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Abstract

Nanocomposites of Cassava Nanowhiskers and Polyvinyl Alcohol Using Electrospinning †

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Cassava production is associated with large amounts of solid and liquid wastes that have scarce options to reuse in the industry life cycle. Cassava starch waste include cellulose, lignin, hemicellulose and proteins in a moisture pasta by-product of the industrial processing. As cellulose is an interesting polymer for its crystalline structure, the cassava starch treatment from chemical process like mercerization, bleaching, acid hydrolysis and dialysis foster the extraction of the non-crystalline elements resulting in nanostructures known as nanowhiskers for its two-dimensional nanoscale. The opportunity of reinforcing polymers to form nanocomposites with matrixes such as polyvinyl alcohol (PVA) that are very used in the food and pharmaceutical industry also may promote benefits due to the challenge of breaking chains of artificial polymers. This work applied electrospinning polymer processing technique to reinforce PVA matrix with cassava nanowhiskers chemically treated in mass/mass percentages of 0, 1, 2.5 and 5. The electrospinning technique was applied under a voltage between 15 to 18 kV to the solution of PVA and cassava nanowhiskers using rotative collector distant 8 to 12 cm from the needle tip at a rate of 0.92 mL/h. According to FTIR and X-ray diffraction test it was possible to have crystallinity increase in the cassava starch sample with mercerization, bleaching, acid hydrolysis and dialyze on chemical treatment. X-ray diffraction showed crystallinity improvement of the cassava with 5% of nanowhiskers sample in relation with other samples. There were achieved improvements in thermal stability of the solution using 5% of nanowhiskers reinforcement compared to the other samples that were electrospun. Polymer processing generated fibers ranging 150 to 600 nanometers diameter from calibrated technical and environmental conditions to form nanofibers. Chemical treatment of the cassava waste also is associated with the use of considerable amount of resources that generate low productivity of the final material after electrospinning.

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