RADIATION PROCESSING OF NUTRACEUTICALLY IMPORTANT SEEDS FOR VALUE ADDITION

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Abstract

Radiation processing as a physical technique of preservation has been extensively employed for decontamination, disinfestation and shelf life improvement of food and agricultural products, which are prone to rapid deterioration. Ban on the use of chemical fumigants (e.g. ethylene dioxide, methyl bromide) in developed countries (2005) and in developing countries (2015) has opened up the possibilities of employing irradiation as a physical method of preservation. Radiation processing involves exposure of food and agricultural commodities to ionizing radiations such as gamma rays (Co-60, Cs-137) or machine generated X-rays (5 Mev) and high-energy electrons (8-10 Mev). Irradiation has been considered as 'cold process', as no or very minimal heat is generated during the processing. Exploitation of underexplored wild legumes is an important approach to combat the protein-energy malnutrition. The nutritional quality and overall acceptability of legumes has been impaired largely due to antinutritional factors (e.g. lectins, phenolics, phytic acid, trypsin inhibitors). Radiation processing has been shown to reduce some of these antinutrients and bring about favorable changes in the nutritional features and functional properties.

In the present study, quality features of two of the nutraceutically valued underutilized seeds, *Mucuna pruriens* and *Nelumbo nucifera* were assessed after exposure to ionizing radiations at various doses (0, 2.5, 5, 7.5, 10, 15 and 30 kGy) of gamma and electron beam. Raw *Mucuna* seeds consisted of 12 fungal species capable of quality deterioration. *Mucuna* seeds were effectively decontaminated on employing gamma as well as EBI at 10 kGy accompanied by either degradation or reduction of Aflatoxin B_1 and ochratoxin A. Gamma and electron beam irradiation had significant positive effects on the nutritional, functional and cooking properties such as crude protein, carbohydrates, *in vitro* protein digestibility, water absorption, oil absorption capacities, protein solubility, emulsion activity and cooking time. Gamma irradiated seeds revealed a dose-dependent increase in total phenols and tannins and decrease in the phytic acid. In electron beam irradiated seeds, total phenols showed dose-dependent increase, while tannins, phytic acid, L-DOPA decreased. Traces of hemagglutination activity of seeds were eliminated by gamma and electron beam irradiation above 5 kGy. The ESR studies revealed that free radicals were more prominent in seed coat than cotyledon portion of raw seeds and irradiation resulted in dose-dependent increase. In seed coat, a weak triplet (satellite peak) accompanied the central line, which can be used as an authentic indication of radiation treatment of *Mucuna* seeds. Some of the common processing practices such as microwave roasting, flame-heating and pounding also generated free radicals similar to irradiation. Storage studies of *Mucuna* seeds exposed to 10 kGy, stored for 6 months at 25±1°C revealed that the quality were minimally deteriorated than control seeds.

Studies on the impact of gamma and electron beam radiation on microbial profile of *Nelumbo nucifera* seeds revealed successful to decontamination with improvement of nutritional and functional properties. Both gamma and EB irradiation increased the total phenols but decreased the tannins. The free radicals were more in seed coat and less in cotyledon portion and increased on irradiation. Studies revealed seed quality preservation even after 6 months of storage on irradiation.