University of Zabol

Graduate School

Faculty of Agriculture

Department of Horticultural Sciences and landscape

The Thesis Submitted for the Degree of Master of Science
(In the field of Horticultural Sciences)

Title

Encapsulation of Fennel essential oil by electrospinning: characterization, study of antimicrobial effects and impact on post-harvest banana life

Supervisor
Dr Mehdi Aran
Dr Mohammadamin Miri

Advisors
Dr Hamid Ahmar

By
Sekineh Khammari

19 January 2021

Abstract:

Plant essential oils are one of the most important ways to increase the shelf life after harvesting fruits. On the other hand, Sweet Fennel (***Foeniculum vulgareis***) one of the most important and widely used medicinal plants possess antimicrobial, antioxidant and antifungal properties. Therefore, the aim of this study was to produce zein composite nanofibers containing fennel essential oil by electrospinning method, as well as to investigate the antibacterial properties and its effect on the postharvest shelf-life of banana fruit. After electrospinning, the characteristics of nanofibers were investigated using scanning electron microscopy tests, Fourier- transform infrared spectroscopy, porosity measurements and specific surfaces, and X-ray diffraction analysis. Also, the efficiency of the loaded essential oil, the antimicrobial activity of nanofibers and the effect of nanofibers on the postharvest shelf life of banana fruit were determined. The results of scanning electron microscopy images showed that the produced nanofibers were uniform and homogeneous and X-ray diffraction test showed that the resulting nanofibers were amorphous and the fibers containing the essential oil had no additional peaks. These cases indicate that there is a compatibility between the essential oil and the Zein polymer. The results of BET test showed that with increasing the essential oil, the average diameter of nanofibers increased and the decreasing trend in high concentrations of essential oil can be attributed to agglomeration. Nanofibers containing sweet fennel essential oil had inhibitory properties for both Staphylococcus and *Escherichia coli* bacteria. The results showed that nanofibers containing different concentrations of fennel essential oil stimulates the production of ethylene and ripen very quickly before reaching the market and reduced postharvest shelf-life. The Post-harvest experiment was also performed on tangerine fruit and due to the fact that tangerine is a non-climacteric fruit, so the mentioned nanofibers had a positive effect and caused longer shelf life and improving fruit quality.

***Keywords*:** fennel essential oil, encapsulation, Medicinal herbs, nanofibers