



Improving the Quality of Smoked Shrimp by Combination Treatments

โดย

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Abstracts

Smoked shrimp (*P. monodon*) was packed into medium density polyethylene (MDPE), then vacuum/atmospheric packing before irradiated at 0, 1, 3, 5, 8, 12 and 25 kGy under frozen/unfrozen condition chemical-microbiological analysis as well as organoleptic evaluation were carried out during storage at ambient (22±5°C) and refrigerator (4°C) for one month. The gamma ray was emitted by Co-60 source of 322,575 curies with a radiation dose rate of 1.265 kGy per hour.

It was found the microorganisms showed not only temperature depending but also found more radiation resistance microorganisms at higher radiation doses on the irradiated sample under frozen condition.

Peroxide value (POV) Total Volatile Nitrogen (TVN) showed higher number duration of storage and temperature together with packing techniques (Vacuum or atmospheric) especially at higher of radiation doses would introduced rapidly increase on the product that irradiated under unfrozen condition.

For the storage study showed radiation doses at 5 kGy is enough to improve the quality of smoked shrimp in order to marketing quality.

Trimethylamine (TMA-N), found slightly increase.

Objectives :

- 1) to extend the shelf-life of the value added products.
- 2) to find the proper radiation dose to preserve the product's quality.
- 3) to study more information on chemical change and microbial activity after the products were treated and irradiated.

Introduction :

Beyond 1985 most of the frozen shrimp fish and squid was exported to Japan, USA and EEC countries. Sometimes our products were detented or rejected because of high contamination of enteropathogenic bacteria and also many EDA's report on decomposition problem, but 5 years later the export problems was slightly change to the enteropathogenic instead of deteriorated problem, the reason, a big quantity of farmed shrimp (tiger) was rapidly increased from 24,000, 53,000 and 90,000 tons in 1988 to 1990 respectively, while the quantity of national catch shrimp is rather stable (100,000 to 120,000 tons). At the present time many of the factories are interested to make a high value product instead of sending a lot of raw materials, packaging and low temperature are the common factors need to be used to extend the shelf-life of that products but the radiation technology play an important role on that combination treatment.

Materials and Methods.

The prawns used in this experiments were black tiger (*P. Monodon*) from farmed culture in southern part of Thailand but it was harvested within 10 hours and transported to processing plant in Samuthsarkorn, 30 k.m. from Bangkok. Then the shrimp (20-25 shrimp/kg) was processed and seasoning then dried for half and hour before smoked at 80°C 3 hours then packed in to medium density poly-ethylene (MDPE) and the smoked shrimp was divided into:-

Smoked shrimp with atmospheric/vacuum packed the irradiated (at 0, 1, 3, 5, 8, 12 and 25 kGy.) under frozen or unfrozen condition then kept at ambient (22±5°C) refrigerator (4°C), and freezer (-30°C) for periodical analysis.

Bacteriological analysis

20 gm of prawn with 180 ml of steriled peptone buffer then homogenised for 1 min. the Total viable aerobic

and anaerobic plate count (TVC, cfu/gm) was carried out and incubated at 30°C for 24-48 hours. Faecal coliformes count was enumerated by using MacConkey agar then incubated at 37°C and 44.5°C for 24 hours. *Staphylococcus aureus* counts were carried out on Baird-Parker agar and incubated at 37°C for 24 hours, suspected colonies were tested for coagulase production using rabbit plasma.

Chemical analysis

TMA-N and TVB-N analysis were followed the Conway microdiffusion technique after extraction with trichloroacetic acid (Conway : 1969)

K-value which are expressed as the ratio of hypoxanthine (Hx) and inosine (Ix) to the total amount of ATP-related compounds that expressed as percentage by the method of Kobayashi and Uchiyama (1978)

Organoleptic evaluations :

General appearances, odour, color, flavour, texture and carried out by 74-8 panelists with well trained. Hedonic scores 7-as the superior quality and 1 as the extremely poor in quality was graded.

