

# Your reliable partner

DELIVERING SAFE AND QUALITATIVE PRODUCTS FOR HIGH PERFORMANCE SOLUTIONS



# Why Corbion?



## Advanced technology and R&D

At Corbion, we engage in ongoing R&D efforts to improve performance and sustainability of our products and processes.



## Consistent high quality

Corbion has mastered the production technology to make high purity, high performance lactic acid, derivatives and lactides at industrial scale.



## 100 years of experience

Corbion has 100 years of experience in sales, application development and industrial scale production. Corbion is the global market leader in lactic acid, derivatives and lactides.



## Global presence

With 10 production facilities and sales offices on every continent, we are always close by to help you with your application development. All our products are available at an industrial scale



## Safer and more friendly for our planet

Corbion produces high quality lactic acid and derivatives using a biochemical fermentation process by efficient conversion of sugars. Corbion products are regarded as safe, offering a good alternative to traditional products that have become under increased regulatory pressure.



Corbion factory in The Netherlands

# Your reliable partner

## Innovation and Application

Our innovation and Application centers are focused on your challenges of tomorrow. Our technical team of chemist, analytical and application technologist are available to provide you with customized solutions.

## Deliveries

Corbion works on continuous improvement of its delivery times and reliability. Working to improve consistency within the supply chain is making the network more responsive while streamlining operations.

## Prevention

Corbion deploys prevention activities in our plants and throughout our supply chain in order to avoid the occurrence of incidents. We have extensive safety program, quality program, maintenance program as well as risk identification and mitigation measures in place.

## Planning

We also have structured emergency response plans, crisis management procedures and business continuity plans in place to ensure we can secure the highest business reliability possible. Corbion aims at creating resilient supply chains for its clients. To that purpose we have multiple production locations.



Corbion factory in Thailand

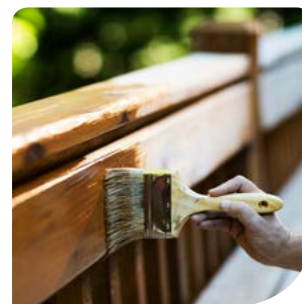
## Corbion's Innovation Platforms



### Bioplastics

- ▶ Biobased
- ▶ Reduced carbon footprint
- ▶ Multiple end-of-life options
- ▶ Proven in durable applications

PLA is a biobased plastic derived from natural resources and offers a significant reduction in carbon footprint compared to oil-based plastics. PLA is currently being used in a variety of applications like packaging and food serviceware, and is increasingly becoming the material of choice for more demanding applications in automotive, electronics and textiles.



### Coatings, Adhesives, Sealants, Elastomers (CASE)

- ▶ Reduces resin viscosity
- ▶ Decreases solvent content
- ▶ Improves adhesion
- ▶ Increases biocontent

With Corbion's lactide technology we bring commercially-available, performance building blocks to the CASE markets. It is a unique, renewable, raw material for coating resins with very high purity that enhances resin efficiency and improves product performance.

