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Studies on Nham-Pla's Processing by Using Rock Salt and Solar Salt

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ABSTRACT

Nham-Pla (fermented fish cakes) were made from striped snake-head fish (*Channa striata*), Nile tilapia (*Oreochromis niloticus*), striped catfish (*Pangasius hypophthalmus*), and hybrid catfish (*Clarias macrocephalus* x *Clarias gariepinus*). The results of the organoleptic test of uncooked Nham-Pla prepared from rock salt showed differences ($p<0.05$) in appearance, texture, odor and average acceptability scores with the exception for dark meat flesh from hybrid catfish which received the lowest acceptability score of color. The organoleptic tests of cooked Nham-Pla prepared by using rock salt revealed that Nham-Pla made from striped catfish received the highest acceptability score for the appearance characteristic and there were no differences in odor, taste and average acceptability score for both samples prepared from rock salt and solar salt. Nham-Pla made from Nile tilapia with solar salt received the lowest acceptability score, but they received the highest acceptability score for texture. Nham-Pla made from snake-head fish using solar salt received better acceptability scores than Nham-Pla prepared by using rock salt. According to the results, rock salt and solar salt were important for Nham-Pla preparation based on species of fresh water fish and some of their characteristics.

Key words: Nham-Pla, rock salt, solar salt

INTRODUCTION

Nham-Pla or sour fish cake is one of fermented fishery products processed from mostly fresh-water fish. Nham-Pla made from *Notopterus chitala* are found in the market but the shapes of the product and the ingredients were the same as Som-Fug. Usually Som-Fug is made from minced fresh water fish and the ingredients are salt, minced garlic and cooked rice, but for Nham-Pla some sliced pork skin are added the same as Nham-Moo and carrot is used for decorating the products. Because there were a lot of reservoirs in the country, the people who live around that area have the great chance to use some common fresh-water fish such as *Oreochromis niloticus*, *Pangasius hypophthalmus*, *Channa striata*, *Clarias* spp., *Notopterus chitala* and *Notopterus notopterus* for Nham-Pla's processing. Sangjindavong *et al.* (2000) made a preliminary study on Nham-Pla made from fresh water fish and marine fish. Sensory evaluation tests showed that Nham-Pla made from the fresh water fish had a higher acceptability score than Nham-Pla made from marine fish.

Fermented fish products are divided into three main categories (Amano, 1962): 1) Traditional products with high salt content which involve enzymes from fish muscle and intestinal organ. Fish sauce and fish paste are categorized in this group. 2) Traditional products with two steps

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reaction: the first step involves enzymes from fish muscle and the second step mainly adds carbohydrate or microbial to start the final reaction. Pla-Ra and Pickled fish are samples of this group. 3) Non-traditional products: acid such as hydrochloric acid (HCI) is added in the processing of fish sauce products.

Rock salt as a mineral occurs naturally in the ground. It contains 98-99% sodium chloride and it has a water insolubility level of about 0.5-1.5%, being mainly calcium sulphate. Solar salt as a natural product is obtained mainly through evaporation of seawater. It contains 85% sodium chloride and has a water insolubility level of less than 0.03%. (http://www.lentech. Com/water-softener-FAQ.htm)

The objective of this study was therefore to assess the quality characteristics of fermented fish cake prepared from four common varieties of freshwater fish by comparing Nham-Pla which using rock salt and solar salt.

MATERIALS AND METHODS

Completely randomized design (CRD) method with four treatments was adopted for this research. Four kilograms of striped snake-head fish (*Channa striata*), Nile tilapia (*Oreochromis niloticus*), striped catfish (*Pangasius hypophthalmus*), and hybrid catfish (*Clarias macrocephalus* x *C. gariepinus*) were bought from the market, cleaned, gutted and filleted, followed by grinding for 10 minutes using Kitchen Aid. Small amount of rock salt or solar salt, up to 30 grams, was added to 1,000 grams of fish minced during the grinding process. All other ingredients (Table 1) were added after grinding and then the samples, weighing about 130-150 grams each, were put into 6"×9" plastic tubes, wrapped with rubber bands on both ends, placed on trays and kept at ambient temperature (28°C-30°C) for 4 days. Sensory evaluation, chemical analysis and microbiological tests were conducted at fermentation period of 4 days. Flow diagram of Nham-Pla processing is shown in Figure 1.

