

Title The influence of electron beam irradiation of antimicrobial-coated LDPE/polyamide films on antimicrobial activity and film properties

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Abstract

We evaluated the effects of ionizing radiation (1–3 kGy) and incorporation of antimicrobials on the functional properties of low-density polyethylene (LDPE)/polyamide films. We established the antimicrobial effectiveness of several coatings of FDA-approved antimicrobial compounds including sorbic acid, carvacrol, trans-cinnamaldehyde, thymol and rosemary oleoresin using selected food pathogen surrogates. The antimicrobial coatings were applied to one side of the LDPE films and dried. Films were irradiated using a 10 MeV linear electron beam accelerator at room temperature. All films showed inhibition zones in an agar diffusion test against *Listeria innocua* ATCC 33090 and *Escherichia coli* ATCC 884. In the liquid culture test, the antimicrobials significantly ($p \leq 0.05$) reduced the specific growth rate of *L. innocua* by 3.8–8.5%, and decreased final cell concentration of both strains by 5.7–14.6% and 7.2–16.8%, respectively. All active compounds retained the antimicrobial activity when exposed to 1–3 kGy. Neither the presence of active compound nor dose affected the film's tensile strength and toughness. Additionally, films became more ductile and had improved moisture barrier functionality. Film's oxygen permeability was not affected by either treatment. Results are an initial step toward the development of self-sterile active packaging materials for use in combination with irradiation treatment of foods.