	condition	unit	PURASOLV® ML	PURASOLV® EL	PURASOLV® NPL	PURASOLV® BL	PURASOLV® EHL
Trivial name	INCI name		methyl lactate	ethyl lactate	n-propyl lactate	n-butyl lactate	2-ethylhexyl lactate
Formula			C <sub>4</sub> H <sub>8</sub> O <sub>3</sub>	C <sub>5</sub> H <sub>10</sub> O <sub>3</sub>	C <sub>6</sub> H <sub>12</sub> O <sub>3</sub>	C <sub>7</sub> H <sub>14</sub> O <sub>3</sub>	C <sub>11</sub> H <sub>22</sub> O <sub>3</sub>
Molecular weight		g/mol	104,10	118,13	132,16	146,19	202,29
CAS no.			27871-49-4	687-47-8	53651-69-7	34451-19-9	186817-80-1
EC no.			248-704-9	211-694-1	611-025-7	252-036-3	606-097-1
TSCA registration			yes	yes	yes	yes	yes
USA/FDA: GRAS (as flavor)			no	yes	no	yes	no
Boiling point		°C/°F	144 / 291	154 / 309	170 / 338	187 / 369	246 / 475
Flash point, ISO 2719, closed cup		°C/°F	58 / 136	56 / 133	69 / 156	79 / 174	113 / 235
Melting point		°C/°F	-44 / -47	-26 / 27	-23 / -9	-20 / -4	-23 / -9
Density	at 20°C/68°F	g/ml	1,092	1,033	1,003	0,944	0,939
Surface tension	at 25°C/77°F	mN/m	34,2	30,4	29,8	29,2	29,5
Viscosity	at 20°C/68°F	cP	3,0 <sup>(1)</sup>	3,0	3,3	3,9	7,6
Vapour pressure	at 20°C/68°F	mBar	3,4	2,2	1,0	0,4	0,02
Vapour pressure	at 100°C/212°F	mBar	240	172	99	50	6
Relative evaporation rate	n-BuAc=1		0,26	0,22	0,054	0,030	0,003
Refractive index	at 20°C/68°F		1,414	1,413	1,417	1,422	1,435
Log P	octanol/water		-0,50	0,03	0,55	1,08	3,12
Solubility in/of water	at 20°C/68°F	%w/w	miscible	miscible	miscible	4.5 / 13.9	0.03 / 3.5
Hansen solubility parameters <sup>(2)</sup>							
total Hildebrand		(J/cm <sup>3</sup> ) <sup>1/2</sup>	24,1	22,6	21,4	21,2	19,0
- disperse		(J/cm <sup>3</sup> ) <sup>1/2</sup>	17,1	16,7	16,6	16,6	16,3
- polar		(J/cm <sup>3</sup> ) <sup>1/2</sup>	8,6	7,7	6,8	6,2	4,6
- hydrogen		(J/cm <sup>3</sup> ) <sup>1/2</sup>	14,6	13,1	11,7	11,6	8,6

<sup>(1)</sup> at 25°C

<sup>(2)</sup> Calculated by the HSPiP software

	condition	unit	PURAC® FCC PURAC® HS PURAC® SANILAC <sup>(3)</sup>	PURAC® DLA	PURALACT® D3	PURALACT® B3
Trivial name	INCI		L-Lactic acid	D-Lactic acid	D-Lactide	L-Lactide
Chemical name			S(+)-2-hydroxypropionic acid	R(-)-2-hydroxypropionic acid	(3R)-cis-3,6-dimethyl-1,4-dioxane-2,5-dione	(3S-cis)-3,6-dimethyl-1,4-dioxane-2,5-dione
Formula			C <sub>3</sub> H <sub>6</sub> O <sub>3</sub>	C <sub>3</sub> H <sub>6</sub> O <sub>3</sub>	C <sub>6</sub> H <sub>8</sub> O <sub>4</sub>	C <sub>6</sub> H <sub>8</sub> O <sub>4</sub>
Molecular weight			90,08	90,08	144,13	144,13
CAS no.			79-33-4	10326-41-7	13076-17-0	4511-42-6
EC no.			201-169-2	233-713-2	603-436-5	224-832-0
TSCA registration			yes	yes	yes	yes
EEC: Food additive			E270	-	-	-
USA/FDA: GRAS			yes	yes	-	-
pKa	at 25°C/77°F		3,86	3,86	-	-
pH	10 (%w/w) solution in water		1,8	1,8	-	-
Melting point		°C/°F	-	-	96 - 100 / 205 - 212	96 - 100 / 205 - 212
Solubility in water	at 20°C/68°F	%w/w	>90	>90	decomposes to lactoyl lactic acid	decomposes to lactoyl lactic acid
Vapour pressure	at 20°C/68°F	mBar	0,004	0,004	0,002	0,002
Typical concentration		%w/w	88	93	100	100
Appearance			slightly viscous liquid	slightly viscous liquid	crystalline solid	crystalline solid
Color			colorless - slightly yellow (grade dependent)	colorless - slightly yellow (grade dependent)	white	white
Refractive index	at 20°C/68°F		1,439	1,439	-	-
Boiling point		°C/°F	125 / 257 (90% solution)	125 / 257 (90% solution)	263 / 505	263 / 505
Density	at 20°C/68°F	g/ml	1,22	1,22	1,33	1,33
Viscosity	at 20°C/68°F	cP	5 - 60 (50-90% solution)	5 - 60 (50-90% solution)	-	-