Quality examination

Sensory evaluation

A sensory panel consisting of 10 persons from the department of Fishery Products was established. Hedonic scale ranged from 1 to 5 was used to indicate the degree of acceptability of each sample (1 = most unacceptable, 5 = most acceptable). The evaluation criteria was manily focused on appearance, color, odor, flavor and texture (Watt *et al*., 1989). Statistical analyses

Table 1 Ingredients used in Nham-Pla processing.

Ingredients	Total weight (gms)
Fish minced	1,000
Pork skin, sliced	300
Rice, cooked	100
Carrot, sliced	150
Garlic, minced	150
Salt (Rock salt, Solar salt)	30
Chilli	10-20

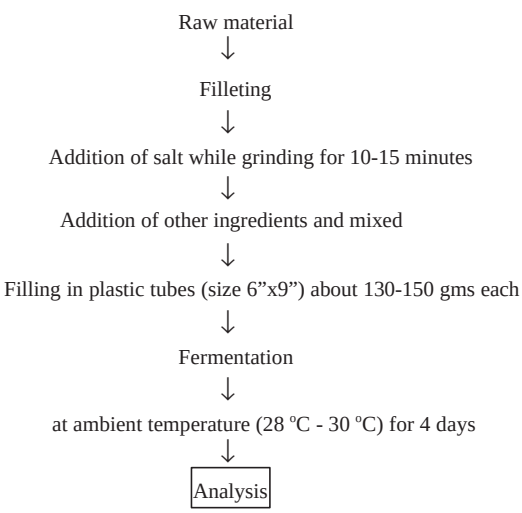

Figure 1 Flow diagram of Nham-Pla.

were carried out using Randomized completed block design (RCBD) method. The mean from 3 replicates was compared by the methods of Duncan's new multiple range test (DMRT) (Khuantham, 1996).

Chemical analysis

The value of pH was measured from 1:10 diluted samples (Metrohm 744 pH meter). Lactic acid, expressed as total acid, was examined from titrating diluted samples with 0.1 N standard NaOH, using phenolphthaline as pH indicator and calculating the lactic acid concentration using the equation % lactic acid = (ml alkali x normality alkali × 9)/ weight of samples in grams (Frazier *et al*., 1968). NaCl content was determined according to Volhard (AOAC, 1990). Protein, fat and moisture content were determined according to AOAC (1984).

Microbiological analysis

Total viable aerobic counts (TVC) were performed on Plate count agar (Merck KGaA), and lactic acid bacteria counted on MRS agar (Merck KGaA). Plates were incubated at 35-37° C for 3 days (TVC count) and incubated at 25°C for 3 days (lactic acid bacteria counted). Strains of lactic acid bacteria were identified according to Sharpe *et al*. (1966).

RESULTS

Chemical analysis

Proximate compositions of Nham-Pla are shown in Table 2. and 3. Sensory evaluation are shown in Table 7 and 8.

Microbiological analysis

Microbiological studied are shown in Table 4, 5 and 6

DISCUSSION

The effect of rock salt and solar salt on Nham-Pla depended on the species of fish and salt characteristics. Flavor of Nham-Pla related to some lactic acid bacteria which might be found in salt. Sangjindavong (1982) reported that 4 genera of bacteria such as *Staphylococcus* sp., *Bacillus* sp. *Arthrobacter* sp. and *Corynebacterium* sp. were isolated from solar salt. Sangjindavong *et al*. (2000) studied on Nham-Pla prepared from striped catfish and Nile tilapia and lactic acid bacteria were isolated namely :- *Leuconostoc mesenteroides, Lactobacillus plantarum, Pediococcus damnosus, Lactobacillus leichmanii, Lactobacillus delbruekii, Lactobacillus brevis* and *Lactobacillus acidophilus*. For this study, lactic acid bacteria isolated from Nham-Pla were *Lactobacillus pentosus, Lactobacillus plantarum, Lactobacillus brevis, Lactobacillus acidophilus and Pediococcus pentosaceus*. Some pathogenic bacteria such as *Staphylococcus aureus, Clostridium perfringens, Salmonella* spp., and fungi were not detected from Nham-Pla.

