ethers—that offer superior solvency, controlled evaporation, and enhanced compatibility with resin systems. In coatings, they play a critical role in dissolving binders, adjusting viscosity, controlling drying time, and influencing film formation and appearance.

Compared to traditional **aromatic solvents** (such as toluene and xylene) and **hydrocarbons**, oxygenated solvents offer significant advantages in terms of **sustainability, worker safety, and regulatory compliance**. Many oxygenated solvents have **lower toxicity, reduced odor, and lower photochemical reactivity**, contributing to **lower VOC emissions** and improved air quality. These attributes make them ideal for modern formulations that aim to balance performance with environmental responsibility.

At **Indorama Ventures**, we combine advanced chemical design with deep formulation expertise to develop **tailored oxygenated solvent solutions** for a wide range of applications—including **automotive coatings, industrial paints, wood finishes, and printing inks**. Our **ULTRASOLVE® series** includes high-performance solvents with optimized boiling points, evaporation rates, and solubility parameters, enabling formulators to fine-tune drying behavior, film quality, and application efficiency.

The performance tests presented in this brochure—such as **evaporation curves, viscosity behavior, gloss and DOI evaluation, solvent dosage optimization, and LCA comparisons**—are **examples** of what can be achieved. We offer **custom testing and development**, adapting our approach to your specific formulation, resin system, and performance goals.

To accelerate innovation and improve formulation accuracy, we also apply **digital simulation tools and predictive modeling**, including **Hansen Solubility Parameters (HSP)** and **Maximum Incremental Reactivity (MIR)** analysis. These techniques allow us to evaluate solvent-resin compatibility, predict environmental impact, and optimize solvent blends—even when the full composition of the system is unknown.

With a science-driven approach, sustainable technologies, and flexible development capabilities, Indorama Ventures is your strategic partner in designing next-generation oxygenated solvents for coatings that perform, protect, and comply.

## Oxygenated Solvents Benefits

- High solvency power
- Excellent film formation and coating finish
- High efficiency as a tail solvent for Industrial Coatings
- Balanced evaporation rate that avoid damages on the coating
- Low hazard in GHS classification, low odor and low toxicity
- Enables excellent color stability on the final paint
- Range of products to serve different segments, such as automotive, industrial paints, protective coatings, wood and printing inks (rotogravure and flexography)

## Propyl Derivatives

### Propanol derivative oxygenated solvents

Products	Description	Hansen Solubility Parameters (MPa <sup>1/2</sup> cm <sup>3</sup> mol <sup>-1</sup> )			Physico-Chemical Properties		
		ΔD	ΔP	ΔH	Density (g/cm <sup>3</sup> )	Boiling Point 760 MmHg (°C)	Evaporation Rate (Butyl Acetate = 100)
ULTRASOLVE® H 2400	Propylglycol	16.1	8.7	13.5	0.913	151.0	17.0
ULTRASOLVE® H 2440	Propylglycol	16.0	7.2	11.3	0.969	215.0	0.6
ULTRASOLVE® H 2300	Propylglycol Acetate	16.0	5.0	6.2	0.940	174.0	8.0
ULTRASOLVE® M 2200	Propyl Acetate	15.3	4.3	7.6	0.889	101.6	209.0

Products	Application	Function		
		Active Solvent	Tail Solvent	Coupling Agent
ULTRASOLVE® H 2400	Printing Inks (flexography) and Industrial coatings	●	●	●
ULTRASOLVE® H 2440	Industrial coatings	●	●	●
ULTRASOLVE® H 2300	Automotive and Industrial coatings	●		
ULTRASOLVE® M 2200	Printing Inks (rotogravure and flexography) and Industrial coatings	●		



# Performance Tests

## Solvent Dosage Optimization



Determining the optimal solvent concentration ensures maximum performance with minimal environmental impact. It balances solvency power, drying time, and application properties, helping formulators achieve cost-effective and efficient paint systems.

ULTRASOLVE® H LINE		Recommended dosage (wt %) in the formulation versus typical solvents*				
		PMA	PM	PE	DPM	DPNB
ULTRASOLVE® H 2300	Propylglycol Acetate	50%				
ULTRASOLVE® H 2400	Propylglycol		50%	60%		
ULTRASOLVE® H 2440	Propyldiglycol				70%	80%

\*e.g.: ULTRASOLVE® H 2440 should be dosed at 70% wt versus DPM dosage, reducing the dosage of active solvent in the formulation by 30%.

**PM:** Propylene glycol monomethyl ether  
**PMA:** Propylene glycol monomethyl ether acetate  
**PE:** Propylene glycol monoethyl ether  
**DPM:** Dipropylene glycol monomethyl ether  
**DPNB:** Dipropylene glycol mono-n-butyl ether

The high solvency power of **ULTRASOLVE® H** enables the dosage reduction of active solvent in the formulation, promoting cost saving.



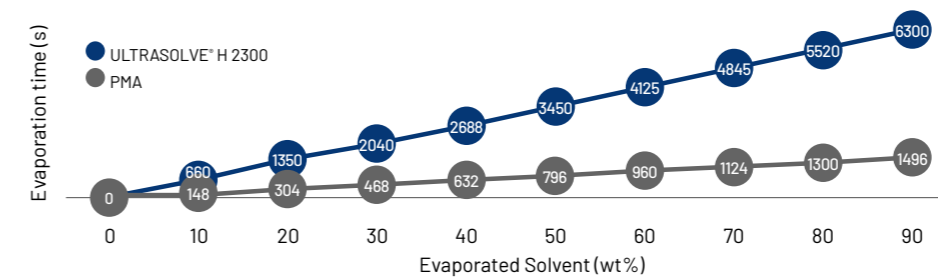
# Performance Tests

## Evaporation Curves

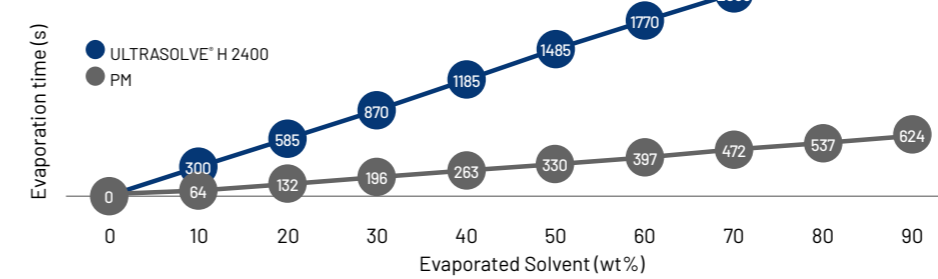


Evaporation profiles reveal how solvents evaporate over time, influencing drying behavior, film formation, and application performance. A well-balanced evaporation curve ensures smooth application and optimal finish.