Results

Peroxide value of irradiated smoked shrimp was increased along the radiated dose (table 5) was sharply increased on the treated sample in atmospheric packed and irradiated under unfrozen condition. The treated sample with vacuum packed and irradiated under frozen condition was not caused much differences between the AF and VF, even the same higher dose has not been applied (table 6,7) to compare each of treatments (AA, VA, AR and VR). It was found that the higher radiation doses cause higher POV number on AA and VA more than AR and VR at a higher dose. On the sample which stored 30 days at ambient, refrigerator and freezer. It was found a higher TMA-value on treated (A) sample while it was

slowly increased on the treated (R) sample and also slightly change on the treated (F) sample even it was stored for 30 days.

TVB-N formation on smoked shrimp during storage was slightly increased even on treated (A) sample and was slightly increased on treated (R and F) sample (table 8). But the irradiated sample and packed into MDPE with Vacuum and atmospheric and irradiated under frozen and unfrozen condition on the treated (au) sample the TVB-N value on (au) increased higher even lower doses has been applied.

The quality of shrimp (fresh, smoked) as reported on cable 1,2 table 3 smoked shrimp was packed in Medium Density Poly Ethylene = MDPE then kept at ambient (22+5°C) refrigerator (4-8°C) and freezer (-30°C) TVC of each sample was studied during storage. It was found that TVC of ambient temperature sample increased from 6.70×10^4 to 4.80×10^9 cfu/gm of 1, 3 and 5 days storage respectively. The quality of shrimp in refrigerator were accepted in order to sensory evaluation until after 21 days storage it was rejected. While the sample was kept under ambient temperature (22+5°C) was spoiled or deteriorated at 4-5 days regard to TVC value, was 9.4×10^9 and 3.66×10^9 cfu/gm on the 5th and 7th after storage respectively.

Microorganism contamination on smoked shrimp in MDPE with atmospheric and irradiated (1, 3, 5, 8, 12 and 25 kGy) under frozen condition were studied and vacuum packed for TVC, Lactic acid bacteria, *E.coli* and *Staph spp.* it was found that the lower radiated dose was able to eliminate microorganism on Atmospheric and irradiated under unfrozen condition but AF and VF boths required higher radiation doses to eliminate microorganism which were in previous reported (P. Rattagool, H. Ito 1992).

TVB-N formation on smoked shrimp, vacuum packed and irradiated under frozen condition gave lower value (80.66-116.19 mgN%) in smoked shrimp, treated by atmospheric packin before irradiated under frozen. The treated smoked shrimp with atmospheric and irradiated (25 kGy) under

unfrozen gave the highest TVB value is 99.5-186.60 mgN%) table 10 smoked shrimp atmospheric packing, irradiated at 0, 1, 3, 5, 8 12 and 25 kGy under frozen condition then stored in refrigerator (5 $^{\circ}$ C) and ambient temperature (22 \pm 5 $^{\circ}$ C). It was also found that TVB value on the ambient temperature sample increased faster the irradiated shrimp stored in refrigerator (5-8 $^{\circ}$ C) for example the TVB on treated sample of 3 kGy; at ambient temperature showed 95.878, 125.590 and 185.351 while they were 78.111, 93.427 and (119.44) mgN% on the sample which was kept under refrigerator. TVB-on, treated sample of showed high value on the sample with higher temperature storage also.

Table 11 irradiated smoked shrimp, vacuum packed and stored 15 days in refrigerator (5-8 $^{\circ}$ C) and also stored for 7 days at ambient temperature. TVB value on the lower radiation dose and shorter storage (0 days) showed less value than the irradiation sample.

The physical properties of treated and untreated smoked shrimp have been used hedonic scale (7-1 persons). 7 is represented good quality and 4 is as a critical point while 1 is represent poor quality. The sample is preserved at atmospheric condition.