<sup>(3)</sup> Registered antimicrobial agent under FIFRA and BPD

	condition	unit	PURACAL® P	PURASAL® S	PURASAL® P	PURASAL® NH
Trivial name	INCI		Calcium lactate	Sodium lactate	Potassium lactate	Ammonium lactate
Molecular formula	as anhydrous		Ca(C <sub>3</sub> H <sub>5</sub> O <sub>3</sub> ) <sub>2</sub>	NaC <sub>3</sub> H <sub>5</sub> O <sub>3</sub>	KC <sub>3</sub> H <sub>5</sub> O <sub>3</sub>	NH <sub>4</sub> C <sub>3</sub> H <sub>5</sub> O <sub>3</sub>
Molecular weight		g/mol	218,22	112,06	128,17	107,11
CAS no.			28305-25-1	867-56-1	85895-78-9	515-98-0
EC no.			248-953-3	212-762-3	288-752-8	208-214-8
TSCA registration			yes	yes	yes	yes
EEC: Food additive			E327	E325	E326	no
USA/FDA: GRAS			yes	yes	yes	no
Melting point		°C/°F	pentahydrate	162 / 324	-	-
Solubility in water	at 20°C/68°F	%w/w	white	completely soluble	completely soluble	completely soluble
Concentration		%w/w	powder	60	60	70
Appearance			14,0	liquid	liquid	liquid
Refractive index	at 25°C/77°F		>200 / >392	1,423	1,4185	1,44
Density	at 25°C/77°F	g/ml	7 - 9	1,33	1,34	1,18
Viscosity	at 20°C/68°F	cP	600 - 800	85	25	28

Class	Type	Brandname	Application	PP	PE	EPS	PVC	Concentrates
Glycerol Monostearate (GMS)	Distilled Monoglycerides	Pationic® 901, 915	Antistat	✓	✓	✓		
			Mold Release	✓	✓	✓		
	Pationic® 909	Pigment dispersant			✓		✓	
	Mono/ Diglycerides	Pationic® 1042, 1052	Antistat	✓	✓		✓	
			Mold Release	✓	✓			
Glycerol Monooleate (GMO)	Distilled Monoglycerides	Pationic® 907	Antifog		✓		✓	
			Internal lubricant				✓	
			Pigment dispersant					✓
	Mono/ Diglycerides	Pationic® 1061	Antifog		✓		✓	
			Internal lubricant				✓	
			Pigment dispersant					✓
Glycerol Tristearate (GTS)	Triglyceride	Pationic® 919	External lubricant			✓		
			Mold Release			✓		
			General purpose lubricant & dispersant			✓		
Lactic acid derivatives	Lactylates	Pationic® 925, 930	Catalyst Residue Neutralizer	✓	✓			
			General purpose acid acceptor	✓	✓			
			External lubricant				✓	
	Lactate salts	Pationic® 1240	Catalyst Residue Neutralizer	✓	✓			
			General purpose acid acceptor	✓	✓			
Specialty Esters	Glycerol Ester Solutions	Pationic® AS500, 1530	Slurry additive				✓	
			External wet-cake additive				✓	
			Antistat				✓	
			General purpose lubricant & dispersant		✓		✓	✓

# Broad experience in many industries



## Agrochemicals

- ▶ Excellent solvency
- ▶ Good wetting properties
- ▶ Safe: Low toxicity and phytotoxicity
- ▶ FIFRA registered

Our PURASOLV® solvents support sustainable production of healthier, stronger crops. PURASOLV are a range of lactate esters that enhance solvency in agrochemical formulations with an outstanding safety profile. Depending upon the specific formulation, PURASOLV can offer additional benefits, such as good wetting properties, low evaporation rates, good penetration on natural surfaces, bio-enhancing effect and low COD /BOD ratio. As an example, PURASOLV EHL is an ideal solvent to formulate emulsion concentrates, given its low water solubility.