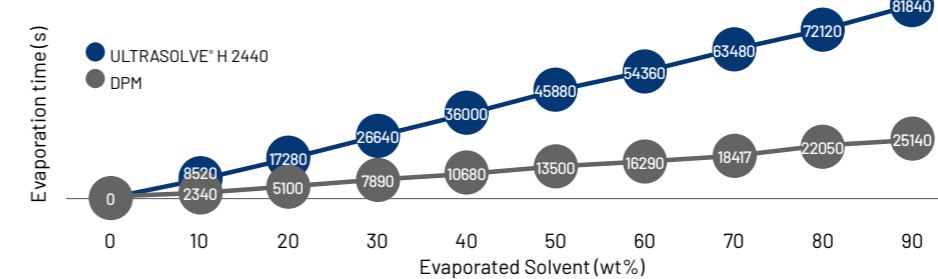
**ULTRASOLVE® H 2300**  
25 °C, 65% RELATIVE HUMIDITY



**ULTRASOLVE® H 2400**  
TAIL SOLVENTS, 25 °C, 65% RELATIVE HUMIDITY



**ULTRASOLVE® H 2440**  
TAIL SOLVENTS, 25 °C, 65% RELATIVE HUMIDITY



Slow-evaporating solvents ensure improved leveling, flow, and film formation, while also providing extended working time.

# Performance Tests

## Thinner formulation for automotive basecoat

### Viscosity after Dilution



Measuring viscosity after dilution helps predict how the paint will behave during application. It ensures compatibility between the solvent and resin system, maintaining flow, leveling, and sprayability.

Composition (wt%)	Formulation 1 ULTRASOLVE® H 2300	Formulation 2 PMA
ULTRASOLVE® H 2300	5.5%	
Sec-Butyl Acetate	44.5%	40.0%
PMA		11.0%
Xylol	50.0%	49.0%
<b>Total</b>	<b>100%</b>	<b>100%</b>

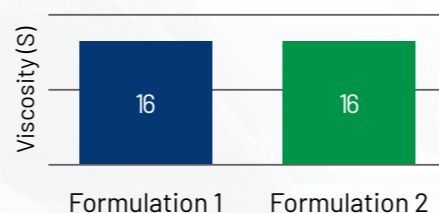
Physico-Chemical Properties	Formulation 1 ULTRASOLVE® H 2300	Formulation 2 PMA
<b>Solubility parameters (J/cm<sup>3</sup>)<sup>1/2</sup></b>		
Delta D	16.4	16.4
Delta P	2.4	2.6
Delta H	4.7	5.1
<b>Evaporation Rate (Butyl Acetate = 100)</b>	<b>96</b>	<b>93</b>

**Delta D** = Dispersion Energy  
**Delta P** = Polar Energy  
**Delta H** = Hydrogen Bond Energy

**30% Thinner**

**70% Basecoat**  
Poliester-based – Silver Color

VISCOSITY CF4, 25 °C



## Thinner formulation for automotive basecoat

### Color, Gloss and Image Quality



These parameters reflect the visual and aesthetic quality of the final coating. High gloss, low haze, and excellent DOI (Distinctness of Image) indicate a smooth, mirror-like surface—critical for premium finishes.

	COLOR				GLOSS			IQ	
	ΔL*	Δa*	Δb*	ΔE*	20°	60°	85°	DOI	HAZE
<b>Formulation 1 ULTRASOLVE® H 2300</b>	0.09	0.01	-0.01	0.06	96	104	98	92	12
<b>Formulation 2 PMA</b>	0.09	0.01	-0.01	0.10	94	103	97	90	12

#### Test conditions

- Coating System applied on carbon steel with air drying:  
**1<sup>st</sup> Layer:** Wash Primer  
**2<sup>nd</sup> Layer after 15 minutes:** Primer surface  
**3<sup>rd</sup> Layer after 24 hours:** Basecoat  
**4<sup>th</sup> Layer after 30 minutes:** Varnish
- Color Determination measured on the Spectrophotometer.
- Brightness determination measured on the Brightness Meter.
- DOI / HAZE determination measured on the Goniophotometer.

It is possible to **replace the active solvent** in the automotive thinner, for example PMA **up to 50%** in the formulation, maintaining the same evaporation rate, solubility parameters and desired properties in the final application, which makes the **formulation competitive!**



# Performance Tests

## Printing Inks – Flexographic Thinners

### Performance of Thinner Formulation



Evaluating thinner performance in flexographic inks ensures proper viscosity control, print quality, and drying speed. It's essential for maintaining sharpness, color strength, and press stability.

Thinners Formulation	Formulation 1 ULTRASOLVE® H 2400	Formulation 2 PM
<b>ULTRASOLVE® H 2400</b>	6.0%	
PM		15.0%
Ethyl Acetate	15.0%	15.0%
Ethanol	60.0%	55.0%
Isopropanol	19.0%	15.0%
<b>Total</b>	<b>100%</b>	<b>100%</b>

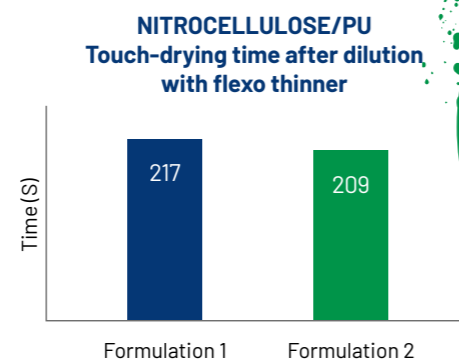
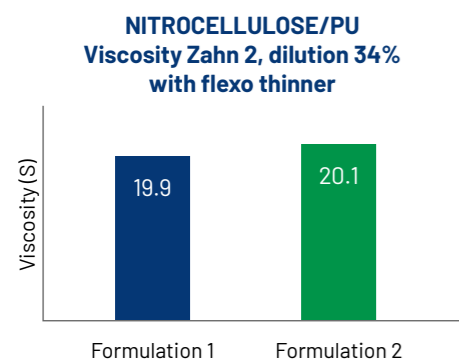
#### Thinners Physico-Chemical Properties

Evaporation Time 90%, 25°C - (s)	63	64
Evaporation Rate (Butyl Acetate = 100)	157	154

### Performance of thinner formulation in flexographic ink dilution



Viscosity and touch-drying time of magenta-colored nitrocellulose/polyurethane flexo ink after dilution with thinner to obtain viscosity at 20 s in a Zahn 2 cup.



It is possible to **replace the active retarding solvent in the formulation by up to 50%**. For example, compared to PM, **optimizing the evaporation rate** and the quality of the final print.

