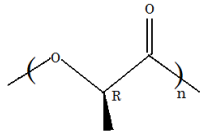
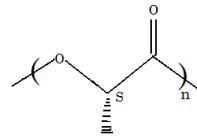


## 2- Poly( lactide):

Lactic acid is a chiral molecule, and exists in two stereo-isometric forms: DLA and L-LA.

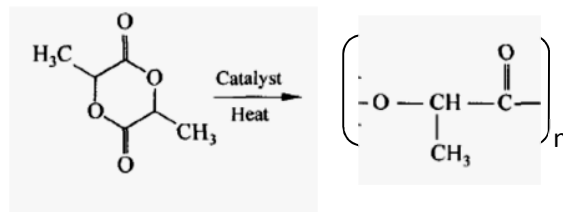


Poly(D-Lactide): (PDLA) Structure



Poly(L-Lactide): (PLLA) Structure

The monomer used to synthesis poly (lactide) (PLA) is lactide, which is the cyclic dimer of lactic acid. L-lactide, is the naturally occurring isomer, and DL-lactide is the synthetic blend of D-lactide and L-lactide. The polymerization of lactide is similar to that of glycolide. Both poly(D-LA) (PDLA) and poly(L-LA) (PLLA) are semicrystalline polymers.



PLLA is the most commonly used form than PDLA because the degradation product L-lactic acid is the natural occurring stereoisomer of lactic acid. Poly( L-lactide) is about 37% crystalline with a melting point of 175°C -178°C and a glass transition temperature of 60°C -65°C .

Because PLLA and PDLA exhibit high tensile strengths and high modulus that makes them more applicable than the amorphous poly( DL-LA) (PDLLA) polymers for load-bearing applications such as in orthopedic fixation and sutures. However, the degradation time of PLLA is much longer than that of PDLLA. It takes more than 3 years for PLLA to be completely absorbed.

As a biodegradable polymer, PLLA has satisfactory biocompatibility in vivo .It is essentially non-toxic, and elicits only a mild inflammatory response. The hydrolysis product L-lactic acid is the normal intermediate of carbohydrate metabolism and will not accumulate in vital organs. It has been proposed and successfully applied in the reconstruction of bone, articular defects, suture materials, drug carriers, and fixation devices .

However, the slow in vivo degradation rate of PLLA opposes a problem for its application. It has been found that bone plates made of crystalline (PLLA) were

used for the fixation of zygoma fractures. After 3 years, all patients showed a severe, well-defined swelling, which was strictly limited to the implantation site. In the case of seven patients, surgeries were performed to surgically remove the swelling. Light microscopic examination showed that the removed tissue was characterized by a foreign body reaction without signs of inflammation. Examination of the tissue samples using transmission electron microscopic revealed the presence of large amounts of highly crystalline PLLA particles. Therefore, it is believed that the swelling of the implantation site was caused by the aseptic inflammatory reaction of the host tissue to the small crystalline PLLA particles. It is also confirmed that the degradation of the PLLA crystals was very slow and that the total degradation time was much longer than 3 years.

To overcome this problem, D-lactic acid was added as co-monomer to obtain a copolymer with a lower crystallinity than PLLA and consequently a higher degradation rate.

The hydrolysis of PLA yields lactic acid, which is a normal byproduct of anaerobic metabolism in the human body and is incorporated in the tricarboxylic acid (TCA) cycle to be finally excreted by the body as carbon dioxide and water.