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Effect of a greener solvent and process parameters on the average diameter of poly (lactic acid) fibers obtained by solution blow spinning

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Poly (lactic acid) (PLA) fibers has been obtained by solution blow spinning (SBS) using different solvents, but many of these solvents are toxic and are included in the volatile organic compounds list (VOCs). Therefore, this work aimed to evaluate the use of dimethyl carbonate (DMC), a VOC exception, on the production of PLA fibers by SBS. Thus, three 3^2 experimental designs was delineated to analyze the influence of three solvents (chloroform, DMC and HFP) in the average fiber diameter (response variable) of PLA fibers, varying two factors in three levels. Scanning electron microscopy (SEM) was used to analyze fiber morphology and diameters. Regression analysis showed for all solvents the polymer solution concentration was significant and the air pressure showed to be significant when using chloroform and HFP. SEM micrographs showed different ranges of average fiber diameter varying the solvents (chloroform: 260-970 nm; DMC: 240-650 nm; HFP: 220-470 nm). Regardless of the air pressure used, increasing the PLA concentration for all solvents increased the average fiber diameters. The use of chloroform and HFP indicated a tendency of reduction on the average fiber diameter when the air pressure was decreased, however this behavior was not observed using DMC. It was also observed the standard deviation indicated to be more affected by the polymer concentration than by air pressure. All solvents showed to be feasible to produce PLA fibers by SBS and DMC can be the best choice to produce PLA fibers with an affordable price using a greener process.

Biography

Delne Domingos da Silva Parize is a PhD candidate in Materials Science and Engineering/Polymers at Federal University of Sao Carlos (Brazil) and her project is being developed at the National Nanotechnology Laboratory for Agribusiness, Embrapa Instrumentacao (Brazil) and at the United States Department of Agriculture, USDA/ARS/WRRRC (Albany, CA). She has completed her BSc in Environmental Engineering in 2009 at University of Joinville Region (Brazil) and her MSc in Materials Science and Engineering/Polymers in 2011 at State University of Santa Catarina (Brazil).

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