### Recommended formulations

Suggestive formulation for printing inks with **ULTRASOLVE® M 2200**

Composition	Formulation 1	Formulation 2	Formulation 3
	PM	ULTRASOLVE® H 2400	ULTRASOLVE® M 2200
Anhydrous Ethanol	57%	60%	50%
N-Propanol	-	-	30%
ULTRASOLVE® M 2200	-	-	20%
Ethyl Acetate	17%	15%	-
Isopropanol	18%	19%	-
ULTRASOLVE® H 2400	-	6%	-
PM	8%	-	-
<b>Total</b>	<b>100%</b>	<b>100%</b>	<b>100%</b>

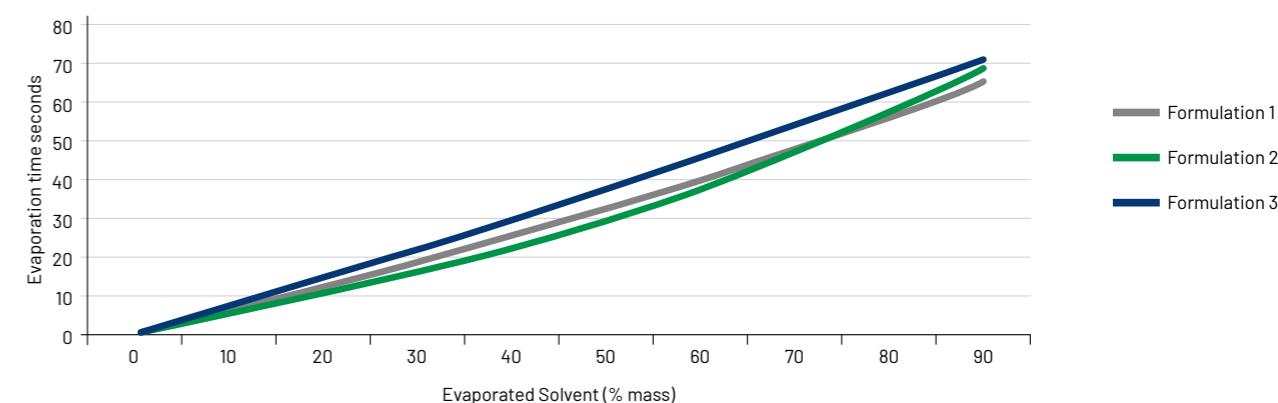
### Evaporation Curves



Comparing evaporation behavior across thinner blends helps tailor formulations for specific application methods and drying requirements, ensuring consistent performance across different systems.

#### Evaporation curves for different thinners

Evaporation Curve, 25 °C, 65% RH

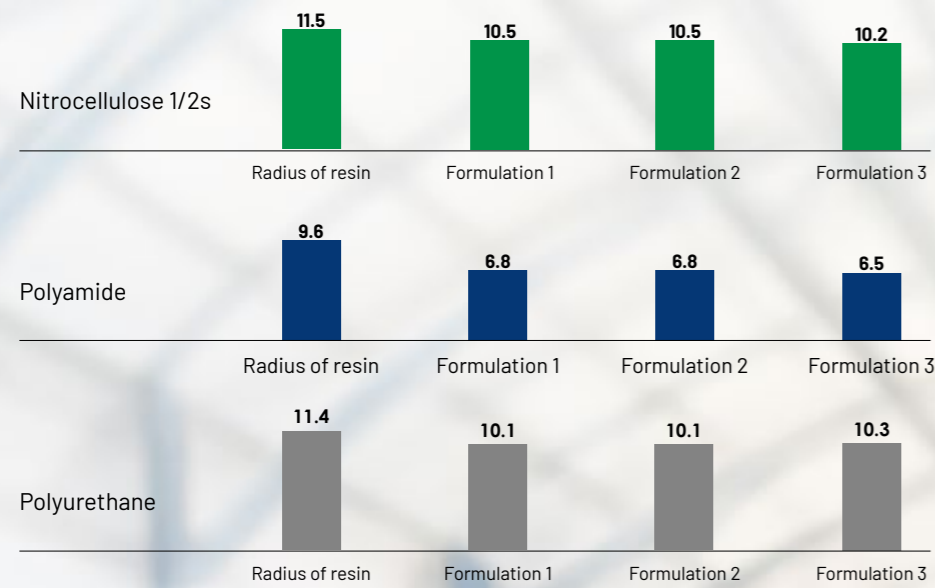


# Performance Tests

## Hansen Solubility Parameters



These parameters predict solvent-polymer compatibility. By matching solubility profiles, formulators can select solvents that dissolve resins effectively, improving stability, clarity, and performance.



**ULTRASOLVE® M 2200** support the **balance of evaporation** rate of paints during flexographic and rotogravure processes, in addition to presenting **excellent compatibility** with the main resins used in these systems.

# Performance Tests

## Wood varnish formulation

### ULTRASOLVE® H as coupling agent

	Water-Based Varnish Standard (wT %)	Water-Based Varnish With ULTRASOLVE® H (wT %)
Water soluble acrylic resin	90	90
DPM solvent	3.7	-
PnB solvent	3.7	-
ULTRASOLVE® H 2400	-	5.9
ULTRASOLVE® H 2440	-	1.5
Surface Additives	2	2
UV absorber	0.6	0.6
	100%	100%

PnB: Propylene Glycol n-Butyl Ether

### Hansen Solubility Parameters (J/cm<sup>3</sup>)<sup>1/2</sup>

	Water-Based Varnish Standard (wT %)	Water-Based Varnish With ULTRASOLVE® H (wT %)
Delta D	15.4	16.1
Delta P	5.1	8.4
Delta H	10.2	13.1

### Relative Energy Difference

Acrylic resin	0.8	0.7
---------------	-----	-----

**Delta D** = Dispersion Energy

**Delta P** = Polar Energy

**Delta H** = Hydrogen Bond Energy

# Performance Tests

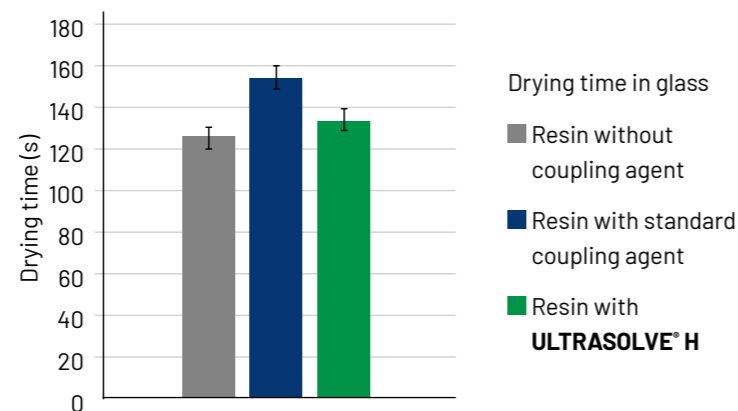
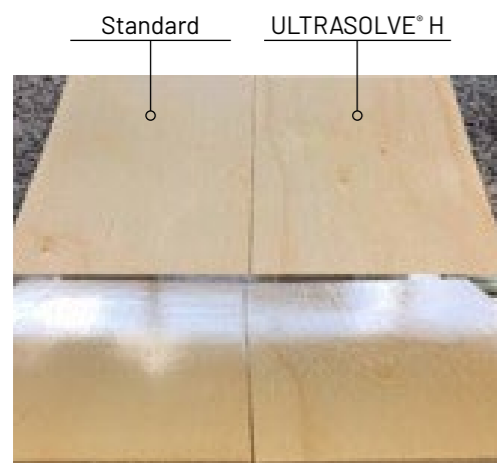
Wood varnish formulation

