Title The effect of bio-based films on quality and shelf life of fresh celery

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Abstract

Bio-based materials have garnered increasing interest as food packaging materials due to their raw materials derived from renewable resources such as corn starch, cellulose, and sugar beets. One important drawback is that they can exhibit poor mechanical performance compared to non-bio based materials and their effect on quality and shelf life of some produce is unknown.

This research studied the effect of three bio-based materials on quality and shelf life of fresh celery. Materials include non-perforated biopolymer films and perforated low density polyethylene (LDPE) film. The variable materials were: Polylactic Acid (PLA), a versatile biodegradable aliphatic polyester derived from 100% renewable resources, Ecoflex, a biodegradable aliphatic-aromatic copolyester, and Mater-Bi, a bio-plastic derived mainly from natural renewable resources such as corn, wheat, and potato starch. The control was perforated LDPE.

The objective of this research was to determine if biopolymer films could be used to package fresh celery and if they were comparable to the currently used packaging material (LDPE).

Whole (uncut) fresh celery stalks packaged into sleeves made from the above materials were subjected to refrigeration conditions (5°C & 95%RH) and bi-monthly analysis for 3 months. The analysis included appearance, weight loss, microbiology, sensory, texture, and petiole color. Material or film analysis included WVTR, OTR, Tensile Strength, and Elongation.

The results showed that product quality attributes did not significantly differ between materials. Consequently, celery could be packaged in any of the materials utilized in the study and maintain natural quality over time as well as naturally deteriorate over time. With respect to weight loss, celery packaged in all bio-based materials experienced decreases in weight. Celery packaged in Mater-Bi material had the least weight loss at end of study. Results also demonstrated material deterioration occurring in both Ecoflex and PLA materials based on tensile and break elongation results under the high humidity conditions of the present study. Both materials also displayed the highest increases and fluctuation in permeation rates. While Ecoflex and PLA materials were suitable materials with respect to product quality attributes, their mechanical properties would need to be improved to match the performance of Mater-Bi.

Mater-Bi was superior to other bio-based materials with regard to mechanical performance and therefore would be recommended for storage of fresh celery over other bio-based materials.