Bhavya Singhi et al., J Bioremediat Biodegrad 2017, 8:6 (Suppl)
DOI: 10.4172/2155-6199-C1-011

Developing a low temperature spinning process for polyhydroxyalkanoates

Bhavya Singhi and **Martin W. King**
North Carolina State University, USA

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. These 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 use of bacterial polyester for controlled release applications with thermally sensitive chemicals and drugs. Since PHAs are melt spun at temperatures as high as 200 °C, this requires a post spinning stage for chemical and drug incorporation. Hence, there is a need for 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 profile. 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. This solvent study found methylene dichloride as the most suitable solvent. As a result, polymer solutions of various concentrations were coagulated and regenerated as polymer films in methanol at different temperatures to determine the optimal coagulating conditions. The polymer films were tested for their thermal properties, molecular weight distribution and degradation profile. It was determined that the process used didn't incur any significant degradation in the polymer. Currently we are working on translating this process of making bacterial polyester polymer films at low temperature to produce continuous filaments at low temperature. The project would further involve testing the process by incorporation of drugs during spinning and determining a release profile for those drugs. This study would help in developing a single step process for drug incorporation during fiber spinning, which can be utilized for drug delivery applications.

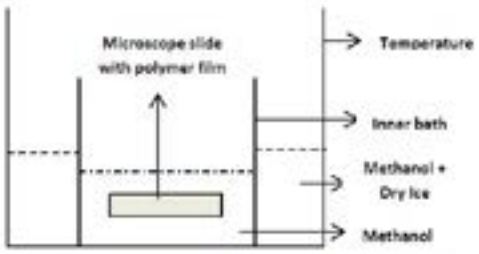

Figure 1. Schematic diagram of P34HB Polymer Film Coagulation

Biography

Bhavya Singhi is pursuing a PhD program in Fiber and Polymer Science at North Carolina State University, Raleigh. She graduated in 2016 with a master's degree in Textile Chemistry from NC State. Her undergrad degree was in Fibers and Textile Processing Technology from the Institute of Chemical Technology, Mumbai, India. She has worked on various projects involving polymer technologies such as encapsulation, extrusion and synthesis. Her research interests include polymer degradation, biopolymers and non-woven fabrics. She enjoys travelling, cooking and exploring new cuisines.

bsinghi@ncsu.edu

Notes: