P3TIR/P.96/2002

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ABSTRAK

PENGARUH IRADIASI GAMMA PADA KUALITAS SOSIS DAN HAMBURGER. Sosis dan hamburger segar masing-masing dikemas secara vakum di dalam bahan pengemas laminasi kemudian diiradiasi dengan dosis 2,4, dan 6 kGy kemudian disimpan pada suhu –2°C. Kemasan tersebut disimpan selama 0, 1, 2 dan 3 bulan, kemudian setiap isi kemasan dibuka untuk keperluan analisa kimiawi seperti TVBN dan pH,. Pengujian mikrobiologi dilakukan terhadap perhitungan total bakteri (TBC), total kapang (TYC) dan bakteri koliform. Pengujian organoleptik sebagai evaluasi secara subjektif dilakukan terhadap warna, bau, tekstur dan penampakan secara umum, Hasil yang diperoleh menunjukkan bahwa iradiasi dengan dosis sampai 6 kGy tidak berpengaruh pada nilai TVBN dan pH baik pada sosis maupun pada hamburger. Hasil pengamatan menunjukkan pula bahwa iradiasi dengan dosis 2 kGy dapat menurunkan 2 desimal TBC, sedangkan pada dosis 4-6 kGy dapat menurunkan total mikroba sebesar 4 desimal setelah penyimpanan 2 bulan. Iradiasi dengan dosis 4-6 kGy dapat mengeliminasi total kapang, dan mulai dosis 2 kGy bakteri koliform dapat dieliminasi secara efektif. Iradiasi pada dosis sampai dengan 6 kGy dapat meningkatkan kualitas sosis dan hamburger baik sebelum maupun sampai penyimpanan selama 3 bulan.

Kata kunci : sosis dan hamburger, iradiasi gamma, pengawetan makanan

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EFFECTS OF GAMMA IRRADIATION ON THE QUALITY KEEPING OF FRANKFURTER AND HAMBURGER

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ABSTRACT

EFFECTS OF GAMMA IRRADIATION ON THE QUALITY KEEPING OF FRANKFURTER AND HAMBURGER. Fresh frankfurter and hamburger were vacuum packed in laminate packaging material and irradiated at 2, 4 and 6 kGy then stored at –2°C at 0, 1, 2 and 3 months of display. Chemical analysis i.e., TVBN and pH were carried out for each type of packages. Microbiological determination was conducted on total bacterial counts (TBC), total yeast counts (TYC), and coliform bacteria. Organoleptic tests as subjective evaluation on colour, odour, texture, and appearance were also done.The results show that irradiation at doses up to 6 kGy did not influence TVBN values both in frankfurter and hamburger but storage time might slightly increase these values in both samples. Similar results were obtained for pH values. Microbiology assessment on the samples show that irradiation at the dose of 2 kGy might reduce 2 log cycles TBC, and the doses 4-6 kGy could reduce the value for about 4 log cycles after 2 months of storage. Irradiation at the doses 4-6 kGy could completely eliminate TYC, and the dose of 2 kGy,

Key words : frankfurters and hamburger, gamma irradiation, food preservation

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could effectively eliminate coliform bacteria while irradiation at the dose up to 6 kGy could increase the quality of frankfurter and hamburger both before and after storage up to 3 months.

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ABSTRAK

PENGARUH IRADIASI GAMMA PADA KUALITAS SOSIS DAN HAMBURGER. Sosis dan hamburger segar masing-masing dikemas secara vakum di dalam bahan pengemas laminasi kemudian diiradiasi dengan dosis 2,4, dan 6 kGy kemudian disimpan pada suhu (–2°C. Kemasan tersebut disimpan selama 0, 1, 2 dan 3 bulan, kemudian setiap isi kemasan dibuka untuk keperluan analisa kimiawi seperti TVBN dan pH,. Pengujian mikrobiologi dilakukan terhadap perhitungan total bakeri (TBC), total kapang (TYC) dan bakteri koliform. Pengujian organoleptik sebagai evaluasi secara subjektif dilakukan terhadap warna, bau, tekstur dan penampakan secara umum. Hasil yang diperoleh menunjukkan bahwa iradiasi dengan dosis sampai 6 kGy tidak berpengaruh pada nilai TVBN dan pH baik pada sosis maupun pada hamburger. Hasil pengamatan menunjukkan pula bahwa iradiasi dengan dosis 2 kGy dapat menurunkan 2 desimal TBC, sedangkan pada dosis 4-6 kGy dapat menurunkan total mikroba sebesar 4 desimal setelah penyimpanan 2 bulan. Iradiasi dengan dosis 4-6 kGy dapat mengeliminasi total kapang, dan mulai

dosis 2 kGy bakteri koliform dapat dieliminasi secara efektif. Iradiasi pada dosis sampai dengan 6 kGy dapat meningkatkan kualitas sosis dan hamburger baik sebelum maupun sampai penyimpanan selama 3 bulan.

