Developing a low temperature spinning process for polyhydroxyalkanoates

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Polyhydroxyalkanoates (PHAs), known as bacterial polyesters, are considered novel polymers because of their biodegradability. A wide range of hydroxyalkanoate units, such as butyrates and valerates, are produced by bacterial synthesis. ese units can be polymerized and copolymerized with varying mechanical and structural properties. Due to their biocompatibility, PHAs have been introduced in the fabrication of medical products, such as sutures and wound dressings. Some studies have explored the u of bacterial polyester for controlled release applications with thermally sensitive chemicals and drugs. Since PHAs are melt spun a temperatures as high as 200 ℃, this requires a post spinning stage for chemical and drug incorporation. Hence, there is a need fo low temperature spinning of bacterial polyester to prevent drawbacks of post-spinning drug incorporation, such as a non-uniform absorption that leads to an uneven release pro le. To achieve this goal, we analyzed PHA solubility properties to develop a spinning process at low temperature. Next we compared dissolution of poly(3-hydroxybutyrate-4-hydroxybutyrate) (P34HB) in multiple solvents such as tetrahydrofuran, dioxane, methylene dichloride, and chloroform. is solvent study found methylene dichloride as the most suitable solvent. As a result, polymer solutions of various concentrations were coagulated and regenerated as polym lms in methanol at di erent temperatures to determine the optimal coagulating conditions. e polymer lms were tested for their thermal properties, molecular weight distribution and degradation pro le. It was determined that the process used didn t incur any signi cant degradation in the polymer. Currently we are working on translating this process of making bacterial polyester polymer lms at low temperature to produce continuous laments at low temperature. e project would further involve testing the process by incorporation of drugs during spinning and determining a release pro le for those drugs. is study would help in developing a single step process for drug incorporation during ber spinning, which can be utilized for drug delivery applications.

Biography

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