





Luminy® PLA neat resins

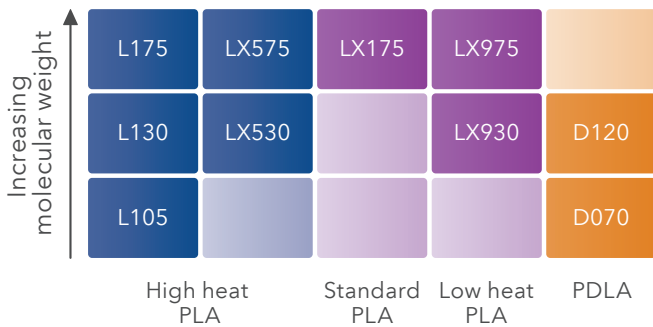
PLA bioplastics for a brighter future



-  **Biobased**
-  **Reduced carbon footprint**
-  **Recyclable and compostable**
-  **Proven in durable applications**

PLA (Poly Lactic Acid) is a biobased plastic derived from renewable resources and offers a significant reduction in carbon footprint compared to traditional 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 durable applications in automotive, electronics and textiles.

Luminy® PLA portfolio from TotalEnergies Corbion



TotalEnergies Corbion's Luminy® portfolio includes products in four categories that can be used in various conversion technologies:

- High heat PLA for demanding applications,
- Standard PLA for general purpose applications,
- Low heat PLA typically used as seal layer,
- PDLA used either as a nucleating agent or to create full stereocomplex compounds.

Luminy® neat resins from TotalEnergies Corbion are compliant with the most relevant regulations and standards related to bioplastics:

- Approved for use in food contact applications in EU (EC No. 10/2011), USA (FDA 21 CFR) and China (GB 9685-2016),
- Compliant with EN13432 and ASTM D6400 standards for industrial composting,
- Biobased content of 100% according to EN16785-1 and ASTM D6866,
- REACH compliant,
- Reduced carbon footprint - peer reviewed LCA study available.
- Made from GMO-free crops.



About TotalEnergies Corbion

TotalEnergies Corbion is a global technology leader in Poly Lactic Acid (PLA) and lactide monomers. PLA is a biobased and biodegradable polymer made from renewable resources, offering a reduced carbon footprint versus many traditional plastics. The Luminy® PLA portfolio, which includes both high heat and standard PLA grades, is an innovative material that is used in a wide range of markets from packaging to consumer goods, fibers and automotive. TotalEnergies Corbion, headquartered in the Netherlands, operates a 75,000 tons per year PLA production facility in Rayong, Thailand. The company is a 50/50 joint venture between TotalEnergies and Corbion.



Throughout our communications, unless otherwise specified, the terms 'biobased' and 'compostable' or 'biodegradable' refer to the EN16785-1 and EN13432 standards respectively. It is the responsibility of the article producer to ensure that claims on final products are substantiated by testing against the relevant standards. Check your locally available end-of-life infrastructure to ensure that legitimate end-of-life claims are made on the final product.

High heat PLA

High heat PLA resins in the Luminy® portfolio are available in a range of melt viscosities and deliver improved heat resistance over standard PLA. These grades can be used as neat resin or as part of a compound to further optimize overall material properties. In order to obtain improved heat resistance over standard PLA, these resins need to crystallize during processing.

- **Luminy® PLA L175** is a high viscosity resin suitable for film extrusion, thermoforming or fiber spinning.
- **Luminy® PLA L130** is a medium flow resin suitable for injection molding and fiber spinning.
- **Luminy® PLA L105** is a high flow resin suitable for thin-wall injection molding.
- **Luminy® PLA LX575** is a high viscosity resin suitable for extrusion processes.
- **Luminy® PLA LX530** is a medium flow fiber-grade resin suitable for staple fiber or spunbond applications.

Standard PLA

- **Luminy® PLA LX175** is a high viscosity, amorphous, transparent resin, suitable for film extrusion, thermoforming or fiber spinning. Also used to add strength to PBAT/starch compounds.

Low heat PLA

- **Luminy® PLA LX975** is a high viscosity resin suitable for use as a heat-seal layer in film applications.
- **Luminy® PLA LX930** is a medium flow resin suitable for use as low melting component in sheath-core configuration.

PDLA

PDLA, when combined with high heat PLA, will yield a compound that combines good heat resistance with excellent mechanical properties and a reduced processing cycle time. Typical nucleated formulations should include 3-7% PDLA.

- **Luminy® PDLA D120** is a medium viscosity PDLA resin for use in full stereocomplex PLA compounds.
- **Luminy® PDLA D070** is a general purpose nucleating agent for high heat PLA resins.

Visualisation of Luminy® polymer chains per PLA category

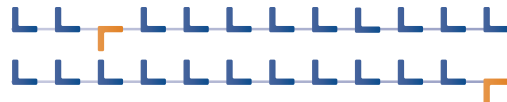
Luminy® stereocomplex PLA ($T_m = 445^\circ\text{F} / 230^\circ\text{C}$)



Luminy® high heat PLA ($T_m = 347^\circ\text{F} / 175^\circ\text{C}$)



Luminy® standard PLA ($T_m = 311^\circ\text{F} / 155^\circ\text{C}$)



┐ D Lactic Acid
 └ L Lactic Acid

		PLA								PDLA		
		L105*	L130*	L175*	LX530	LX575	LX175	LX930**	LX975**	D070	D120	
Application	Injection molding	•	•								•	
	Fiber spinning		•	•	•		•	•			•	
	Extrusion / Thermoforming			•		•	•		•		•	
	Nucleating agent									•		
Physical	Density	g/cm ³	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	1.24	
	Optical purity	% isomer	>99% L	>99% L	>99% L	98% L	98% L	96% L	90% L	88% L	>99% D	>99% D
Processing	MFI (Flow, 210°C/2.16 kg)	g/10min	70	23	8	23	7	6	18	10	>100	23
	MFI (Flow, 190°C/2.16 kg)	g/10min	30	10	3	10	3	3	8	4	>50	10
	Melting temperature (T_m)	°C	175	175	175	165	165	155	130	130	175	175
	Glass transition temperature (T_g)	°C	60	60	60	60	60	60	60	60	60	60
	Pre-drying before processing	yes/no	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes	Yes
Mechanical	Tensile modulus	MPa	3500	3500	3500	3500	3500	3500	3500	3500	3500	3500
	Tensile strength	MPa	50	50	50	50	50	45	40	40	50	50
	Elongation at break	%	<5%	<5%	<5%	<5%	<5%	<5%	<5%	<5%	<5%	<5%
Impact	Charpy notched, 23°C	kJ/m ²	<5	<5	<5	<5	<5	<5	<5	<5	<5	<5
Heat***	HDT B (amorphous)	°C	60	60	60	60	60	60	60	60		
	HDT B (crystalline)	°C	105	105	105							

Values listed are typical values, not to be interpreted as specifications. * Values listed are for resins in crystalline state, for more detailed information please refer to specific datasheets. ** Developmental grades, check for commercial availability. *** HDT B, 0.45MPa, flatwise. HDT depends on processing conditions. For crystalline resins, formulation included 3 - 7% nucleating agent (Luminy® D070) and molding took place in a 90 - 100°C tool.

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