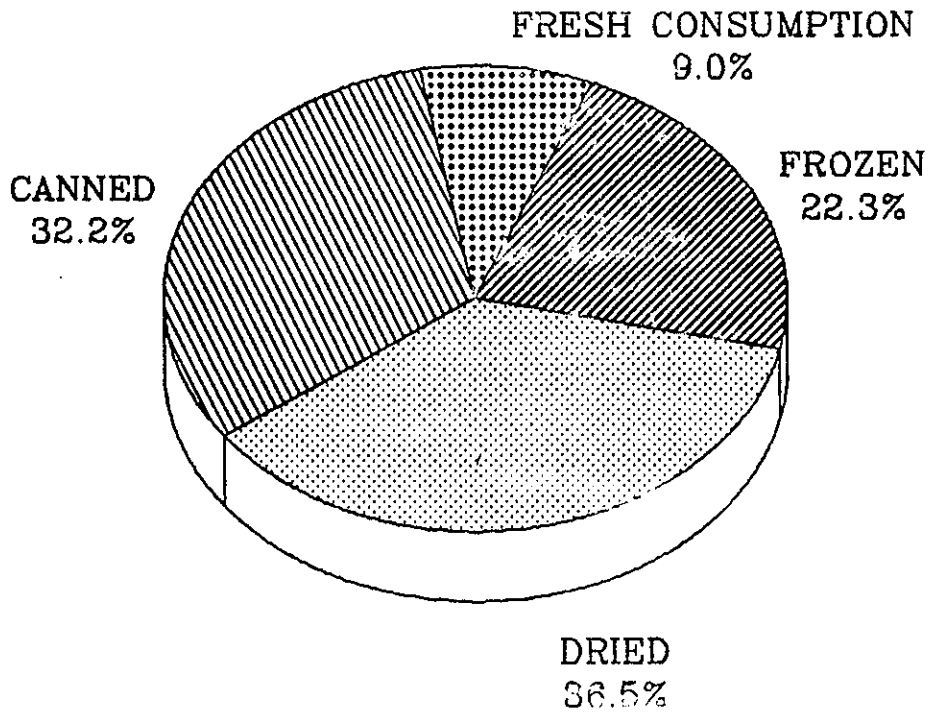
Conclusion and Discussions

It was found that radiation treatment is able to extend the shelf-life of smoked shrimp at least 10 more days last longer. Formation on radiation odour that may cause if the products were irradiated at higher doses than 3 kGy and also found that microorganism was able to resisted higher radiation dose of the products.

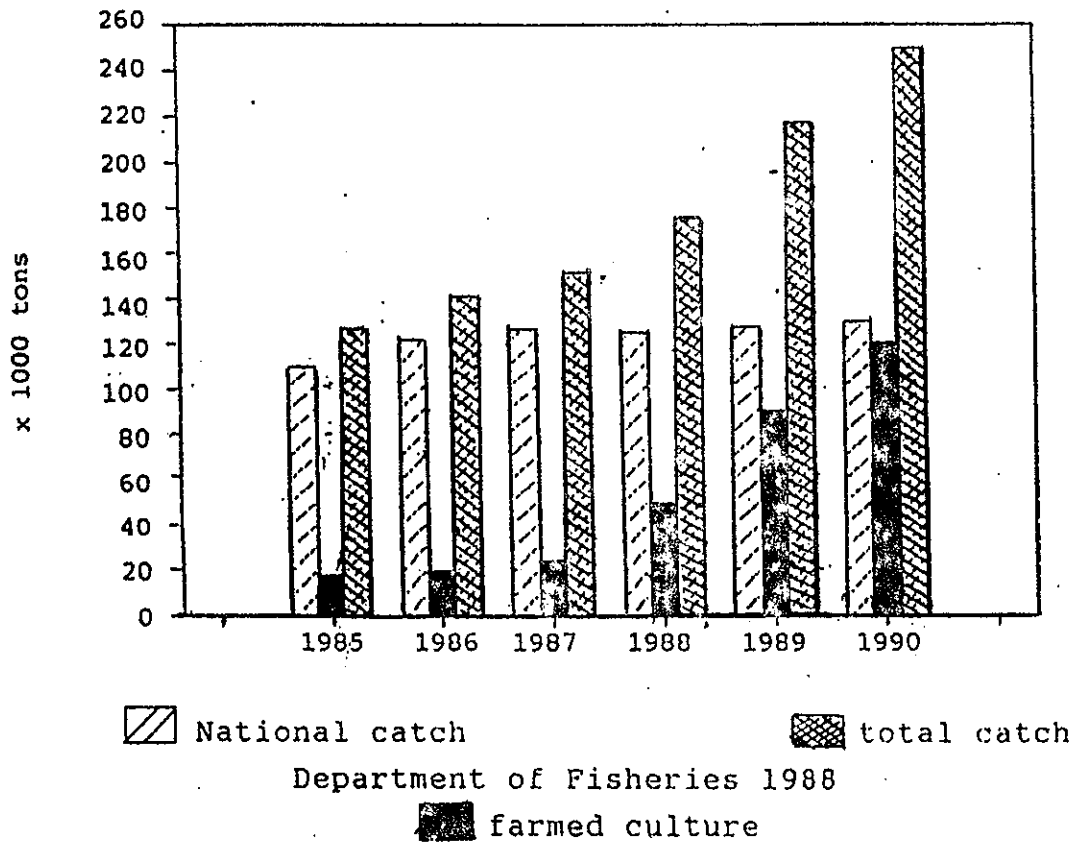
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GRAPH I : Utilization of shrimp in 1984
Sources: Fishery Economic Report
Dept. of Fisheries 1988