Kata kunci : sosis dan hamburger, iradiasi gamma, pengawetan makanan

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INTRODUCTION

Low dose gamma irradiation has a major impact on the microflora of foods as well as in meat and meat products. Many researchers reported that most of the vegetative bacteria, including pathogens, are eliminated by a dose of 5 kGy. GRAU (1) has studied microbial growth of vacuum-packaged chilled beef, he reported that *Brochothrix thermosphacta*, *Enterobacteriaceae* and the *Pseudomonas-Moraxella* group grew more rapidly on the fat than on the lean surfaces of chilled vacuum-packaged beef striploins of pH 5.45-5.85. It has intensively been studied by several investigators that ground meat generally has a more diversified flora than raw fresh meat.

Research work on the irradiated of meat for the production of fermented sausage using commercial batter revealed that irradiation with doses up to 5 kGy at 5°C± 3°C reduced the total aerobic bacteria in commercial batter up to 2.2 log cycles. The irradiation dose could also reduced the *coliform* and *staphylococci* counts after fermentation of sausage to levels that minimized public health concern (2). Other study on changes in the microflora of Vienna sausages after irradiation with gamma-rays and storage at 10°C revealed that irradiation at doses of 3 and 5 kGy reduced *Lactobacillus*, *Streptococcus*, *Acinetobacter* and *yeasts*. A combined treatment between irradiation at a dose of 3 kGy and nitrogen gas treated in the packed Vienna sausages did not increase the number of micro organism for 3 to 7 days of storage, and the storage-life was extended 2-3 times. Irradiation on the sausages with the dose of 5 kGy and stored at 10°C could suppress the number of microorganisms for

9-14 days (3). It seems from these results that the combined selective effects of irradiation and refrigeration caused to eliminate the dominating flora.

However, irradiation has a potential use in the production of fermented sausage, where it could decrease the dominance of lactic acid bacteria in the microflora which reduce the desired flavour and inhibit the growth of pathogens (2). Irradiation would also ensure the safety of the product by eliminating pathogenic bacteria in its vegetative state and would be similar in principle to pasteurizing milk.

Objective of this study was to determine the potential of irradiation for reduction of microorganisms in vacuum packaged frankfurter and hamburger.

MATERIALS AND METHODS

Materials. Total amount of 16 vacuum packaged containing 3 beef-frankfurters, and 3 slices of hamburger respectively were freshly obtained from a delicatessen and sausage manufacturer in Jakarta. Moisture content of frankfurters was 38.08%, and salt content was 1.56%. Moisture content of hamburger was 30.20% and salt content was 1.29%.

Storage conditions

Following completion of irradiation , the experimental samples were stored at –2°C. Quality evaluation for all samples was conducted after storage periods of 1, 2 and 3 months. Chemical analysis, microbiological assessments, and subjective evaluations in all irradiated and unirradiated samples were observed before and after storage time.

Total Volatile Base Nitrogen (TVBN) and pH measurements

TVBN was determined using Conway plate and acid titration method in order to indicate the degree of deterioration within the samples. The value of pH was measured at 25°C in a Prolabo pH meter.

Microbiology assessments

Microbial assessments were done in each sample either unirradiated or irradiated to determine microbial load of frankfurter and hamburger. Total Bacterial Count was enumerated in Tryptic Soya Agar media after incubation at 37°C for 48 h, Total Yeast Count was enumerated in Sabouroud Dextrose Agar media after incubation at 22-25°C for 6-7 days, and Coliform was enumerated in Mac. Conkey Agar media after incubation at 37°C for 18-24 h.

Subjective evaluation

Sensory analysis in all analyzed samples as well as subjective testing was done by 5 to 10 selected panelists using a degree of preferences as subjective evaluation on the following parameters, i.e., colour, odour, taste, texture and appearance.

