ALIPHATIC POLYESTERS:SYNTHESIS, PROPERTIES AND APPLICATIONS

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ABSTRACT

Since the pioneering studies of Wallace Carothers in the thirties, aliphatic polyesters have attracted the attention of chemists. The quintessential "ester linkage" became the basis of many industrially useful polymers. However, wholly aliphatic polyesters were pushed to the background since it lacked the mechanical properties desired for every day applications.

About two decades ago, aliphatic polyesters were resurrected due to new found interest in sustainable materials as well materials useful in biological applications. Aliphatic "ester linkage" undergo hydrolytic degradation under the influence of enzymes, found both in nature as well as in human physiological conditions. This was accompanied by the development of practical processes for isolating pure L(+) lactic acid from fermentation of sugars and conversion to cyclic lactide followed by ring opening polymerization (ROP) of cyclic lactide to high molecular weight poly(L-lactic acid)s (PLLA). Currently, over 100,000 tpa of PLLA is produced commercially and sold for several applications.

Industrial applications of PLLA has attracted consideration attention. However, the applications of this family of materials in applications such as drug delivery systems, protein encapsulation and delivery, development of microspheres and hydrogels, as scaffolds for tissue engineering and as bioabsorbable materials for sutures and prosthesis has created new interest in the design, synthesis and characterization of novel polymers/ copolymers, functional polymers as well as new polymer architectures (branched, hyper-branched and star-branched polymers).

This lecture will provide an overview of the chemistry of aliphatic polyesters with an emphasis on "controlled synthesis". The objective is to tailor polymer properties to specific applications. Some recent studies on synthesis of polymers derived from L(+) lactic acid from our laboratory will be presented as illustrative examples of the strategy of controlled synthesis