## Chiral synthesis

- ▶ Higher purity
- ▶ Lower production costs
- ▶ Waste reduction
- ▶ Improved safety

The use of single enantiomers of chiral active ingredients is of crucial importance to improve the overall efficacy of active ingredients. With our latest breakthrough in D-Lactic acid technology, Corbion produces both stereochemically pure (R)- and (S)-lactate esters on an industrial scale. These stereochemically pure products offer, to producers of chiral intermediates and active ingredients, the opportunity to lower production costs, reduce conversion steps and waste streams, and enhance quality.



## Oil industry

- ▶ Descaling
- ▶ Cross-linkers
- ▶ Slow acid release
- ▶ Cleaning agents

The oil industry constantly searches for products to improve performance and reduce processing costs, while pressured to use environmentally-benign products. The functionalities of Corbion product range include descaling, mud/oil cleaning, slow acid release and building blocks to synthesize customized polymers or crosslinkers. Alongside our standard products, we can develop new lactic acid derivatives with properties tailored to the specific needs of your application.



## Electronics

- ▶ High quality solvent
- ▶ Low metal content
- ▶ Statistical Process Control
- ▶ Security of supply

From solvents used for edge bead removal or Thinner applications, to solvents used in photo-resist or polymer alignment applications, we have a long and proud heritage of innovation and helping our customers perform better. PURASOLV® ELECT combines (extremely) low metal specifications with strict Statistical Process Control (SPC) to deliver consistency across all product parameters. Thanks to our integrated supply chain in lactic acid we can deliver security and consistency of supply.



## Polymer additives

- ▶ Antistat
- ▶ Mold Release
- ▶ Cross-linkers
- ▶ Catalyst neutralizers

Our synthesis chemists and application engineers welcome the opportunity to tackle your most challenging additive problems. Our product lines are based on glycerol ester, lactate and stearyl lactylate chemistries. We supply polymer producers in the polypropylene, polyethylene, PVC, and engineering thermoplastics industries as well as compounders, concentrate manufacturers, superabsorbent and other resin producers. In addition, special products can be developed to meet customer specific requirements.



