ISBN 978-85-63274-02-4

International Conference on Food and Agriculture Applications of Nanotechnologies

Editors:
Caue Ribeiro
Odílio Benedito Garrido de Assis
Luiz Henrique Capparelli Mattoso
Sergio Mascarenhas

São Pedro, SP
2010

1st Edition
1st print: 500 copies

Anais da 1. International Conference of Food and Agriculture Applications of Nanotechnologies – São Pedro: Aptor Software, 2010.
284 p.

ISBN 978-85-63273-02-4

1. Nanotechnologies – Events. 2. Ribeiro, Caue. 3. Assis, Odílio Benedito Garrido de. 4. Mattoso, Luiz Henrique Capparelli. 5. Mascarenhas, Sergio

Thermal characterization of electrospun PVA/TiO_2 nanocomposite fibers

R. G. F. Costa [(1),(2)*], J. E. de Oliveira [(3),(2)], C. Ribeiro [(2)] and L. H. C Mattoso [(2)]

(1) PPGQ - Departamento de Química, UFSCar, São Carlos – SP, Brazil
e-mail: guerreiro_rodrigo@yahoo.com.br
(2) Laboratório Nacional de Nanotecnologia Aplicada ao Agronegócio, Embrapa Instrumentação Agropecuária, Rua XV de Novembro, 1452, São Carlos-SP, 13560-970, Brazil
(3) PPGCEM - Departamento de Materiais, UFSCar, São Carlos-SP, Brazil
* Corresponding author.

Abstract – Nanocomposite fibers of PVA loaded with nanoparticles of TiO_2 anatase were produced by electrospinning. The PVA/TiO_2 nanocomposite fibers were characterized by scanning electron microscopy (SEM) and thermogravimetric analyzer (TGA). The characterization showed that the average diameter rangend from 200 to 600 nm. The TGA analysis showed that the thermal stability of pure PVA fibers was enhanced by the increase of TiO_2 phase.

Electrospinning has been extensively explored as a simple and a versatile technique to produce nanofibers of polymers, ceramics and nanocomposites [1]. In electrospinning, a high electric field (5-30 KV) is applied to a polymer solution or melt. This technique has gained academic attention only in the 1990s and due this there are few works using TiO_2 as a filler in PVA fibers prepared by electrospinning [1]. This polymer has interesting properties such as chemical resistance, thermal stability and biocompatibility [2].

In this study, we employed the electrospinning technique to develop a method to produce nanocomposite fibers of PVA/TiO_2 and investigate their properties, such as morphology and thermal. Viscous PVA/TiO_2 solutions were obtained with TiO_2 contents of 5.0 and 10.0 wt% (wt. TiO_2/wt. PVA). These solutions were transferred to a plastic syringe. The needle was connected to a high-voltage d.c. source and an aluminum foil fixed on the grounded aluminum drum, served as counter electrode. A voltage of 8 KV was applied to the solution, the working distance was 10 cm, and the injection rate was 0.7 $ml.h^{-1}$. A web of fibers was collected on the aluminum foil, which was dried for 8h at 50°C for subsequent characterization. The morphologies of the PVA and PVA/TiO_2 fibers were observed with a scanning electron microscopy (SEM). A statistical analysis of the fiber diameters was done in each sample by direct measuring of at least 100 fibers. Thermogravimetric analysis was performed in nitrogen at a heating rate of 10°C/min.

The TGA thermograms of PVA fiber and PVA/TiO_2 nanocomposite fibers are shown in Figure 1. It is observed that all the fibers underwent two degradation steps [2]. The weight residue of PVA fiber becomes 5.6% at 594°C, and that of the PVA/TiO_2 (10 wt%) nanocomposite is 14% at 594°C.

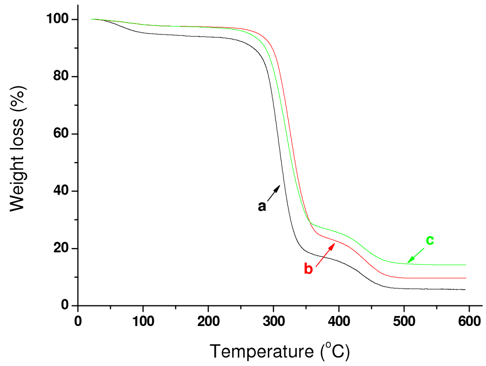

Figure 1: Thermogravimetric curves of PVA/TiO_2 nanocomposite fibers: (a) 0 wt% TiO_2; (b) 5 wt% TiO_2 ; (c) 10 wt% TiO_2.

References

[1] N. Wu, D. Shao, Q. Wei, Y. Cai and W. Gao. Journal of Applied Polymer Science, 112, 2009, 1481-1485.
[2] Z. Pheng and L. X. Kong. Polymer Degradation and Stability, 92, 2007, 1061-1071.