SHORT COMMUNICATION

Investigation the effect of gamma irradiation on mass preservation of the local mango fruit (chokanan sp.)

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Abstract:

At the ambient temperature the mango fruit being a highly perishable fruit possesses very short shelf-life and reaches to respiration peak of ripening process on third or fourth day after harvesting. Due to the overripe of the mango, the mango will lose their mass. The objective of this study was to correlate the percentage of the weight loss of the local mango fruit (chokanan sp.) with different doses of gamma irradiated to the samples. Four groups of mango A, B, C and D were prepared, three groups were irradiated with 400, 800, 1200 Gy according to their groups. Another one group, D is the controlled group. Then, the weights of all groups were measured at initial and final day of the research. Based on the result, there was significant negative correlation between weight loss of the sample at different dose of gamma after 21 days irradiation ($p = 0.047$, $r = -0.953$). Thus, gamma irradiation is a potential method to preserve the weight loss of the mango.

Keywords: *Chokanan sp;* gamma irradiation; weight loss

1. INTRODUCTION

The scientific name for mango is Mangifera indica and it belongs to the Anacardiaceae family with 60 genera [1]. Mango is one of the most consumed fresh fruit in the world, with production from more than one hundred countries [2]. According to the research made by Mahto and Das [3], mango under the tropical conditions will ripen within five days of storage and become overripe after seven to eight days. Due to the overripe of the mango, the moisture of the fruit loss to environment thus, reducing the mass of the mango. As the moisture loss, the acidity of the fruit also will decrease due to respiration, transpiration, and metabolic changes such as conversion of starch to sugar by enzyme [4].

In this study, the aim was to highlight that the gamma irradiation is an essential and secure technique of mass preservation as it can avoid from food borne illness, increase of the food safety and increase the shelf-life of the foods [5]. Gamma irradiation has been regarded as for the extension of shelf-life quality improvement and gives the solution to reduce the bioburden in food production [6]. In fact, low dose of irradiation can be used to reduce microbial spoilage and delay ripening that may preserve the weight of fruit [7].

2. MATERIALS AND METHODS

The materials used for this experiment were 12 pieces of Chokanan sp. mango, distilled water, digital balance, and Gamma-Cell 220 Excel. 12 pieces of the Chokanan sp. mango were chosen with uniform size and same maturity at the green matured stage. All samples immediately were transported to the research laboratory at UiTM Puncak Alam. During the transportation, all samples were put in the box and covered with old newspaper to protect the samples from weather damaged. The samples were washed with distilled water for detection of wound and to remove the stain. The samples were dried at a relative humidity of 50% and the average temperature of 28ºC. 12 pieces of mango were grouped into 4 groups, 3 pieces for each group (Group A, B, C and D). 3 groups of the samples (A, B and C) were irradiated by using Gamma Cell 220 Excel at 400, 800 and 1200 Gy respectively, while group D is the controlled group.

The initial mass for each group was measured on the day before all the sample groups were irradiated by gamma by using digital mean mass. All measurements were taken three times to get accurate values and to get the mean mass. The final mass of the group samples was measured at day 21 after being irradiated by gamma [5]. The weight loss percentage of the groups sample was calculated by using the following formula [5]:

$$\text{Weight loss (\%)} = \frac{W_i - W_f}{Wi} \times 100\%$$

where W_i is initial mean mass, W_f is final mean mass.

Pearson's correlation coefficient test was done to investigate the correlation between the weight loss of the samples and different doses of gamma by using Microsoft Excel.

3. RESULTS AND DISCUSSION

The dependent variable involved are the four different doses of gamma which are 0 Gy, 400 Gy, 800 Gy, and 1200 Gy and the independent variable was the percentage of weight loss of the groups sample. Table 1 below shows the initial and final mean mass percentage of weight loss of the group samples. The result shows that the percentage of weight loss for group A is 30.1%, group B is 29.0%, group C is 24.9% and group D is 24.4%. Based on Table 1, among the four groups, group A which is the controlled group reported the highest percentage of weight loss. This was followed by group B, C and D. It shows that the higher the dose, the lower the weight loss. This result can be supported by study done by Pricaz & Ţă [6], which shows that gamma irradiation can reduce the weight loss of the mangoes. In fact, Table 2 shows the p-value of the Pearson's correlation coeffiecint which is p = 0.047 which is less than α=0.05. Thus, there was significant correlation between weight loss of the samples with different doses of gamma. The value of the correlation coefficient (r-value) is r = -0.953, which is closed to -1 shows that there was strong negative correlation between weight loss of the samples and doses of gamma. This indicates that there is inversely proportional relationship between weight loss of the samples with different doses of gamma. Thus, as the dose of gamma increases, the weight loss of the sample decreases. This result can be supported by the study done by Maxwell et al. [5], stated that low dose of gamma has no effect on mass preservation as compared to the highest dose. Besides, the study also stated that, the amount of gamma irradiation dose to preserve the mass of the mango must be more than 400 Gy.

Table 1: Mass loss and the percentage of the mass loss of the groups sample

Group	Initial mean mass (g)	Final mean mass (g)	Mass loss	% mass loss
A (0 Gy)	0.8568	0.5972	0.2596	30.1%
B (400 Gy)	0.8394	0.5958	0.2436	29.0%
C (800 Gy)	0.8324	0.6255	0.2069	24.9%
D (1200 Gy)	0.8339	0.6353	0.2037	24.4%

Table 2: Pearson's correlation coefficient between radiation dose and percentage of mass loss

Pearson correlation	-0.953
p-value	.047

4. CONCLUSION

Based on this result, there is significant correlation between the doses of gamma and weight loss of samples. As the gamma irradiation dose increases, the percentage of weight loss of the mangoes would decreases. Thus, gamma irradiation is a potential method to preserve the weight loss of the mango.

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REFERENCES

[1] Phianmongkhol, A., & Wirjantoro, T. I. "Effect of ripening stage and vacuum pressure on vacuum impregnated mango 'Chok Anan', *International Food Research Journal*, vol. 23, no. 3, pp.1085-1091, 2016

[2] Siddiq. M, Brecht. J, and Sidhu. J. "Handbook of Mango Fruit", Oxford, UK: Wiley, 2017

[3] Mahto, R. and Das, M. "Postharvest biology and technology effect of gamma irradiation on the physicochemical and visual properties of mango (Mangifera indica L.), cv. "Dussehra" and "Fazli" stored at 20°C"', *Postharvest Biology and Technology*. 86, pp. 447–455, 2013

[4] Youssef, B., Asker, A., El-Samahy, S., & Swailam, H. "Combined effect of steaming and gamma irradiation on the quality of mango pulp stored at refrigerated temperature. *Food Research International*, vol. 35, no. 1, pp. 1-13, 2002

[5] Maxwell, I., Haruna, A. and Kutigi, B. "Effect of irradiation on rotting and mass of mango fruits with gamma ray from cobalt-60 source", *Asian Journal of Chemical Sciences*, vol. 2, no. (2). pp. 1–6, 2017

[6] Pricaz, M. and Ţă, A. U. "Gamma radiation for improvements in food industry, environmental quality and healthcare", *Romanian Journal of Biophysics*, vol. 25, no., pp. 143–162, 2015

[7] Lacroix, M. and Ouattara, B. "Combined industrial processes with irradiation to assure innocuity and preservation of food products — a review, *Food Research International*, vol. 33, no. 9, pp. 719-724, 2000