ABSTRACT

In this PhD dissertation, it is described a procedure in which chitosan fibers were prepared by wet spinning method and the effects of various carboxylic acids, specifically acetic acid, citric acid, and lactic acid as solvents in the dope solution were assessed, as well as their influence on the properties of the resulting fibers, also, this research involves the use of analytical techniques such as FTIR spectroscopy, UV spectroscopy, SEM, and mechanical testing to identify the optimal solvent and characterize the fibers. In addition, the incorporation of Ursolic acid as an antibacterial agent and tripolyphosphate (TPP) as cross-linker to enhance the mechanical properties of the fibers was explored. Initially, dope solutions of chitosan/acetic acid were prepared at two different polymer concentrations (7% and 8%), the dynamic viscosity of the solutions was evaluated. Out of that range, the 7% chitosan solution was determined as the most suitable for wet spinning process; later two more dope solutions were prepared 7% chitosan/citric acid and 7% chitosan/lactic acid and their rheological properties were evaluated as well, after this, it was determined to prepare chitosan fibers with the polymeric solutions containing three different solvents, and as coagulant medium, sodium hydroxide was used. Among the three solvents tested, acetic acid was found to be the most suitable solvent for preparing the dope solution and producing chitosan fibers, the results showed that chitosan fibers can be produced with sufficient tensile strength and smooth morphological surface using 7% chitosan/acetic acid dope solution. To enhance the fibers' antibacterial properties, ursolic acid was incorporated through wet impregnation method, while tripolyphosphate (TPP) was used as a cross-linker to improve their mechanical strength by the same method. The morphology of the fibers was studied by means of SEM and the properties of the fibers were evaluated using FTIR spectroscopy, UV spectroscopy, tensile strength tests, and antibacterial activity tests against two common bacterial strains, Staphylococcus aureus and Escherichia coli. The outcomes proven that 7% chitosan fibers can be produced with adequate tensile

strength, smooth morphological surface and their antibacterial properties can be enhanced by using ursolic acid as an antibacterial agent, as well as the tensile strength properties can be improved by using TPP as cross-linker.