ULTRASOLVE® H as coupling agent



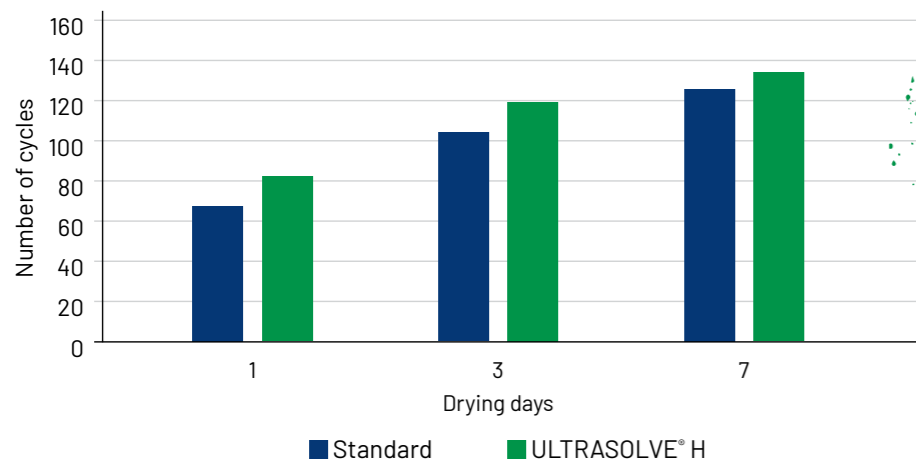
## Initial Touch-Drying Time

This measures how quickly the surface becomes dry to the touch. Faster touch-dry times improve productivity and reduce the risk of dust contamination, especially in high-throughput environments.



## König Hardness Evolution

Tracking hardness over time provides insights into film curing and durability. Higher König values indicate better resistance to scratching and mechanical wear, essential for long-lasting coatings.



**ULTRASOLVE® H 2440** as Coupling Agent provide **excellent appearance and good hardness** evolution, guaranteeing good **mechanical resistance** to the film. Shorter drying time, allowing shorter intervals between coats without impact performance.

ULTRASOLVE® M 1200 - Sec-Butyl Acetate

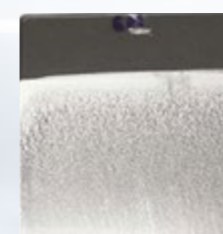
# Original Automotive Paints

LCA study: comparison of original automotive paint with different diluents

The study example relates to the life cycle assessment of a solvent-based technology automotive paint (base coat) diluted by both a diluent A and a diluent B. The diluent for the automotive base coat guarantees the performance in the application and the proper finishing of the vehicle paint, in addition to being used in the cleaning of pipes and equipment of the paint system in the automotive industry. As shown in the Table below, diluents A and B are composed of a mixture of solvents containing natural alcohol esters (isoamyl acetate, sugarcane derivative) or esters of synthetic alcohols (sec-butyl acetate) or aromatic solvent (xylene).

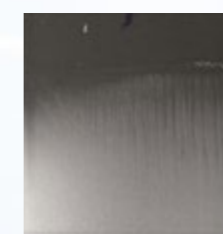
Component	Diluent A (% mass)	Diluent B (% mass)
Xylol	55	0
ULTRASOLVE® L 1100 - Sec-Butyl Alcohol	10	0
ULTRASOLVE® M 1200 - Sec-Butyl Acetate	35	68
Isoamyl Acetate	0	32
<b>Total</b>	<b>100</b>	<b>100</b>

DILUENT A



Decreased cleaning efficiency

DILUENT B



Increased cleaning efficiency

Laboratory simulation of the cleaning of paint impregnated on a glass plate.

The test results indicated that the volume of solvent required for the total cleaning of the glass plate was twice lower for diluent B. The superior yield of diluent B was also proven on an industrial scale at the vehicle manufacturer.

# Sec-Butyl Acetate

## Original Automotive Paints

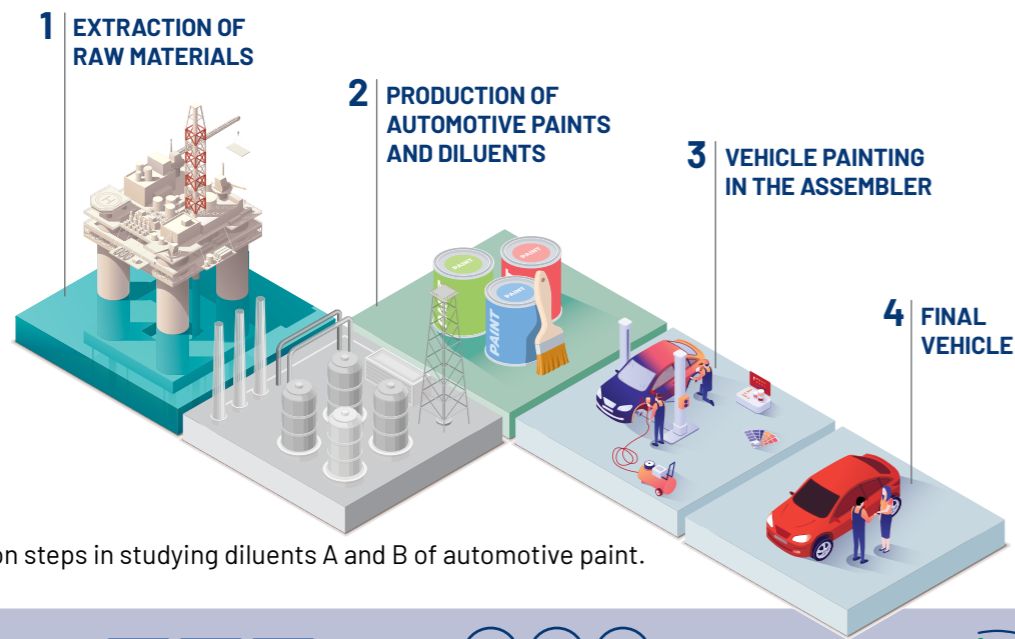
### LCA study: comparison of original automotive paint with different diluents

**Product systems:** comparison of diluents A and B used for paint dilution and cleaning of pipes and equipment in paint lines at the vehicle assembler.

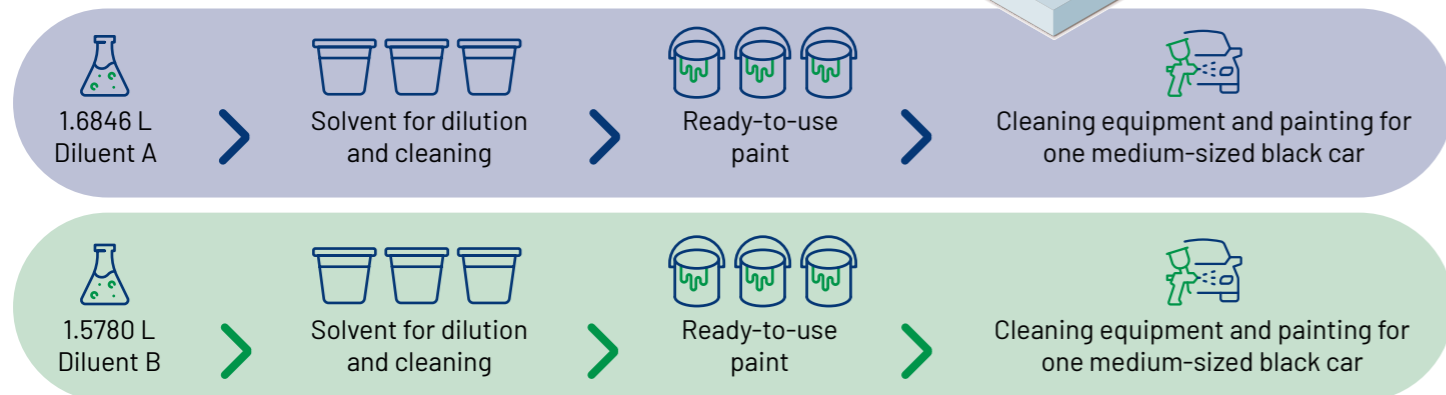
**Function:** dilution of basecoat and cleaning of equipment and pipelines.

