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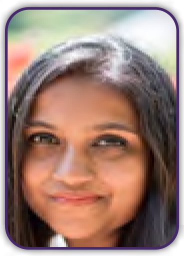

Wet Spinning of drug-loaded poly (4-hydroxybutyrate) fibers

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Abstract

Polyhydroxyalkanoates (PHAs) or bacterial polyesters, as they are commonly known, is a category of novel polymers because due to their biodegradability. Poly-4-hydroxybutyrate (P4HB) is one of the most developed polyhydroxyalkanoate that has several promising absorbable biomaterial applications such as implants, sutures, stents and tissue engineering scaffolds. They also have potential for controlled release drug delivery applications using various therapeutic chemicals and drugs, most of which are thermally sensitive. P4HB is typically melt spun and drawn into fibers at temperatures between 180 – 210 °C, although higher molecular weight P4HB (>800 K) need even higher temperatures for processing because of the high melt viscosity. Such high temperatures of P4HB melt processing prevents the incorporation of drugs in the polymer structure during the spinning stage, as most drugs are susceptible to high temperatures and can breakdown during the process. Hence a post spinning drug incorporation process such as coating or surface absorption is required. The secondary steps have major disadvantages, such as non-uniform absorption, and uneven and unpredictable release profile.

This raises the need for a low temperature process for producing P4HB fibers that can address the drawbacks associated with incorporating drugs in a post melt spinning process. Presently, there is no defined procedure to produce P4HB fibers through a solution or wet spinning process. Hence, this work focuses on identifying suitable wet spinning process conditions for poly (4- hydroxybutyrate) (P4HB) and developing a scalable method for the continuous extrusion of P4HB fibers. Based on the results of this project, a suitable combination of these parameters will be used to further produce drug loaded P4HB monofilaments and study their fiber properties as well as their drug release profiles.

Biography

Bhavya Singhi graduated with a PhD in Fibers and Polymer Science from NC State University. Her doctoral research focused on producing biopolymer fibers for controlled-release drug delivery applications. Currently, she is working as a Research Engineer at Zeus Industrial Products in South Carolina. Her work involves studying and developing new polymeric products and processes for medical device applications. She serves as the Industry Chair (2021-2022) for the Young Scientist Group within Society for Biomaterials and also volunteers with several committees within American Chemical Society.

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