11th International Conference
on Advanced Materials

Rio de Janeiro Brazil
September 20 - 25

ICAM2009

FTIR and Swelling of Chemically Crosslinked Chitosan Films

V. M. Bispo[(1)], A. A.P. Mansur[(1)] and H.S. Mansur[(1)*]

(1) Department of Metallurgical and Materials Engineering, Laboratory of Biomaterials and Tissue Engineering, Federal University of Minas Gerais / R. Espírito Santo 35, 30160-030, Belo Horizonte, Brazil.

* Author to whom correspondence should be addressed; E-Mail: hmansur@demet.ufmg.br

Abstract –The chitosan has several important properties for biomaterials: biocompatibility, biodegradability, acceleration in the recovery of injuries. In this work, it was prepared films of chitosan crosslinked with genipin, and characterized by infrared spectroscopy and swelling assays. The infrared analysis was used to evaluate the chemical reaction of chitosan with genipin crosslinker. The intensity of the amide band at approximately 1650 cm^{-1}, suggests that the carboxymethyl group of genipin reacted with the amino group to form a secondary amide. Moreover, the swelling behavior of chitosan films was altered by the crosslinking extension.

In the last 2-3 decades, biocompatible polymers have been extensively researched, developed and refined for biomedical applications [1,2]. This has occurred in large part because of the great need that exists to improve the medical treatment in the world. Chitosan is a polymer that has gained prominence in research. Studies based on chitosan has presented several properties of this polymer such as biocompatibility, biodegradability, acceleration in the recovery of injuries. All these characteristics make chitosan suitable for potential use in matrices for growing tissues. Nevertheless, there are several difficulties to be overcome in order to control some features for instance mechanical properties. One way to gain control of these properties is the use of substances called crosslinkers. These crosslinkers will react with the polymers forming structures similar to networks with greater stability to the material. Among the crosslinkers, glutaraldehyde has been widely used. However, this substance is produced synthetically and has unwanted cytotoxic effect. In a recent report, Sung and co-workers [3] found that genipin is a crosslinking reagent 10,000 times less cytotoxic than glutaraldehyde. Thus, matrices of chitosan films and their mechanical properties could be improved with genipin.

In this work, it was used different amounts of genipin to produce films of chitosan crosslinked. It was verified the influence of the concentration of crosslinker and the chemicals reactions by using the infrared spectroscopy (FTIR). Also, the swelling degree was investigated as an important tool to assess the effect of crosslink on the overall behavior of the polymer network in aqueous medium.

In the FTIR spectra of samples, the intensity of the amide band at approximately 1650 cm^{-1} was used to monitor the crosslinking reaction of chitosan with genipin. In other words, that region indicated that the carboxymethyl group of genipin reacted with the amino group to form a secondary amide (Fig.1). Moreover, the swelling behavior of chitosan films was altered by the crosslinking extension (Fig.2).

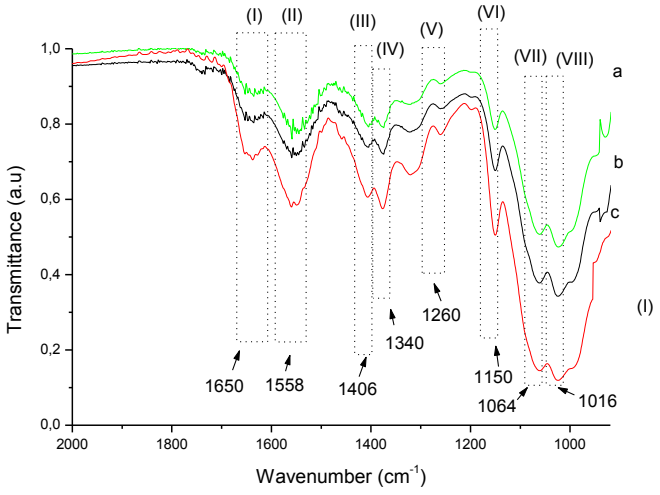

Figure 1: FTIR spectra of chitosan (a); Chitosan with 0.5% genipin (b); Chitosan with 1.0% genipin;

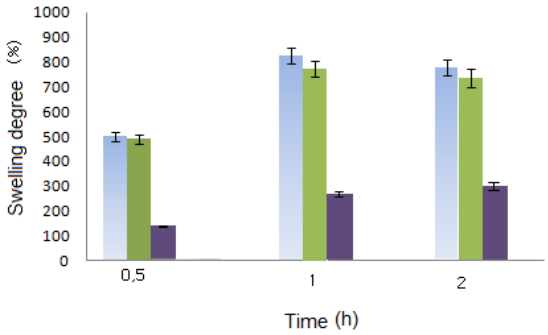

Figure 2: Swelling in PBS of chitosan films: without crosslink, with 0.5% of genipin, with 1% of genipin.

References

[1[1] M.F. Butler; P.D.A Pudney. Journal Pol. Chem. 41, (2003) p. 3941.

[2] F.L. Mi; H.W. Sung; S.S. Shyu Journal. Pol. Sci. 38, (2000) p. 2804

[3] H.W. Sung; R.N. Huang; L.L.H. Huang; C.C. Tsai; C.T. Chiu, J. Biomed. Mater. Res. 42 (1998) 568.