**Functional unit:** the amount of diluent for diluting the basecoat and cleaning equipment and pipes for painting a medium-sized black car.

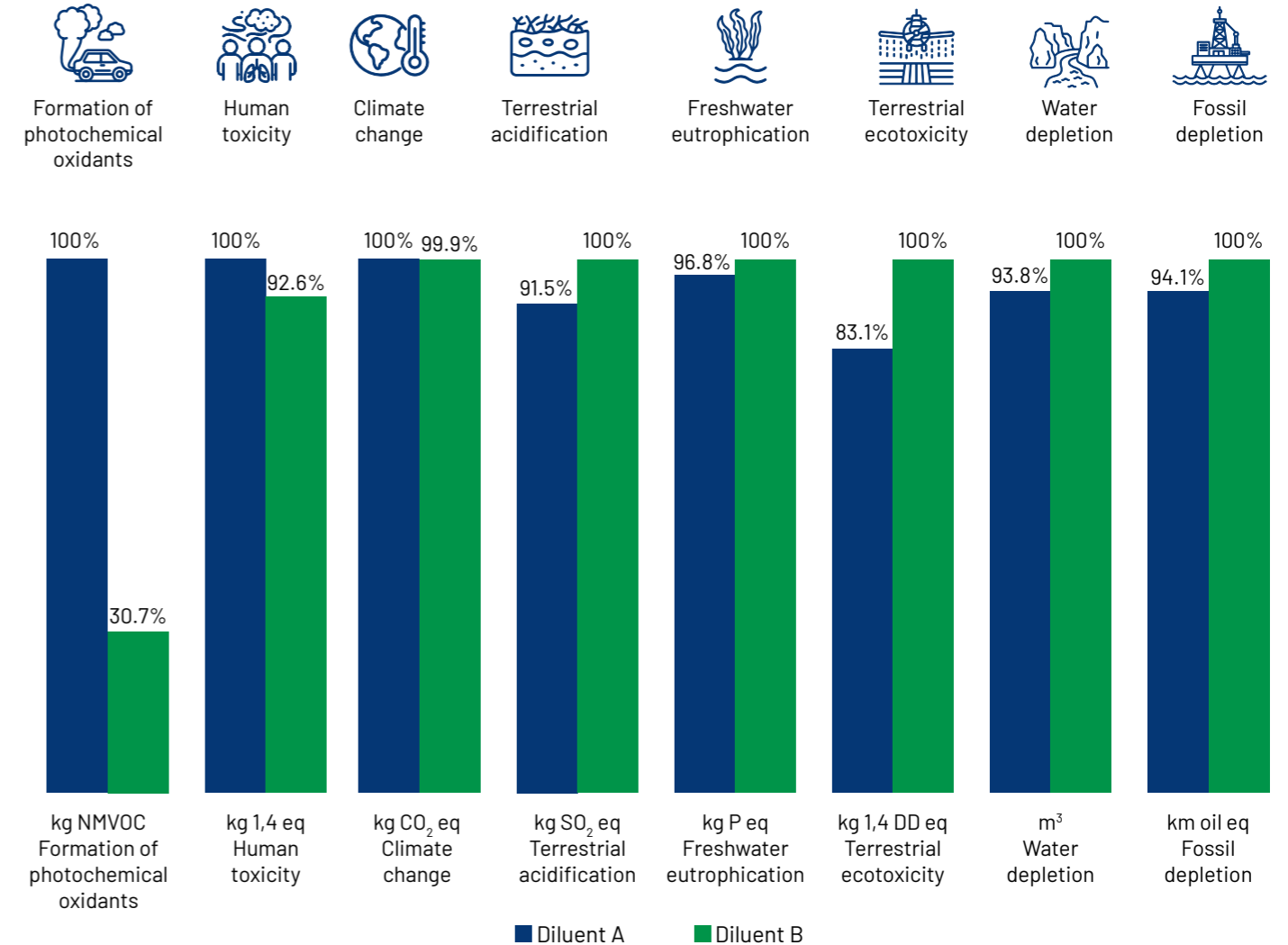
### Technical performance coefficient.



LCA: evaluation steps in studying diluents A and B of automotive paint.



### Environmental impact categories.



Comparison of environmental performance between different formulations of solvents for the purpose of a painted car, used in Brazil, normalized data.

**Diluent B has less impact on the environment because its use causes less photo-oxidant formation and less human toxicity.**

The green lines represent Indorama Ventures' products.

