

Effects of Gamma Irradiation on Microbial Load and Chemical Properties for Preserve Dried Shiitake Mushroom Powder

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ABSTRACT

Mushrooms are easily susceptible to microorganism spoilage and insect damage. Thus, the process of preservation is necessary for extending mushroom shelf-life. The objective of this study was to investigate the effects of gamma radiation on microbial analysis, antioxidant activities and chemical constituents of dried shiitake mushrooms. The shiitake powder was irradiated with gamma radiation at doses of 2.5, 5.0, 7.5 and 10 kGy. The irradiated samples were extracted with distilled water using ultrasonic bath. The extract was examined for microbial load, antioxidant activities by means of DPPH, FRAP and total phenolic content. Chemical properties were analyzed for total protein content and β -D-glucan content. The result showed that the total bacterial count was eliminated at a dose of 5 kGy and 2.5 kGy for yeast and mold, respectively. Pertaining to antioxidant activities; Increasing gamma irradiation dose, decreasing DPPH, FRAP and total phenolic content of shiitake powder were observed. At the dose of 10 kGy, the lowest DPPH value 2.07 ± 0.02 mgAAE/g, was achieved. The non-irradiated sample showed the highest value (3.16 ± 0.11 mgAAE/g). The FRAP values of irradiated samples ranged from 40.24 ± 0.41 to 3.16 ± 0.11 $\mu\text{molFeSO}_4/\text{g}$. At the dose of 2.5, 5.0, 7.5 and 10 kGy significantly reduced total phenolic acid content (9.00 ± 0.09 , 9.05 ± 0.47 , 8.12 ± 0.48 and 8.15 ± 0.10 mgGAE/g), respectively as compared with control (9.66 ± 0.13 mgGAE/g). Irradiation at the dose of 10 kGy did not significantly affect to total protein content and β -D-glucan content. The total protein contents

ranged from 28.45 ± 0.24 to 28.60 ± 0.07 %w/w. The amount of β -D-glucan in non-irradiated and irradiated samples varied from 23.27 ± 1.21 to 25.11 ± 0.51 %w/w. The results of this investigation suggested that gamma irradiation could be applied to preserve the dried shiitake mushroom powder for food seasoning.

Keywords: Shiitake, Gamma irradiation, *Lentinus edodes*

INTRODUCTION

The Shiitake (*L. edodes*) mushroom belongs to the Omphalotaceae family. It is an edible medicinal mushroom that is traditionally consumed in East Asian countries. In Thailand, *L. edodes* is commonly known as Hed Hom. It is well known for its delicious taste and its nutritional values. Shiitake mushrooms also contain several bioactive compounds such as polysaccharides (β -D-glucan), ergosterol, vitamin B₁, B₂, C and minerals (Mattila et al., 2001). The antioxidant activity of shiitake mushroom extracts was found to be correlated with their polysaccharide and total phenolic content (Cheung et al., 2003). The mushroom water extracts contained various polysaccharides, phenolic compounds, and small proteins such as lectins, each of which may have its own biological effects (Kozarski et al., 2012). The shiitake mushrooms are easily perishable and tend to lose their qualities 2-3 days after harvest. The high respiration rate and a tendency to turn brown (enzymatic activity), and susceptibility to lose water result in quick deterioration (Simon et al., 2005; Jiang et al., 2010). Therefore, preservation methods are to extend the shelf-life of the mushroom. Freezing and drying techniques are the most popular methods, especially sun-drying and hot air oven. (Ma et al., 2013).

Irradiation is known to be a safe technology for treating food products using ionizing radiation. Gamma ray ionizing radiation is used to extend the shelf-life of food products and results in the inactivation of foodborne pathogens (Jiang et al., 2010). Research on disinfection irradiation, spores inhibition and extension of shelf-life has been undertaken by many (WHO, 1981; Farkas, 1998).

Irradiation at an average dose of 10 kGy has shown no toxicological hazards and no specific microbial and nutritional problems (WHO, 1981). Gamma irradiation at a dose 0.25–1.0 kGy is recommended for insect disinfestation and at 6–10 kGy to control mold growth (Diehl, 1995). Radiation doses in the range of 2.5–10.0 kGy were selected for this study. The purpose of this study was to determine the effects of gamma irradiation on microbial decontamination, antioxidant activities, and chemical compositions of dried shiitake mushroom powder.