Irradiation treatment

Gamma irradiation was conducted at the IRPASENA irradiator at the National Nuclear Energy Agency, Pasar Jumat, Jakarta. Co-60 was used as the source

of ionizing radiation. The minimum radiation absorbed doses applied were 2, 4 and 6 kGy. The irradiated samples were stored at –2°C prior to its analysis.

RESULTS AND DISCUSSION

Total volatile base nitrogen (TVBN) values and pH of irradiated and unirradiated frankfurter during storage at –2°C are presented in Table 1. The results show that irradiation at doses up to 6 kGy could slightly increase the TVBN value both before and after storage, meanwhile the pH values remained stable in all treated samples before and after storage. The increasing TVBN values was probably due to the fact that frankfurter a product with high protein and lipid content when vacuum packed are likely to create several ecologically different environments at certain pH. Similar results were also found in the study on irradiated semi dried shrimps (4). Results of TVBN value of irradiated hamburger show a decrease in the value both before and after storage. The results revealed that TVBN value shows a decrease by increasing radiation dose and increasing storage time. pH values did not change in all treated samples before and after storage (Table 2).

Microbial load of irradiated and unirradiated frankfurter and hamburger stored at –2°C are presented in Table 3 and Table 4 respectively. Results show that for both frankfurter and hamburger the effect of irradiation was dose dependent with reduction in total bacterial count ranging from 2 log cycle at 2 kGy and 4 log cycle at 4 and 6 kGy. The microbial load of irradiated samples shows a decrease by increasing storage time. Apparently irradiation treatment at the similar exposure dose is more effective in eliminating microbes in

hamburger rather than in frankfurter. Total Yeast Count in frankfurter was totally eliminated by the radiation dose starting from 4 kGy, and of 6 kGy in hamburger. Coliform bacteria was totally eliminated at doses 2-6 kGy both in frankfurter and hamburger. Obviously this is due to the fact that the initial contamination of coliform bacteria were already low in those samples.

Results of subjective evaluation of irradiated and unirradiated frankfurter and hamburger stored at -2°C are presented in Table 5 and Table 6 respectively. The results revealed that irradiation dose starting from 2 kGy particularly during storage could keep the quality of these products. The parallel result is in line with RICHARD *et.al.* (5) who reported that acceptable processing and flavour profile characteristics of frankfurter were achieved near pH of 6.0 and at low salt content. Irradiation could improve the quality of colour, odour, taste, texture and appearance of frankfurter and hamburger. No "radiation smell" was found in those observed samples.

CONCLUSION

It can be concluded from the finding results that gamma irradiation at doses 2-6 kGy could maintain the quality of frankfurter and hamburger both before and after storage at -2°C. Low moisture and salt content, pH value of 6.0 and proper packaging material used in this work might also contribute to stability of irradiated frankfurter and hamburger during storage.

ACKNOWLEDGEMENT

The authors wish to thank a delicatessen and sausage manufacture in Jakarta for providing us the samples during conducting the research work.

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Table 1. Total volatile base nitrogen (TVBN) values and pH of irradiated and unirradiated frankfurter during storage at –2°C.

Storage time (months)	TVBN* (mg%N)				pH*			
	0 kGy	2 kGy	4 kGy	6kGy	0 kGy	2 kGy	4 kGy	6 kGy
0	8.72	9.49	9.39	9.99	6.13	6.17	6.12	6.15
1	8.67	11.52	9.01	9.78	5.68	5.65	5.65	5.70
2	9.54	12.62	10.14	9.85	5.77	5.82	5.77	5.80
3	10.78	8.02	10.27	8.82	5.62	5.73	5.67	5.72

* Average of 3 replications

Table 2. Total volatile base nitrogen (TVBN) values and pH of irradiated and unirradiated hamburger during storage at -2°C.