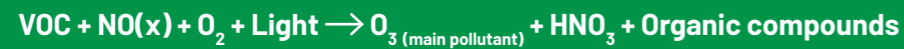
SOLVENTS	Formula	Molecular weight (g/mol)	CAS N°	Density (g/cm <sup>3</sup> )	Boiling point at 760mmHg (°C)	Evaporation rate (butyl acetate =100)	Hansen solubility parameters (J/cm <sup>3</sup> ) <sup>1/2</sup>			Viscosity (10% Nitrocellulose 1/2s solution, 25 °C) (cP)	Dilution rate			Blushing resistance at 25 °C (% U.R.)	Solubility at 20 °C (% weight)		Distillation range at 760 mmHg (°C)	Freezing point (°C)	Flash point (closed Cup) (°C)
							d D	d P	d H		Toluene	Xylene	Naphta		Solvent in water	Water in solvent			
Acetone	CH <sub>3</sub> COCH <sub>3</sub>	58.08	67-64-1	0.792	56.1	560	15.5	10.4	7.0	12	4.5	--	0.7	20	100	100	56 - 57	-94.9	-17
Diacetonalcohol	CH <sub>3</sub> COCH <sub>2</sub> C(CH <sub>3</sub> ) <sub>2</sub> OH	116.16	123-42-2	0.939	169.2	12	15.8	8.2	10.8	295	3.0	2.3	0.5	76	100	100	155-175	-42.8	45.0
Diisobutylketone	(CH <sub>3</sub> ) <sub>2</sub> CHCH <sub>2</sub> COCH <sub>2</sub> CH(CH <sub>3</sub> ) <sub>2</sub>	142.24	108-83-8	0.808	169.3	19	16.0	3.7	4.1	148	1.5	1.5	0.8	95	0.05	0.70	163-173	-41.5	49.0
Isophorone	COCH=C(CH <sub>3</sub> )CH <sub>2</sub> C(CH <sub>3</sub> ) <sub>2</sub> CH <sub>2</sub>	138.20	78-59-1	0.922	215.2	2	17.0	8.0	5.0	220	6.2	5.1	0.3	97	1.20	4.30	215-220	-8.1	84.4
Methyl Amyl Ketone	CH <sub>3</sub> COC <sub>5</sub> H <sub>11</sub>	114.18	110-43-0	0.818	151.4	33	16.2	5.7	4.1	40	3.9	3.6	1.2	93	0.50	1.30	147 - 153	-27.0	39.0
Methyl Ethyl Ketone	CH <sub>3</sub> COC <sub>2</sub> H <sub>5</sub>	72.10	78-93-3	0.806	79.6	390	16.0	9.0	5.1	20	4.3	--	0.9	45	27.00	12.50	78-81	-86.7	-5
Methyl Isoamyl Ketone	CH <sub>3</sub> COC <sub>2</sub> H <sub>4</sub> CH(CH <sub>3</sub> ) <sub>2</sub>	114.18	110-12-3	0.814	144.9	53	16.0	5.7	4.1	42	4.1	--	1.2	89	0.50	1.20	141-148	-73.9	36.0
<b>Alcohols</b>																			
n-Butanol	C <sub>4</sub> H <sub>9</sub> OH	74.12	71-36-3	0.811	117.7	46	16.0	5.7	15.8	Insoluble	--	--	--	--	7.90	20.10	116.5-118.5	-89.0	35.0
Ethanol	C <sub>2</sub> H <sub>5</sub> OH	46.07	64-17-5	0.791	78.3	165	15.8	8.8	19.4	Insoluble	--	--	--	--	100	100	78.3-78.5	-114.1	12.78
Isoamyl alcohol	(CH <sub>3</sub> ) <sub>2</sub> CHCH <sub>2</sub> CH <sub>2</sub> OH	88.15	123-51-3	0.812	131.4	20	15.8	5.2	13.3	Insoluble	--	--	--	--	1.70	9.50	120 - 138	-117.2	42.7
Isopropanol	(CH <sub>3</sub> ) <sub>2</sub> CHOH	60.09	67-63-0	0.786	82.4	150	15.8	6.1	16.4	Insoluble	--	--	--	--	100	100	81.5-83.0	-89.5	12.0
Methanol	CH <sub>3</sub> OH	32.04	67-56-1	0.793	64.5	210	14.7	12.3	22.3	25	2.2	--	0.5	--	100	100	64-65	-97.8	11.1
n-Propanol	CH <sub>3</sub> CH <sub>2</sub> CH <sub>2</sub> OH	60.09	71-23-8	0.805	97.2	89	16.0	6.8	17.4	Insoluble	--	--	--	--	100	100	96-98	-127.0	15.0
s-Butanol/ <b>ULTRASOLVE<sup>®</sup> L 1100</b>	CH <sub>3</sub> CHOHCH <sub>2</sub> CH <sub>3</sub>	74.12	78-92-2	0.808	99.5	89.7	15.8	5.7	14.5	Insoluble	--	--	--	--	60.00	22.50	98 -101	-114.7	23.9
<b>Esters</b>																			
n-Butyl acetate	CH <sub>3</sub> COOC <sub>4</sub> H <sub>9</sub>	116.16	123-86-4	0.883	126.1	100	15.8	3.7	6.3	49	2.7	2.7	1.4	83	0.70	1.60	124-127	-73.5	22.2
Butylglycol Acetate	CH <sub>3</sub> COOC <sub>2</sub> H <sub>4</sub> OC <sub>4</sub> H <sub>9</sub>	160.22	112-07-2	0.942	191.6	3.7	15.3	7.5	6.8	188	1.8	--	1.2	96	1.50	1.70	186 - 194	-64.6	74
Ethyl Acetate	CH <sub>3</sub> COOC <sub>2</sub> H <sub>5</sub>	88.10	141-78-6	0.901	77.2	400	15.8	5.3	7.2	36	3.1	--	1.1	39	8.70	3.30	75.5 - 78.0	-83.6	-3
Ethylglycol Acetate	CH <sub>3</sub> COOC <sub>2</sub> H <sub>4</sub> OC <sub>2</sub> H <sub>5</sub>	132.16	111-15-9	0.974	156.3	19	15.9	4.7	10.6	130	2.5	2.3	0.9	94	23.80	6.50	150-160	-61.7	52
Isobutyl Acetate	CH <sub>3</sub> COOCH <sub>2</sub> CH(CH <sub>3</sub> ) <sub>2</sub>	116.16	110-19-0	0.873	117.2	145	15.1	3.7	6.3	42	2.7	--	1.1	80	0.70	1.60	116-119	-99.8	21
Isoamyl Acetate	CH <sub>3</sub> COOC <sub>5</sub> H <sub>11</sub>	130.19	123-92-2	0.875	142.0	53	15.3	3.7	6.9	65	2.3	--	1.3	91	0.20	0.90	139 - 144	-100.0	34
