



EFFECT OF EDIBLE COATINGS BASED ON BIOPOLYMERS AND ANTIMICROBIAL AGENTS IN QUALITY OF LEMON (*Citrus limon*)

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Key words: Edible coatings, biopolymers, lemon

Introduction. Edible films and coatings, such as wax on various fruits, have been used for centuries to prevent loss of moisture and to create a shiny fruit surface for aesthetic purposes. During time-consuming steps involved in handling, storage and transportation, products start to dehydrate, deteriorate, and lose appearance, flavor and nutritional value. The time period, whereby a product is not only safe to eat, but still has acceptable taste, texture and appearance after being removed from its natural environment, is defined as shelf life.

Mexico is one of the leading producers of citrus worldwide. In 2011, there was a production of 2,132,921.78 tons of lemon (Mexican, Persian, Italian and Real) 3. Among the citrus is considered as the most versatile fruit and is the third most important after orange and mandarin 2. Lemon is a subtropical fruit of high commercial value on the international fruit market. It has a split skin and very juicy which easily can suffer damage by molds and environmental conditions^{1,2}. The objective of this research was to evaluate the effects of edible coatings based chitosan/antimicrobials and a commercial wax on shelf life of Italian lemon.

Methods. Formulation based on chitosan, antimicrobials (sodium benzoate and potassium sorbate) and glycerol (F1) were prepared. F1 and F2 (commercial wax) were applied as edible coating (for immersion), uncoated lemons were used as control. Treatments were stored during 60 days at 21° C and 60% RH the physicochemical and microbiological properties were followed. Weight loss and juice content were expressed by (%). Soluble solids were determined by refractometer Exttech RF15 (0-32%) at 20° C, and the results were expressed as °Brix. The peel thickness, fruit diameter and length were also evaluated. The account of mesophilic aerobes, total coliform, fungi and yeasts were determined according to NOM-093-SSA1-1994, NOM-113-SSA1-1994 and NOM-111-SSA1-1994 respectively.

Results were subjected to analysis of variance (ANOVA) and Tukey test in SPSS 17.0.

Results. In the parameter of weight loss was found a significant difference between treatments and during storage ($p < 0.05$), while in F2 decreased significantly until 30.34% ($p < 0.05$). Although the percent juice decreased significantly ($p < 0.05$) during storage (45 days), the coating wax-based (F2) and chitosan (F1) maintained major percentage of juice. Solid soluble content increased significantly ($p < 0.05$) during storage in all treatments (45 days), however this increase was less in F1 and F2 ($p < 0.05$). The peel thickness decreased significantly ($p < 0.05$) during storage in all treatments (45 days), although the coated lemons showed significantly higher peel thickness compared to control ($p < 0.05$). Diameter of product decreased significantly during storage in all treatments ($p < 0.05$). On the other hand, length decreased significantly during storage in control and F1, however remained stable F2. Finally the mesophilic aerobes, total coliform, fungi and yeast were stable during 60 days of storage for all treatments, indicating that the addition of different coatings had no effect on microbiological parameters.

Conclusions. The addition of the coatings improved the physicochemical and microbiological parameters relative to control, especially with F2. However in the microbiological testing there were no differences between the wax-based formulations and biopolymers.

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