GRAPH II shrimp from natural culture
and farmed raising farm 1985-1990



GRAPH III shrimp for export 1985-1990

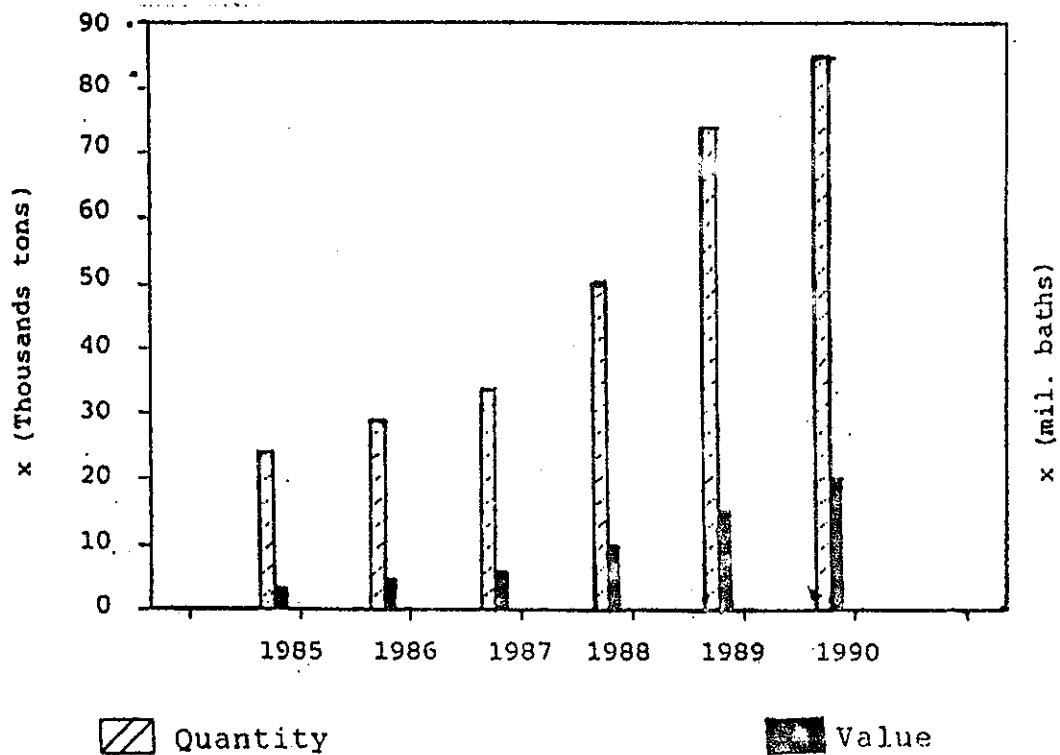


Table 1 Quality and composition of fresh shrimp

	pH	moisture (%)	fat (%)	protein (%)	TVB-N (mgN%)	TMA-N (mgN%)
Fresh	6.87	79.40	0.07	19.94	7.16	0.00
	6.90	78.9	0.06	20.88	8.72	0.00
Ave.	6.88	79.1	0.65	20.36	7.94	0.00
after smoked						
Ave. (3)	6.28	70.44	0.44	28.16	13.64	4.60

