USE OF CHITOSAN-BASED EDIBLE COATINGS IN COMBINATION WITH OTHER NATURAL COMPOUNDS, TO CONTROL *RHIZOPUS STOLONIFER* AND *ESCHERICHIA COLI* DH5A IN FRESH TOMATOES

ABSTRACT

During storage of tomatoes, *Rhizopus stolonifer* rapidly spreads towards adjacent fruits causing severe economic losses while *Escherichia* coli may cause serious even life threatening diseases. Chitosan-based materials can be used as edible films or coatings to avoid water loss and microbial spoilage. Waxes and essential oils may also be considered for use as antimicrobial agents in chitosan coating. In this study, various chitosan-based formulations (1%) mixed with beeswax (0.1%), oleic acid (1.0%), and lime or thyme essential oil (0.1%) were tested on tomato at three different maturity stages to control *R. stolonifer* and *E. coli* DH5α at storage temperatures of 12 °C and 25 °C. Control fruit were only dipped in water. Overall, fruit were wounded, coated and inoculated. Once the coatings were applied, 20 μl of *R. stolonifer* spore suspension at 10^5 spores ml^{-1} concentration and 35 μl of bacterial solution of E. coli DH5α, at 10^5 cfu μl^{-1}, concentration, were dispensed over the wounded surface. Experiments were carried *out in vitro,* at a small scale and at semi commercial level. Overall, the protection effect of coating applications was better against *E. coli* DH5α than *R. stolonifer.* For *in vitro* experiments the best coatings was that of chitosan (1%) + beeswax (0.1%) + lime essential oil (0.1%) since no growth *of R. stolonifer* and *E. coli* DH5α took place. Other coating that stopped *R.* stolonifer growth was that of chitosan (1%) + oleic acid (1%) + lime essential oil (0.1%) while for *E. coli* DH5α were chitosan (1%) + beeswax (0.1%) + thyme essential oil (1%) and chitosan (1%) + beeswax (0.1%). Observation with an electronic scanning microscope showed distorted mycelia and no development of *R. stolonifer sporangiospores,* and no growth of *E. coli* DH5α when both microorganisms were grown on the formulation of chitosan (1%) + beeswax (0.1%) + lime essential oil (0.1%). For *E. coli DH5α,* this same formulation applied on tomatoes at a small scale and in the semi commercial level completely controlled *E. coli* DH5α at both storage temperatures. The application of chitosan-based edible coating containing beeswax and lime essential oil is promising to follow since it is an environmentally-friendly alternative to control this important pathogenic microorganism. Export tomato producers might benefit from this nonchemical alternative.

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