n-Propyl acetate/ <b>ULTRASOLVE<sup>®</sup> M 2200</b>	CH <sub>3</sub> COOC <sub>3</sub> H <sub>7</sub>	102.14	109-60-4	0.889	101.6	209	15.3	4.3	7.6	38	3.2	--	1.5	65	2.30	2.60	99-103	-92.5	14
Propylglycol Acetate/ <b>ULTRASOLVE<sup>®</sup> H 2300</b>	CH <sub>3</sub> COOC <sub>2</sub> H <sub>4</sub> OC <sub>3</sub> H <sub>7</sub>	146.18	20706-25-6	0.94	173.6	8	16.0	5.0	6.2	158	--	--	--	95	5.0	--	--	-47.8	66.3
s-Butyl acetate/ <b>ULTRASOLVE<sup>®</sup> M 1200</b>	CH <sub>3</sub> COOCH(CH <sub>3</sub> )CH <sub>2</sub> CH <sub>3</sub>	116.16	105-46-4	0.875	112.0	195	15.1	3.7	6.3	63	2.9	--	--	--	2.00	2.60	--	-99.0	17
Propylene Glycol Methyl Ether Acetate	CH <sub>3</sub> COOCH(CH <sub>2</sub> ) <sub>2</sub> OCH <sub>3</sub>	132.20	108-65-6	0.968	145.8	33	15.6	5.6	9.8	180	2.5	--	0.4	87	19.80	3.21	140-150	-66.0	47
<b>Glycolic Ethers</b>																			
Butylglycol	C <sub>4</sub> H <sub>9</sub> OC <sub>2</sub> H <sub>4</sub> OH	118.18	111-76-2	0.902	171.2	7	16.0	5.1	12.3	220	3.4	3.2	2.1	96	100	100	168-172	-70.0	65.5
Butyldiglycol	C <sub>8</sub> H <sub>17</sub> (OC <sub>2</sub> H <sub>4</sub> ) <sub>2</sub> OH	162.22	112-34-5	0.956	230.6	<1	16.0	7.0	10.6	510	3.9	4.2	1.9	85	100	100	223-235	-68.1	105
Methyl Dipropylene Glycol Ether	CH <sub>3</sub> O[CH <sub>2</sub> CH(CH <sub>2</sub> ) <sub>2</sub> O] <sub>2</sub> H	148.12	34590-94-8	0.951	188.3	2	16.1	6.7	10.4	530	3.4	--	0.8	90	100	100	184-193	-82.7	75
Methyl Propylene Glycol Ether	CH <sub>3</sub> OCH <sub>2</sub> CHOHCH <sub>3</sub>	90.12	107-98-2	0.923	120.1	71	15.6	6.3	11.6	187	4.0	--	0.9	61	100	100	117-125	-96.6	32
Ethyldiglycol	C <sub>4</sub> H <sub>9</sub> (OC <sub>2</sub> H <sub>4</sub> ) <sub>2</sub> OH	134.17	111-90-0	0.990	202.7	<1	16.1	9.2	12.2	376	1.9	1.2	0.2	76	100	100	196-207	-76.0	91
Ethylglycol	C <sub>2</sub> H <sub>5</sub> OC <sub>2</sub> H <sub>4</sub> OH	90.12	110-80-5	0.931	135.1	35	15.9	7.2	14.0	143	4.9	4.3	1.1	59	100	100	134-137	-76.0	43
Ethyltriglycol	C <sub>2</sub> H <sub>5</sub> (OC <sub>2</sub> H <sub>4</sub> ) <sub>3</sub> OH	178.2	112-50-5	1.023	256.0	<1	16.2	7.1	10.8	--	--	--	--	100	100	--	-19	129	
Methyldiglycol	CH <sub>3</sub> (OC <sub>2</sub> H <sub>4</sub> ) <sub>2</sub> OH	120.15	111-77-3	1.028	194.2	2	16.2	7.8	12.6	371	2.3	1.0	--	76	100	100	188-198	-85.0	83
Propylglycol/ <b>ULTRASOLVE<sup>®</sup> H 2400</b>	C <sub>3</sub> H <sub>7</sub> OC <sub>2</sub> H <sub>4</sub> OH	104.15	2807-30-9	0.913	151.1	20	16.1	8.7	13.5	181	4.0	--	2.0	90	100	100	149.5-153.5	-90	57.2
Propyldiglycol/ <b>ULTRASOLVE<sup>®</sup> H 2440</b>	C <sub>3</sub> H <sub>7</sub> (OC <sub>2</sub> H <sub>4</sub> ) <sub>2</sub> OH	148.2	6881-94-3	0.969	215	<1	16.0	7.2	11.3	443	4.6	--	1.6	--	100	100	210-220	-53	93
Propyltriglycol/ <b>ULTRASOLVE<sup>®</sup> H 2480</b>	C <sub>3</sub> H <sub>7</sub> (OC <sub>2</sub> H <sub>4</sub> ) <sub>3</sub> OH	192.1	23305-64-8	0.992	270.3	<0.01	16.1	6.5	9.9	--	--	--	--	--	--	--	--	-25	117.3
<b>Glycols</b>																			
Ethylene Glycol	HOCH <sub>2</sub> CH <sub>2</sub> OH	62.07	107-21-1	1.115	197.6	<1	17.0	11.0	26.0	--	--	--	--	--	100	100	194-199	-12.7	116
Diethylene Glycol	HOCH <sub>2</sub> CH <sub>2</sub> OCH <sub>2</sub> CH <sub>2</sub> OH	106.12	111-46-6	1.118	245.8	<0.1	16.6	12.0	19.0	--	--	--	--	--	100	100	242-250	-7.8	124
<b>Hydrocarbons</b>																			
Toluene	C <sub>6</sub> H <sub>5</sub> CH <sub>3</sub>	92.13	108-88-3	0.870	110.5	200	18.0	1.4	2.0	Insoluble	--	--	--	--	0.06	0.05	109-111	-95.1	4.4
Xylene	C <sub>6</sub> H <sub>4</sub> (CH <sub>3</sub> ) <sub>2</sub>	106.16	1330-20-7	0.869	140.0	77	17.6	1.0	3.1	Insoluble	--	--	--	--	0.04	0.05	136-144	-45.0	31
Hexane	CH <sub>3</sub> (CH <sub>2</sub> ) <sub>4</sub> CH <sub>3</sub>	86.18	110-54-3	0.682	68.7	765	14.9	0.0	0.0	Insoluble	--	--	--	--	0.01	0.00	64-74	-95.0	-35
Solvent Naphta C-9	Mixture	--	64742-95-6	0.867	165.9	27	17.6	0.8	2.0	Insoluble	--	--	--	--	0.02	--	155-180	-60	40
Stoddard Solvent	Mixture	--	64475-85-0	0.774	148.0	28	16.2	0.2	0.3	Insoluble	--	--	--	--	--	--	148-216	<-20	>38