Storage time (months)	TVBN* (mg%N)				pH*			
	0kGy	2kGy	4kGy	6kGy	0kGy	2kGy	4kGy	6kGy
0	13.99	14.75	12.14	13.85	6.18	6.22	6.07	6.07
1	12.58	10.66	11.44	9.39	5.90	6.00	5.92	5.98
2	11.68	13.12	11.30	13.09	5.97	5.97	5.95	6.02
3	14.20	12.81	13.01	13.47	5.93	5.95	5.98	5.90

*Average of 3 replications

Table 3. Microbial load* of irradiated and unirradiated frankfurter stored at -2°C

Storage time (Months)	TBC /g				TYC/g				Coliform bacteria/g			
	0 kGy	2kGy	4 kGy	6 kGy	0 kGy	2 kGy	4 kGy	6 kGy	0 kGy	2 kGy	4 kGy	6 kGy
0	$1.74x10^4$	$3.00x10^4$	$2.50x10^2$	$1.33x10^2$	$7.73x10^2$	0	0	0	$7.07x10^2$	0	0	0
1	$0.99x10^4$	$1.04x10^2$	16	3	$4.17x10^2$	129	0	0	0	0	0	0
2	$0.71x10^4$	$2.04x10^2$	6	0	$2.67x10^2$	13	0	0	0	0	0	0
3	$1.03x10^4$	50	6	2	$9.53x10^3$	0	0	0	0	0	0	0

*Average of 3 replications

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Table 4. Microbial load* of irradiated and unirradiated hamburger stored at -2°C

Storage time (Months)	TBC /g				TYC/g				Coliform bacteria/g			
	0 kGy	2kGy	4 kGy	6 kGy	0 kGy	2 kGy	4 kGy	6 kGy	0 kGy	2 kGy	4 kGy	6 kGy
0	$4.92x10^5$	$2.04x10^3$	54	21	$1.47x10^4$	$3.17x10^3$	150	0	$2.97x10^3$	0	0	0
	$2.09x10^5$	$5.92x10^2$	96	6	$2.63x10^4$	$1.51x10^3$	2	0	100	0	0	0
	$1.94x10^5$	$5.46x10^2$	4	0	$2.54x10^4$	$6.59x10^2$	1	0	150	0	0	0
	$1.27x10^5$	$3.06x10^3$	3	2	$2.49x10^4$	$2.71x10^2$	0	0	200	0	0	0

age of 3 replications

e 5. Results of subjective evaluation* of irradiated and unirradiated frankfurter stored at -2°C

age onths)	Parameter	Irradiation dose (kGy)			
		0	2	4	6
0	Colour	orange reddish	orange reddish	orange reddish	orange reddish
	Odour	strong	strong	weaker	weaker
	Taste	good	good	good	good
	Texture	good	good	good	good
	Appearance	good	good	good	good
1	Colour	orange reddish	orange reddish	orange reddish	orange reddish
	Odour	strong	strong	weaker	strong
	Taste	good	good	good	good
	Texture	good	good	good	good
	Appearance	good	good	good	good
2	Colour	less bright/dull	orange reddish	orange reddish	orange reddish
	Odour	weaker	weaker	strong	strong
	Taste	passable	passable	passable	good
	Texture	good	good	good	good
	Appearance	passable	good	good	good
3	Colour	less bright/dull	orange reddish	orange reddish	orange reddish
	Odour	off-odour/putrid	passable	strong	strong
	Taste	off-flavour	good	good	good
	Texture	good	good	good	good
	Appearance	passable	good	good	good

verage of 10 panelists

ble 6. Results of subjective evaluation* of irradiated and unirradiated hamburger stored at –2°C

storage (months)	Parameter	Irradiation dose (kGy)			
		0	2	4	6
0	Colour	Pink brownish	Pink brownish	Pink brownish	Pink brownish
	Odour	strong	strong	weaker	weaker
	Taste	good	good	good	good
	Texture	good	good	good	good
	Appearance	good	good	good	good
1	Colour	Pink brownish	Pink brownish	Pink brrownish	Pink brownish
	Odour	strong	weaker	strong	weaker
	Taste	good	good	good	good
	Texture	good	good	good	good
	Appearance	good	good	good	good
2	Colour	Pink brownish	Pink brownish	Pink brownish	Pink brownish
	Odour	weaker	Strong	strong	strong
	Taste	passable	good	good	good
	Texture	good	good	good	good
	Appearance	good	good	good	good
3	Colour	Pink yellowish	Pink brownish	Pink brownish	Pink brownish
	Odour	off-odour/putrid	good	good	Good
	Taste	off-flavour	good	good	good
	Texture	good	good	good	good
	Appearance	not good	good	good	good

Average of 10 panelists