Table 2 Microorganisms on shrimp before and after smoking

	TVC (cfu/gm) (aerobe) (anaerobe)		<u>E.coli</u>	<u>Staph.sp</u>	Yeast & Mold
fresh shrimp (Ave. of 3)	3.7×10^5	4.10×10^5	2.5×10^3	3.5×10^3	1.25×10^4
smoked shrimp (Ave. of 3)	2.86×10^3	7.61×10^3	4.2×10^1	6.4×10^2	8.6×10^2

Table 3 Total plate count (cfu/gm) of smoked shrimp stored at ambient (A, 22±5°C), refrigerator (R, 4°C) and (F, -30°C)

Storage (days)	TVC (cfu/gm)		
	A	R	F
1	6.70×10^4	2.75×10^3	1.74×10^3
3	4.80×10^6	-	-
5	9.4×10^8 *	-	-
7	3.66×10^9 *	3.64×10^4	4.68×10^2
10	rejected	2.40×10^5	-
14	-	6.60×10^5	-
21	-	3.9×10^6 *	7.46×10^2
30	-	8.1×10^6 *	-

*=rejected

Table 4 Microorganisms on smoke shrimp, packed under atmospheric and vacuum condition then irradiated at 0, 1, 3, 5, 8, 12 and 25 kGy. under frozen and unfrozen condition

Treated sample at (kGy)	TVC (cfu/gm) 30° C	Lactic acid Anaerobe bacteria	E.coli	Staph.sp
1 AU	2.0x10 ³	8.6x10 ²	2.9x10 ²	1.0x10 ¹
3 AU	1.8x10 ³	4.0x10 ²	5.0x10 ¹	1.3x10 ¹
5 AU	8.7x10 ¹	7.5x10 ¹	2.1x10 ¹	1.1x10 ¹
8 AU	1.0x10 ⁰	0	0	0
12 AU	0	0	0	0
25 AU	0	0	0	0
1 AF	1.0x10 ³	1.9x10 ²	1.0x10 ¹	1.5x10 ¹
3 AF	2.8x10 ²	6.1x10 ¹	1.5x10 ¹	0
5 AF	2.5x10 ¹	2.2x10 ¹	5.0x10 ⁰	0
8 AF	1.0x10 ¹	5.0x10 ⁰	5.0x10 ⁰	0
12 AF	0	0	0	0
25 AF	0	0	0	0
1 VF	1.35x10 ³	5.5x10 ²	5.0x10 ²	2.5x10 ¹
3 VF	1.12x10 ²	1.0x10 ²	5.0x10 ⁰	2.0x10 ¹
5 VF	1.0x10 ¹	1.0x10 ²	1.0x10 ¹	0
8 VF	5.0x10 ⁰	5.0x10 ¹	5.0x10 ⁰	0
12 VF	0	1.0x10 ¹	0	0
25 VF	0	0	0	0

AU = Smoked shrimp, atmospheric packed and irradiated under unfrozen condition

AF = Smoked shrimp, atmospheric packed and irradiated under frozen

VF = Smoked shrimp vacuum packed and irradiated under frozen condition

Table 5 Peroxide value (meq/kg) of the irradiated smoked shrimp (*P.monodon*) with atmospheric and vacuum packed under frozen and unfrozen condition

Treated sample at (kGy)	AF	AU	VF
unirradiated (control)	= 3.602 meq/kg		
1	8.60	7.55	8.50
3	16.82	46.37	15.10
5	37.36	134.65	35.82
8	66.23	146.84	50.61
12	113.37	153.46	107.04
25	136.94	221.12	152.45

