

Irradiation and Postirradiation Storage at $2 \pm 2^\circ\text{C}$ of Tilapia (*Tilapia nilotica* \times *T. aurea*) and Spanish Mackerel (*Scomberomorus commerson*): Sensory and Microbial Assessment

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ABSTRACT

Tilapia (low-fat farm fish, *Tilapia nilotica* \times *T. aurea*) and Spanish mackerel (high-fat seawater fish, *Scomberomorus commerson*) were subjected to gamma irradiation doses of 1.5, 3.0, 4.5, 6.0, and 10.0 kGy by using a semicommercial gamma irradiator. The irradiated and unirradiated (controls) fish were stored at $2 \pm 2^\circ\text{C}$ and samples were drawn at day 0, 4, 8, 12, 16, and 20 for sensory evaluation and microbiological analysis. Doses of 3.0 and/or 4.5 kGy extended the sensory acceptability (appearance, odor, texture, taste) and the microbial quality (total count and coliforms) by 8 days compared to the unirradiated controls. Hydrogen sulfide-producing bacteria were low in both types of fish and a dose of 1.5 kGy kept this flora at low levels throughout the storage period. Moreover, this dose level was also sufficient to eliminate *Salmonella* spp. from both fish. *Yersinia* and *Campylobacter* species were effectively eliminated by doses of 1.5 and 3.0 kGy. Doses of 6.0 and 10.0 kGy caused a reduction in psychrotrophic counts but were detrimental to the quality of both species of fish.

Key words: Gamma irradiation, tilapia, Spanish mackerel, fish, microbial quality, sensory evaluation

Irradiation pasteurization has proved particularly effective in significantly extending the refrigerated storage life of many fishery products while retaining the characteristics of a good-quality product (2, 3, 7, 11, 14). Shelf-life extensions for various fish species after treatment with different dose levels under varying conditions has been studied by many investigators (7, 13, 18, 22, 23). Venugopal et al. (30) indicated that irradiation of refrigerated Indian mackerel with a dose of 1.5 kGy kept the fish in acceptable condition up to 20 days. Poole et al. (21) studied the effect of irradiation treatment in nine fish species and concluded that all species examined, with the exception of Moreton Bay (*Metapenaeus* spp.) and cooked King prawns (*Penaeus plubujus*), and remained acceptable after a 5.0 kGy dose.

Doses higher than 3 kGy caused adverse odor and flavor in Moreton Bay and cooked king prawns. Bacterial counts decreased by 1.5 to 4 log units with a 1.0-kGy dose.

The local production of fish in Saudi Arabia was 48,163 and 55,960 tons in the years 1993 and 1994, respectively, and is expected to increase in the coming years (16, 17). Therefore, the need for extending the shelf life and decreasing losses by means of irradiation is required. No research on irradiation treatment of seafood has been done in Saudi Arabia and the country has not yet established its own rules and regulations on application of gamma irradiation. Therefore, the objective of this work was to study the effect of gamma irradiation treatment at different doses and during postirradiation storage at $2 \pm 2^\circ\text{C}$ on the sensory and microbial quality of seawater high-fat fish (*Scomberomorus commerson*) and low-fat farm fish (*Tilapia nilotica* \times *T. aurea*).

MATERIALS AND METHODS

Preparation and irradiation of fish

Tilapia samples (*Tilapia nilotica* \times *T. aurea*) were purchased from an aquatic farm in Al-Kharg (South of Riyadh) and transported alive to the meat laboratory in the Food Science Department of King Saud University. The fish were sacrificed, gutted, and washed. The gutted fish and fillets were placed in separate boxes (Rubbermaid, Medina, OH) with dimensions of 96.25 by 42.5 by 42.25 cm.

For Spanish mackerel (*Scomberomorus commerson*), approximately 160 kg of fish were obtained from the Qatif fish market in the Eastern province of Saudi Arabia. This market is one of the main sources of fish. The fish are from the Eastern coast (Arabian Gulf) of Dammam and were purchased 3 h after catching. The fish were iced and arranged in the separate plastic boxes (25-kg capacity) and transported (4 h driving) directly in an air-conditioned van to the Food Science Department in Riyadh. Immediately on receipt, the fish were washed, gutted, beheaded, sliced, and washed again.

All samples were iced during sampling and transportation to King Faisal Specialist Hospital and Research Center (KFSHRC). The boxes containing fish and ice were irradiated by using a ^{60}Co

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