The ® symbol refers to registered trademarks.

# Volatile organic compound (VOC) - MIR concept

“VOC” (volatile organic compound) is a term commonly used in the industry. It is emitted from various sources, such as car exhausts, industrial processes, consumer products, paints and coatings, among others. The coating industry contributes with a small portion of the VOC emissions; however, in the applications, the solvents correspond to the majority of the VOC emissions.

One way to evaluate the VOC and its impact on the environment is by the photochemical reactivity of each VOC. The photochemical reactivity is based on the ozone formation potential of a given VOC under specific atmospheric conditions and nitrogen oxide concentrations, and can be represented by the equation below:



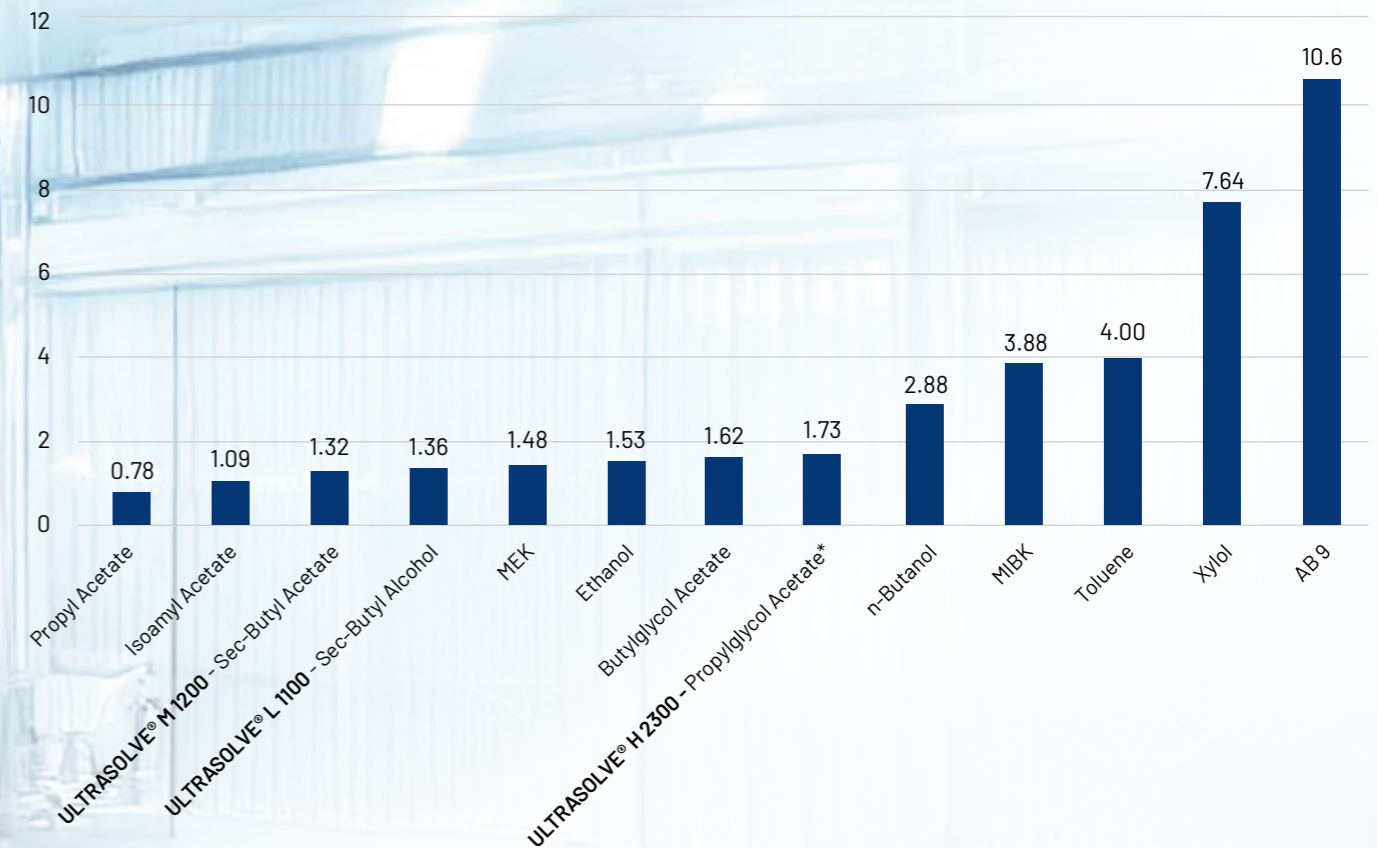
It is possible to evaluate the maximum potential for photochemical reactivity for each VOC.

**Through this evaluation, maximum incremental reactivity (MIR) is obtained. MIR is expressed in grams of ozone formed per gram of VOC:**

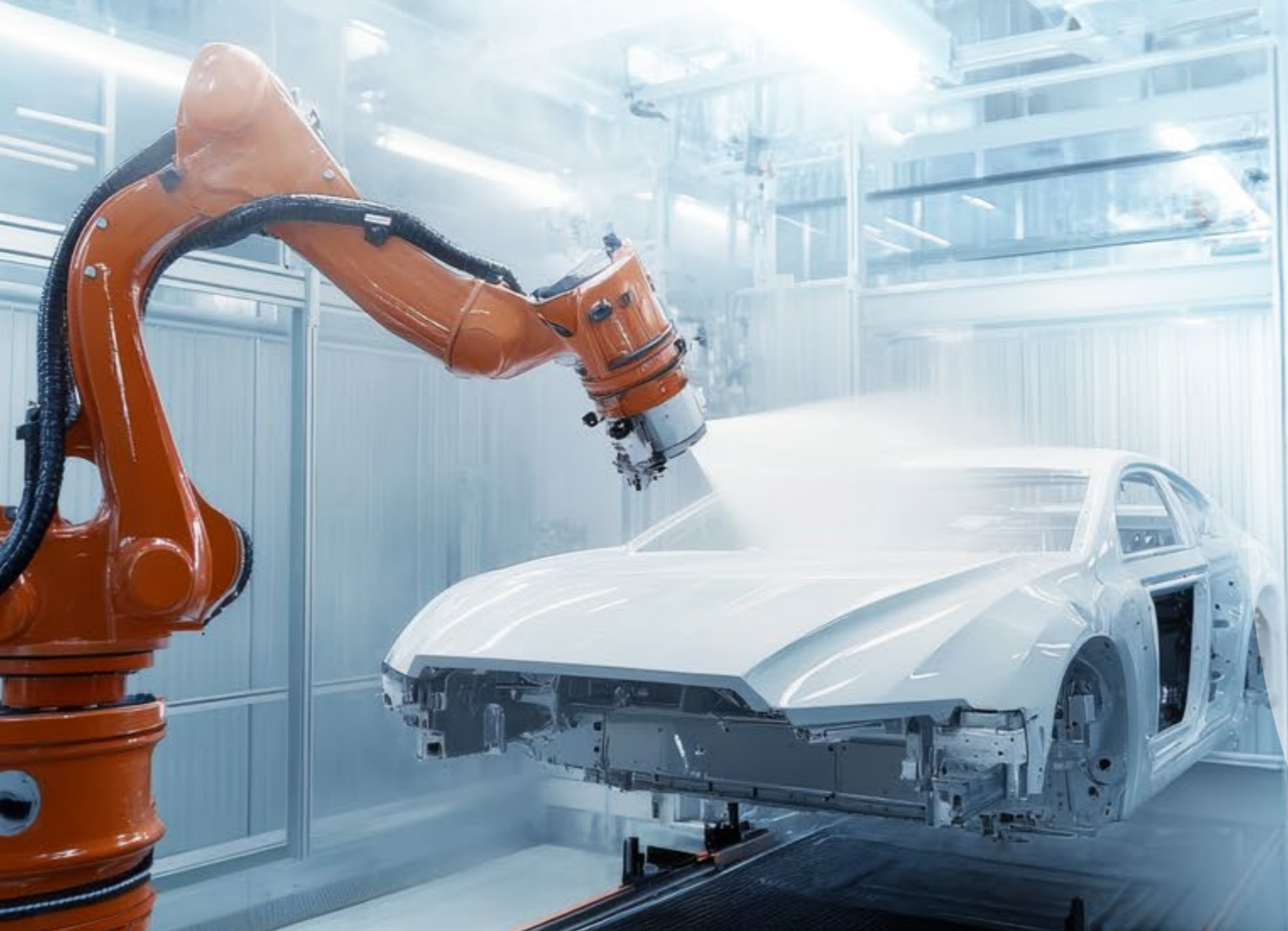
$$\text{MIR (g O}_3 \text{ + g VOC)} = \max \left( \frac{\text{O}_3}{\text{VOC mass}} \right)$$

VOCs have different photochemical reactivity, producing more or less ozone. The following graph shows a comparison of the MIR of some solvents.

**MIR of different solvents (g O<sub>3</sub> + g VOC)**



\* Estimated value





If you are looking for superior performance on application, **ULTRASOLVE® Line** is what you need! Contact us and request a sample.