



Effect of Electron Beam Irradiation on the Quality of Dried Fish and Shell Fish

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Abstract

In the present study, quality of electron beam irradiated dried Bombay duck (*Harpadon nehereus*) and dried Jawala shrimp (*Acetopus* sp.) were studied. The irradiation doses used were 0, 2.0 kGy, 4.0 kGy and 6kGy. After the exposure of irradiation doses, all the samples were kept at room temperature. Biochemical and microbiological qualities were analyzed. Moisture content ranged between 16.71-17.78%. There is no significant difference in the proximate composition of irradiated and non-irradiated samples. Biochemical analysis indicated that control had higher TVB-N in both dried Bombay duck and dried acetopus sp. than irradiated ones. Moreover, Peroxide value was higher in irradiated sample than control in dried Bombay duck. Microbial analysis of dried Bombay duck indicated that total bacterial count (3.8-3.3 log cfu/g) was lower in the irradiated samples compared to control (4.35 log cfu/g). Results suggested that electron beam irradiation could reduce the biochemical and microbial activity there by extend the shelf life of fishery products.

Key words : Electron beam irradiation, fishery product, quality

Introduction

Fish and fishery products are important source of protein, fat, essential amino acids, minerals, vitamins and other nutrients. Drying is one of the oldest known method of preservation of food. In India, consumption of dried fishes is about 32% of the total marine landings and about 17% of the total catch used for the production of dry fishes (Sheetal *et al.*, 2017). Bombay duck (*Harpadon nehereus*) is one of the most abundant and preferable marine species in Maharashtra and Gujarat region (Chakrabarti, 2010). *Acetopus* sp. contributes about 20% of marine shrimp landing and constitute a seasonal fishery along the Maharashtra coast. *Acetopus* caught as bycatch during trawling is discarded back to sea due to its low price. Locally called Jawala in Maharashtra. *Acetopus* is mostly consumed in dried forms (Jaiswar and Chakraborty, 2005). Electron beam irradiation (EBI) is a non-thermal processing technique gaining more attention by a food processor to improve the shelf-life and preserve the food's nutrient value. The advantage of the electron beam irradiation over gamma irradiation that it can be applied in a bidirectional manner in which the irradiation can come into contact with the food product from the top and bottom of the sample. This penetration can offer the advantage of a more uniform application of the irradiation, which can lead to a more effective elimination of bacteria, particularly on product surfaces (Lewis *et al.*, 2002). Based on the above information, In the present study was aimed to study the quality of electron beam irradiated dried Bombay duck (*Harpadon nehereus*) and dried Jawala shrimp (*Acetopus* sp.) under room temperature.

Materials and Methods

Dried Bombay duck (*Harpadon nehereus*) and dried Jawala shrimp were purchased from local fish market, packed in polyethylene pouches and exposure to electron beam irradiation in a linear EB RF accelerator (EB tech., BRIT, Mumbai). The irradiation process parameters used were includes beam energy 5 MeV, beam power 40 kW, beam current:0-4.5 mA; conveyer velocity of 10m/min; sample thickness 1-3cm. The doses used were 0, 2.0 kGy, 4.0 kGy and 6kGy. All the samples were kept at room temperature. Biochemical and microbiological qualities were analyzed against a control sample.

Biochemical and microbial quality : Moisture, protein, fat and ash content were analyzed according to AOAC (2019) method. Total volatile base nitrogen (TVB-N) content was measured according to Conway (1950). Peroxide value (PV) was determined according to Yildiz *et al.* (2003). Total plate count (TPC) was assessed according to FAO (1992) method.

Results and Discussion

Proximate composition of dried Bombay duck and *Acetopus* sp. are given in table-1. The moisture content is one of the important parameter which determines the quality of dried fishes. In general, the moisture content less than 15% in dried fish is recommended better for longer keeping quality. However, a reduction in moisture content of fresh fish by drying to 25% will stop bacterial growth and reduce autolytic activity. In the present study, Moisture content of both the samples ranged between 16.71-17.78%. There is

Table-1 : Proximate composition of electron beam irradiated dried Bombay duck and Acetus sp.

