

## **ABSTRACT**

Polyhydroxyalkanoates (PHAs) are naturally occurring biopolymers produced by microorganisms. PHAs have become attractive research biomaterials in the past few decades owing to their extensive potential industrial applications, especially as sustainable alternatives to the fossil fuel feedstock-derived products such as plastics. Among the biopolymers are the bioplastics and oligomers produced from the fermentation of renewable plant biomass. Bioplastics are intracellularly accumulated by microorganisms as carbon and energy reserves. The bioplastics, however, can also be produced through a biochemistry process that combines fermentative secretory production of monomers and/or oligomers and chemical synthesis to generate a repertoire of biopolymers. PHAs are particularly biodegradable and biocompatible, making them a part of today's commercial polymer industry. Their physicochemical properties that are similar to those of petrochemical-based plastics render them potential renewable plastic replacements. The design of efficient tractable processes using renewable biomass holds key to enhance their usage and adoption. In 2008, a lactate-polymerizing enzyme was developed to create new category of polyester, lactic acid (LA)-based polymer and related polymers. This review aims to introduce different strategies including metabolic and enzyme engineering to produce LA-based biopolymers and related oligomers that can act as precursors for catalytic synthesis of polylactic acid. As the cost of PHA production is prohibitive, the review emphasizes attempts to use the inexpensive plant biomass as substrates for LA-based polymer and oligomer production. Future prospects and challenges in LA-based polymer and oligomer production are also highlighted.