AF = atmospheric packed and irradiated under frozen condition

AU = atmospheric packed and irradiated under unfrozen condition

VF = vacuum packed and irradiated under frozen condition

Table 6 Peroxid value on smoked shrimps (*P.monodon*) packed under atmospheric and vacuum, irradiated under frozen condition at 0,1, 3, 8, 12 and kGy, then stored at ambient temperature (22±5°C)

Treated samples at(kGy)	POV (meq/kg) (AA)=(AF)			POV (meq/kg) (VA)		
	0 day	3 days	7 days	0 day	3 days	7 days
control	3.60	35.09	66.84	ND	32.82	49.11
1	8.60	39.33	62.46	8.57	27.91	47.32
3	26.82	67.88	82.47	15.10	44.64	64.74
5	37.36	66.70	89.11	25.82	61.08	72.11
8	66.23	87.20	110.28	50.61	73.49	90.61
12	113.37	126.25	130.56	107.04	120.51	119.34
25	136.94	171.30	202.86	122.45	162.41	180.66

AA = irradiated smoked shrimp under atmospheric packed, stored at ambient temperature

VA = irradiated smoked shrimp under Vacuum packed, stored at ambient temperature

ND = not determined

Table 7 Peroxide value of smoke shrimp (*P.monodon*), then vacuum packed before irradiated at 0, 1, 3, 5, 8, 12 and 25 kGy, under frozen condition and stored in refrigerator (4°C)

Treated samples at(kGy)	POV (meq/kg) (AR)			POV (meq/kg) (VR)		
	0 day	7 days	15 days	0 day	7 days	15 days
control	3.60	27.64	48.31	ND	ND	ND
1	8.60	29.33	59.40	8.57	29.91	47.12
3	26.82	53.40	53.46	45.10	44.64	66.78
5	37.30	75.94	91.49	45.82	55.80	76.69
8	66.23	85.91	108.20	50.61	75.77	82.42
12	113.37	122.81	133.15	107.04	119.63	121.83
25	136.94	143.52	164.66	122.64	146.64	161.55

AR = irradiated smoked shrimp, atmospheric packed stored at Refrigerator condition (4°C)

VR = irradiated smoked shrimp, Vacuum packed stored at Refrigerator condition (4°C)

ND = not determined

Table 8 TMA-N (mgN%), TVB-N (mgN%) of smoked shrimp and kept at ambient (A), refrigerator (R) and freezer (F)

storage (days)	TMA-N (mgN%)			TVB-N (mgN%)		
	A	R	F	A	R	F
0	0.07	0.07	0.07	10.64	10.64	10.64
1	0.74±.02	0.12±.02	0.07±.01	13.88±.65	11.74±.32	-
3	1.04±.01	-	-	16.83±.67	-	-
5	1.42±.13	-	-	18.06±.66	-	-
7	2.47±.05	0.17±.02	-	24.24±.25	-	-
14	-	0.24±.04	0.11±.04	-	28.43±1.18	15.33±0.75
21	-	0.43±.02	-	-	30.47±.79	-
30	-	0.74±.03	0.15±.03	-	34.14±.25	20.14±1.57

Table 9 Total Volatile Base Nitrogen (TVB-N) smoked shrimp atmospheric and vacuum packed then irradiated at 0, 1, 3, 5, 8, 12 and 25 kGy under frozen and unfrozen condition

Doses (kGy)	Total Volatile Base Nitrogen (mgN%)		
	Treated sample		
	vf	af	au
1	20.66	31.28	99.36
3	48.53	51.28	100.17
5	68.53	78.63	99.25
8	86.07	99.25	109.36
12	94.46	101.08	149.46
25	116.19	136.63	186.60

vac. irradiat. under frozen (vf) = vacuum and irradiated under frozen condition

atm. irradiat. under frozen (af) = atmospheric and irradiated under frozen condition

atm. irradiat. under unfrozen (au) = atmospheric and irradiated under unfrozen condition