Sample/Parameter	Moisture (%)	Protein (%)	Fat (%)	Ash (%)
Bombay duck				
Control	17.78±0.25	65.49±0.10	4.57±0.05	16.33±0.10
2.0kGy	17.66±0.20	64.2±0.05	4.28±0.04	16.43±.15
4.0kGy	17.52±0.15	64.51±0.02	4.26±0.10	16.27±0.25
6.0kGy	17.18±0.20	68.33±0.20	3.84±0.15	15.89±0.20
Acetus sp.				
Control	17.77±0.30	66.76±0.10	3.10±0.30	12.80±0.10
2.0kGy	16.71±0.25	66.50±0.20	2.93±0.20	12.64±0.20
4.0kGy	16.92±0.20	65.80±0.08	2.96±0.15	12.69±0.25
6.0kGy	17.18±0.15	66.40±0.06	2.60±0.10	12.60±0.20

no significant difference in the proximate composition of irradiated and non-irradiated samples.

Biochemical quality of electron beam irradiated (EBI) dried Bombay duck and Acetus sp. indicated that control had higher TVB-N in both dried Bombay duck and dried acetus sp. than irradiated ones (Fig.-1a). Moreover, Peroxide value was higher in irradiated sample than control in dried Bombay duck (Fig.-1b). Similar trend also observed for dried Acetus sp. Hocaoglu *et al.* (2012) observed similar results for irradiated shrimp.

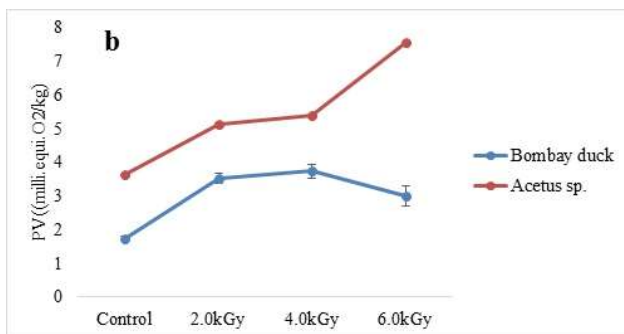
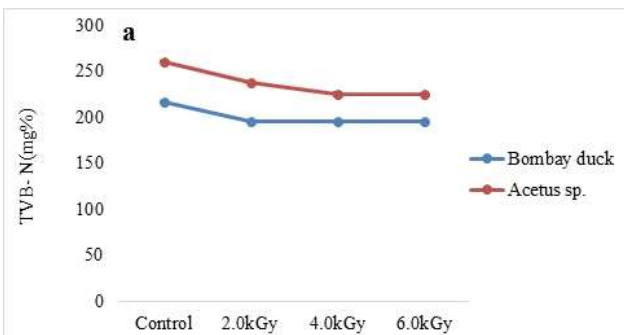


Fig.-1. (a) : Changes in TVB-N content (b) PV of EBI dried dried Bombay duck and Acetus sp.

Microbial analysis of dried Bombay duck indicated that total bacterial count (3.8-3.3 log cfu/g) was lower in the irradiated samples compared to control (4.35 log cfu/g). Similar trend also observed for electron beam

irradiated dried Acetus sp. (Fig.2). The results are in line with similar study in irradiated barracuda (Sinduja *et al.*, 2015).

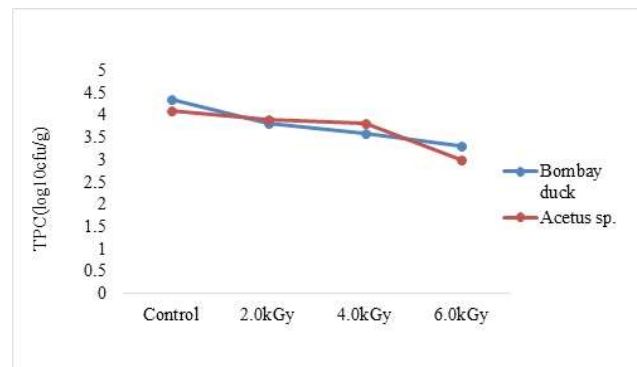


Fig.-2 : Changes in TPC of EBI dried Bombay duck and Acetus sp.

Organoleptic quality of the dried fish products were evaluated in terms of in color, odor, texture, insects' infestation, and overall quality. The color of dried Bombay duck was found to be whitish to yellowish. The color of dried Acetus sp. found to be brownish to reddish. Texture was firm and flexible in all samples. No insects' infestation was found in the dried products. The overall acceptability of the products does not showed any significant difference between the samples. Results from the study suggested that electron beam irradiation can be used as an alternative method to improve the dried fish product quality during storage.

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