584i Synthesis of Biodegradable Poly (L-Lactic Acid): Process Path Optimization

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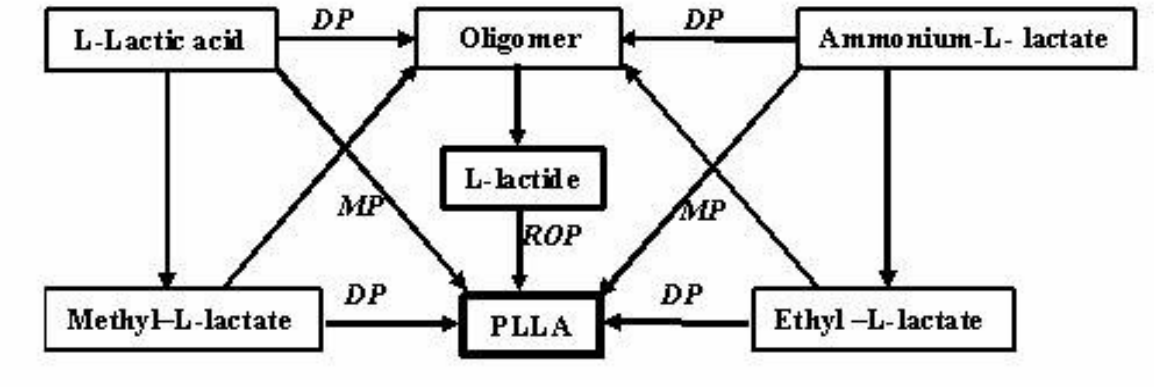
Poly (L-lactic acid) (PLLA) belongs to the family of aliphatic polyesters. PLA is a thermoplastic, high strength biodegradable polymer and can be made from renewable resources such as sugarcane. Hence, the synthesis of PLLA is of prime importance for an agricultural country like India. Synthesis of PLLA has been done by various routes such as direct polycondensation (DP), melt polycondensation (MP) and ring opening polymerization(ROP). Ammonium-L-lactate, methyl-L-lactate and ethyl-L-lactate have been polymerized by direct polycondensation method whereas L-lactic acid has been polymerized by melt polycondensation. Higher molecular weight PLLA synthesis proceeds by ring opening polymerization of L-lactic acid shown in scheme 1. Various experimental runs have been performed for all the above synthesis methods. Polymerization parameters such as type of catalysts, monomer to catalyst ratio, polymerization temperature, pressure, and polymerization time are optimized for obtaining desired molecular weight and other material properties. Various analytical techniques such as IR spectral analysis, ^{1}H and ^{13}C NMR spectral analysis, Viscometric analysis, GPC and DSC-TGA analysis have been done to characterise the structural and bulk properties.



Scheme 1. Different routes used for synthesis of polylactic acid.