Title Quality of packaged romaine lettuce hearts exposed to low-dose electron beam irradiation

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Abstract

Irradiation treatment has been shown to effectively reduce the number of food spoilage organisms and to increase the shelf-life on fruits and vegetables. Studies have been conducted using gamma rays as the irradiation source, but little informations is available on the effect of electron beam irradiation when used in fresh produces including lettuce. Also, the effect of low energy irradiation on food packaging materials has not been studied extensively. The study aimed to investigate the effects of low-dose electron beam irradiation (1.0, 1.5 and 3.2 kGy) on the quality of commercially prepackaged romaine lettuce hearts. The irradiation impact on the functionality of the package was also evaluated. For 21 d, measurements of color, respiration rate, texture, and sensorial analyses were done to evaluate produce the quality. Analyses of texture and permeability were carried out for the packaging. Irradiated samples showed only slight changes in color, but these changes were not significantly ($p>0.05$) different from the non-irradiated (control) samples. Sample firmness decreased by 49.58% (leaves) and 29.13% (ribs), as the dose level increased. Sensory attributes such as overall quality, color, sogginess, and off-flavor were found less acceptable at the higher dose level. Irradiation affected the respiration rates inside the packages, with lower O_2 (up to 10.38%) and higher CO_2 levels than the control. Irradiation at 1.5 and 3.2 kGy dose levels improved the oxygen barrier capacity of the low-density polyethylene (LDPE) bags by 7.67% and 4.48%, respectively. Water vapor permeability was unaffected for all irradiation dose levels. The stiffness of LPDE films did not change due to irradiation treatment. This study shows that it is feasible to irradiate romaine hearts using electron beam technology at a recommended dose of 1.0 kGy and maintain the produce quality as well as the packaging characteristics.