Polylactic acid or polylactide (PLA) is a thermoplastic aliphatic polyester derived from renewable resources, such as corn starch (in the United States), tapioca roots, chips or starch (mostly in Asia), or sugarcane (in the rest of the world).

In 2010, PLA was the second most important bioplastic of the world in regard to consumption volume.

PLA was discovered in the 1920s by Wallace Corothers the scientist who invented nylon, but it never had been successfully commercialized on a large scale.

Polylactic Acid (PLA) is a bioplastic made from lactic acid and is used in the food industry to package sensitive food products.

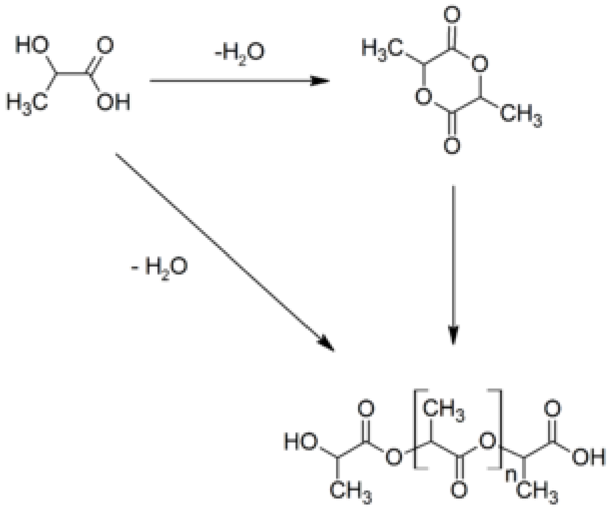
However, **PLA** is too fragile and is not compatible with many packaging manufacturing processes. Therefore it should be strengthen with additives.

Polylactic acid, or **polylactide** (**PLA**) is a thermoplastic polyester formally obtained by condensation of lactic acid $C(CH_3)(OH)HCOOH$ with loss of water (hence its name). It can also be prepared by ring-opening polymerization of lactide $[–C(CH_3)HC(=O)O–]_2$, the cyclic dimer of the basic repeating unit.

PLA has become a popular material due to it being economically produced from renewable resources. In 2010, PLA had the second highest consumption volume of any bioplastic of the world, although it is still not a commodity polymer. Its widespread application has been hindered by numerous physical and processing shortcomings. PLA is the most widely used plastic filament material in 3D printing.

The monomer is typically made from fermented plant starch such as from corn, cassava, sugarcane or sugar beet pulp.

Route to PLA is the direct condensation of lactic acid monomers. This process needs to be carried out at less than 200 °C; above that temperature, the entropically favored lactide monomer is generated. This reaction generates one equivalent of water for every condensation (esterification) step. The condensation reaction is reversible and subject to equilibrium, so removal of water is required to generate high molecular weight species. Water removal by application of a vacuum or by azeotropic distillation is required to drive the reaction toward polycondensation. Molecular weights of 130 kDa can be obtained this way. Even higher molecular weights can be attained by carefully crystallizing the crude polymer from the melt. Carboxylic acid and alcohol end groups are thus concentrated in the amorphous region of the solid polymer, and so they can react. Molecular weights of 128–152 kDa are obtainable thus.[6]



Polymerization of a racemic mixture of L- and D-lactides usually leads to the synthesis of poly-DL-lactide (**PDLLA**), which is amorphous. Use of stereospecific catalysts can lead to heterotactic PLA which has been found to show crystallinity. The degree of crystallinity, and hence many important properties, is largely controlled by the ratio of D to L enantiomers used, and to a lesser extent on the type of catalyst used. Apart from lactic acid and lactide, lactic acid *O*-carboxyanhydride ("lac-OCA"), a five-membered cyclic compound has been used academically as well. This compound is more reactive than lactide, because its polymerization is driven by the loss of one equivalent of carbon dioxide per equivalent of lactic acid. Water is not a co-product.