## Chemical specialties

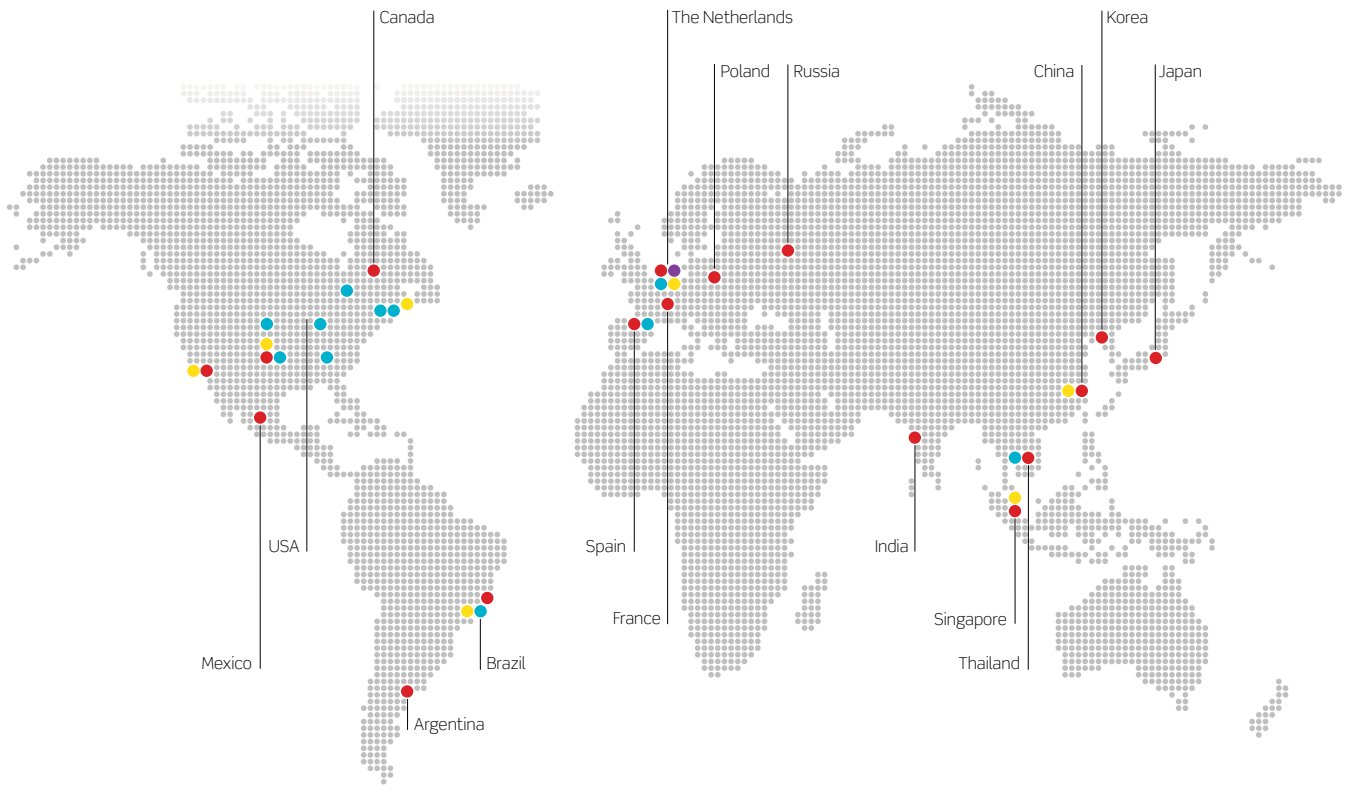
- ▶ pH regulation
- ▶ Antimicrobial efficacy
- ▶ Humectancy
- ▶ Chelation, descaling, degreasing
- ▶ High solubility

Lactic acid and its derivatives give you one thing above all else - versatility. Our products are also successfully used in:

- Industrial cleaning (descaling, degreasing, antimicrobial)
- Electroless plating (complexation, pH stability)
- Ethoxylation (base catalyst killer)
- Paints & Inks (solvent, coalescent)
- Textile (pH regulation) & leather (deliming)

# Let us know how we can help you

● Corbion Headquarters ● Corbion Production Location ● Corbion Sales Office ● Corbion Innovation Center



[corbion.com/contact](http://corbion.com/contact)

## About Corbion

Corbion is the global market leader in lactic acid, lactic acid derivatives, and a leading company in emulsifiers, functional enzyme blends, minerals, vitamins and algae ingredients. We develop sustainable ingredient solutions to improve the quality of life for people today and for future generations. For over 100 years, we have been uncompromising in our commitment to safety, quality, innovation and performance. Drawing on our deep application and product knowledge, we work side-by-side with customers to make our cutting edge technologies work for them. Our solutions help differentiate products in markets such as food, home & personal care, animal nutrition, pharmaceuticals, medical devices, and bioplastics. In 2016, Corbion generated annual sales of € 911.3 million and had a workforce of 1,684 FTE. Corbion is listed on Euronext Amsterdam.

Interested in solutions for the Chemical Specialty industry? [Go to corbion.com/biochemicals](http://Go to corbion.com/biochemicals)



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