Table 2 Chemical composition of Nham-Pla using rock salt.

Kinds of Nham-Pla	Moisture (%)	pH	Lactic acid (%)	Salt (%)	Protein (%)	Fat (%)	Ash (%)
Nile tilapia	75.11	3.81	2.37	1.63	15.58	1.06	2.14
Hybrid catfish	68.02	4.03	1.78	1.72	17.23	2.15	2.49
Striped snake-head fish	72.73	4.06	2.81	1.76	18.17	0.94	2.06
Striped catfish	71.26	4.05	2.17	1.73	16.97	3.25	2.24

Table 3 Chemical composition of Nham-Pla using solar salt.

Kinds of Nham-Pla	Moisture (%)	pH	Lactic acid (%)	Salt (%)	Protein (%)	Fat (%)	Ash (%)
Nile tilapia	75.58	4.06	2.48	1.59	17.12	1.07	2.33
Hybrid catfish	73.49	4.09	2.58	1.70	16.62	2.19	2.56
Striped snake-head fish	73.67	4.10	2.68	1.67	17.22	1.03	2.26
Striped catfish	73.16	4.09	2.32	1.8	17.52	3.01	2.35

Table 4 Total lactic acid bacteria in Nham-Pla.

Kinds of Nham-Pla	Total lactic acid bacteria (CFU/g)	
	Rock salt	Solar salt
Nile tilapia	>300	>300
Hybrid catfish	>300	>300
Striped snake-head fish	>300	>300
Striped catfish	>300	>300

Table 5 Total viable aerobic counts.

Kinds of Nham-Pla	Total viable aerobic counts (CFU/g)	
	Rock salt	Solar salt
Nile tilapia	4.65×10^8	2.90×10^9
Hybrid catfish	5.65×10^8	9.25×10^8
Striped snake-head fish	3.95×10^8	6.10×10^8
Striped catfish	1.64×10^9	3.40×10^8

Table 6 Coliforms, faecal coliforms and *Escherichia coli* in Nham-Pla.

Kinds of Nham-Pla	Coliforms (MPN/gm)		Faecal coliforms (MPN/gm)		*Escherichia coli* (MPN/gm)	
	Rock salt	Solar salt	Rock salt	Solar salt	Rock salt	Solar salt
Nile tilapia	>1100	>1100	<3	<3	<3	<3
Hybrid catfish	>1100	>1100	<3	<3	<3	<3
Striped snake-head fish	>1100	>1100	<3	<3	<3	<3
Striped catfish>1100	>1100		<3	<3	<3	<3

Table 7 Comparative sensory scores of uncooked Nham-Pla using rock salt and solar salt, fermented at ambient temperature for 4 days.

Kinds of Nham-Pla	Sensory properties				
	Appearance	Texture	Color	Odor	Average acceptability
1. Striped snake-head fish	$4.21^{a} \pm 0.11$	$3.00^{b} \pm 1.18$	$4.36^{a} \pm 0.11$	$3.93^{a} \pm 0.83$	$3.57^{abc} \pm 1.22$
2. Striped catfish	$4.04^{a} \pm 0.50$	$3.71^{a} \pm 0.83$	$3.82^{ab} \pm 0.54$	$3.68^{a} \pm 0.77$	$4.14^{a} \pm 0.53$
3. Nile tilapia	$3.43^{ab} \pm 0.65$	$3.57^{ab} \pm 0.65$	$3.82^{ab} \pm 0.88$	$2.96^{b} \pm 0.97$	$3.50^{abc} \pm 0.52$
4. Hybrid catfish	$3.54^{ab} \pm 1.04$	$4.07^{a} \pm 0.73$	$3.54^{b} \pm 1.05$	$3.43^{ab} \pm 1.16$	$3.71^{b} \pm 0.61$
5. Striped snake-head fish	$3.71^{ab} \pm 0.83$	$3.43^{ab} \pm 0.65$	$3.57^{b} \pm 0.94$	$3.00^{b} \pm 1.11$	$3.21^{bc} \pm 1.05$
6. Striped catfish	$3.15^{b} \pm 0.86$	$3.46^{ab} \pm 0.63$	$2.71^{c} \pm 1.00$	$2.86^{b} \pm 0.86$	$2.93^{c} \pm 0.62$
7. Nile tilapia	$3.79^{ab} \pm 1.05$	$3.43^{ab} \pm 0.76$	$3.85^{ab} \pm 0.95$	$3.36^{ab} \pm 0.84$	$3.57^{abc} \pm 0.85$
8. Hybrid catfish	$3.86^{a} \pm 0.85$	$3.36^{ab} \pm 0.84$	$3.79^{ab} \pm 0.89$	$3.21^{ab} \pm 0.89$	$3.64^{ab} \pm 0.93$

