

Difference Between PLA and ABS

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Key Difference – PLA vs ABS

PLA and ABS are two organic elastomers that have a broad range of applications owing to their unique set of properties. The key difference between PLA and ABS is that **PLA is a biodegradable aliphatic polyester, whereas ABS is a non-biodegradable thermoplastic elastomer.** In addition to this, there are certain other differences between these two polymers that will be further discussed in this article. These two elastomers are also used for different applications due to these diverse properties.

What is PLA (Polylactic Acid)?

PLA is a biodegradable aliphatic polyester that has a wide range of applications. Because of its biodegradability and biocompatibility, PLA has been widely used in biomedical and pharmaceutical industries for several decades. In past decades, application of PLA was very limited due to its high manufacturing cost. Earlier, PLA was synthesized from lactic acid by direct polycondensation route, which resulted in poor mechanical properties and low molecular weights. However, scientists were able to improve the properties of PLA later on by changing the previous method to ring-opening polymerization. This process requires lactide, which is the cyclic dimers of lactic acid that acts as an intermediate substance during the polymerization process.

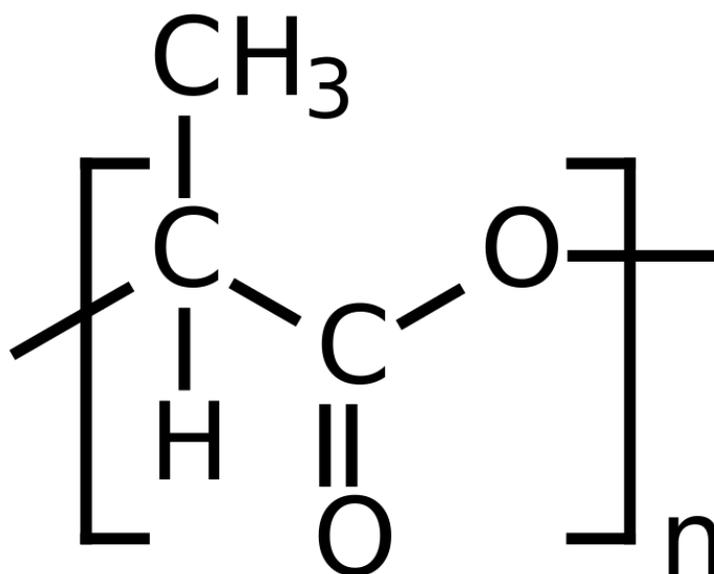


Figure 01: Polylactic Structure

The current production of PLA is initiated by the lactic acid obtained during fermentation of carbohydrates like [cellulose and starch](#). When compared with [petroleum](#)-based polyesters, PLA has a good set of properties, especially high hardness, high elastic modulus, thermoplastic behavior, and good moulding capability. Moreover, the properties of PLA are superior to those of other biodegradable aliphatic polyesters such as PBS (polybutylenes succinate), PLC (polycaprolactone), and PHB (polyhydroxybutyrate). PLA is used in the packaging industry to manufacture lightweight and transparent food packaging containers. PLA films are used to make shrink wraps, envelope windows, laminated coatings, and multilayer performance packaging. PLA is also used to manufacture rigid consumer goods such as casings for electronic devices, stationary, and cosmetics. In addition, products made from fibers and foams of PLA are also available in the market.

What is ABS?

ABS is a graft [copolymer](#) made from three monomers: acrylonitrile, butadiene, and [styrene](#). It is among most successful thermoplastics. It provides a good combination of properties including high strength, high hardness, high-temperature resistance, and most importantly ease of moulding. In ABS, the continuous phase consists of styrene and acrylonitrile, while the dispersed phase consists of butadiene. Butadiene provides excellent mechanical properties to ABS, but at the same time, it lowers the mechanical properties of ABS upon long-term exposure to heat and oxygen. This oxidation is due to the residual double bonds present in polybutadiene. ABS is mainly used in automotive applications such as knobs, wheel covers, mirror and headlight housings. In addition, ABS is used to build refrigerator linings, kitchen appliance housings, vacuum cleaners and power tools. ABS is manufactured mainly by emulsion, mass, and suspension polymerization methods.

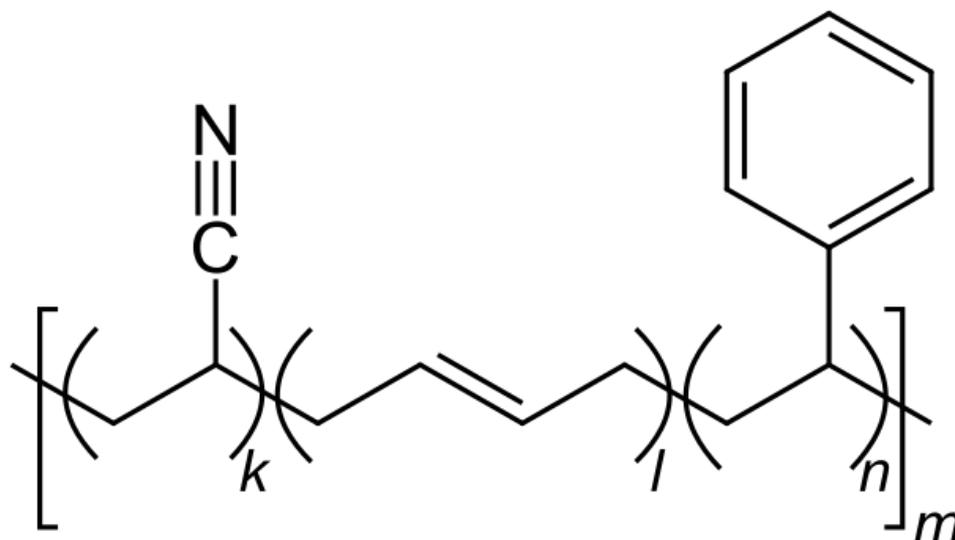


Figure 02: ABC

What is the difference between PLA and ABS?

PLA vs ABS	
PLA is a biodegradable aliphatic polyester.	ABS is a non-biodegradable thermoplastic elastomer.
Chemical Nature	
PLA is an aliphatic polyester.	ABS is a graft copolymer.
Production	
PLA is produced from lactic acid.	ABS is produced from acrylonitrile, butadiene, and styrene.
Cross Linkage	
PLA is made by ring-opening polymerization.	ABS is made by emulsion, mass and suspension polymerization.
Cost of Production	
PLA has a comparatively high cost of production to that of ABS.	ABS has a comparatively low cost of production.
Heat Resistance	
PLA has low heat resistance.	PLA has high heat resistance.
Applications	
PLA is used in lightweight and transparent food packaging containers, casings for electronic devices, stationary, and cosmetics	ABS is used in automotive applications, appliances, housings of kitchen appliance, power tools, and vacuum cleaners.

Summary – PLA vs ABS

PLA is a biodegradable and biocompatible polymer made by the ring-opening polymerization of lactic acid in the presence of lactid. It shows high hardness, high elastic modulus, thermoplastic behavior, biodegradability and good moulding capability, thus used mainly in packaging and pharmaceutical industries. ABS is a rigid thermoplastic elastomer, which is produced from acrylonitrile, butadiene, and styrene by emulsion, mass, and suspension polymerization techniques. ABS has high impact resistance, good electrical properties, lightweight and good chemical resistance, thus used mainly in automotive and appliance industries.

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