Means followed by different letter are significantly different ($P<0.05$)

1-4 Nham-Pla; Using Rock salt

5-8 Nham-Pla; Using Solar salt

Table 8 Comparative sensory scores of cooked Nham-Pla using rock salt and solar salt, fermented at ambient temperature for 4 days.

Kinds of Nham-Pla	Sensory properties					
	Appearance	Texture	Color	Odor	Flavor	Average acceptability
1. Striped snake-head fish	$3.93^{ab} \pm 0.96$	$2.87^{c} \pm 1.25$	$4.00^{a} \pm 0.85$	$3.30^{ab} \pm 1.19$	$3.13^{ab} \pm 1.25$	$3.30^{ab} \pm 1.10$
2. Striped catfish	$4.20^{a} \pm 0.41$	$3.67^{ab} \pm 0.90$	$4.00^{a} \pm 0.53$	$3.60^{a} \pm 0.83$	$3.80^{a} \pm 0.94$	$3.63^{a} \pm 0.80$
3. Nile tilapia	$3.90^{ab} \pm 0.84$	$4.00^{a} \pm 0.85$	$3.90^{a} \pm 0.93$	$3.40^{ab} \pm 0.91$	$3.23^{ab} \pm 1.24$	$3.63^{a} \pm 1.01$
4. Hybrid catfish	$3.47^{b} \pm 0.83$	$3.67^{ab} \pm 0.90$	$3.13^{b} \pm 0.74$	$3.60^{a} \pm 0.74$	$3.93^{a} \pm 0.70$	$3.53^{a} \pm 0.64$
5. Striped snake-head fish	$4.00^{ab} \pm 0.76$	$3.53^{b} \pm 0.92$	$3.87^{a} \pm 0.83$	$3.32^{ab} \pm 1.14$	$3.47^{ab} \pm 0.99$	$3.57^{a} \pm 0.90$
6. Striped catfish	$3.73^{ab} \pm 0.70$	$3.20^{ac} \pm 0.85$	$3.40^{ab} \pm 0.83$	$3.50^{ab} \pm 1.12$	$3.33^{ab} \pm 0.98$	$3.30^{ab} \pm 0.88$
7. Nile tilapia	$2.66^{c} \pm 0.82$	$3.33^{bc} \pm 0.90$	$2.53^{c} \pm 0.74$	$2.73^{b} \pm 0.59$	$2.80^{b} \pm 0.86$	$2.67^{b} \pm 0.72$
8. Hybrid catfish	$4.00^{ab} \pm 0.65$	$3.27^{bc} \pm 0.80$	$3.67^{ab} \pm 0.72$	$3.00^{ab} \pm 1.13$	$3.27^{ab} \pm 0.80$	$3.40^{a} \pm 0.74$

Means followed by different letter are significantly different ($P<0.05$)

1-4 Nham-Pla; Using Rock salt

5-8 Nham-Pla; Using Solar salt

CONCLUSIONS

Sensory properties of uncooked Nham-Pla prepared from striped snake-head fish and striped catfish using rock salt were highest based on the criteria of appearance, color and odor at fermentation period of 4 days while Nham-Pla made from striped catfish using rock salt gave the highest average acceptability. Sensory evaluation of cooked Nham-Pla prepared from striped catfish and Nile tilapia both using rock salt showed the highest average acceptability. Nham-Pla made

from hybrid catfish using rock salt and Nham-Pla made from Nile tilapia using solar salt gave the lowest acceptability. Nham-Pla made from striped snaked-head fish using rock salt had better texure than using rock salt.

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