



Survey Situation Of Formaldehyde In Fresh Seafood In Lampang Province, Thailand

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Abstract

Formalin is a toxic substance used to form certain things. But nowadays, there are some entrepreneurs who illegally apply it to seafood, especially in provinces that are far from coastal areas, including Lampang Province, to ensure that it remains fresh and lasts for a long time, therefore it affects consumers' health. This study aimed to detect formaldehyde contamination in fresh seafood in Muang District, Lampang Province, take the result as a case study, and disseminate knowledge to ensure safety for consumers in Lampang Province. This study was a cross-sectional study to detect formalin contaminants in 5 seafood species, including Octopuses, Splendid Squids, Cuttlefish, Crispy Pickled Squids, and Pacific White Shrimps, from 12 samples each, totaling 60 samples, from 2 sources in Muang District, Lampang Province, which are supermarkets and fresh markets. The researchers used a Test Kit for Formalin in Food from the Government Pharmaceutical Organization (GPO) Thailand, consisting of 3 reagent bottles and formalin testing in food, with the lowest sensitivity of the test kit at 0.5 mg/kg. From a total of 60 seafood samples, 5 types, 12 samples each, were tested for formalin contamination. The results showed that there are 11 formalin-detected samples, accounting for 18.33%, including 8 samples of Crispy Pickled Squid, representing 80% of all Crispy Pickled Squid samples, and 3 samples of Splendid Squid, representing 25% of all Splendid Squid samples. If classified as formalin-detected samples by the source, it was found that 10 samples were from the fresh market, representing 90.90%, and 1 sample was from the supermarket, representing 9.09%. The 8 samples of Crispy Pickled Squid were 100% from the fresh market, 1 sample of Splendid Squid was from the supermarket, representing 33.33%, and the other 2 samples were from the fresh market, representing 66.67%.

Keywords: seafood, formaldehyde, contamination

Introduction

Formalin is a toxic substance used in the chemical industry, agriculture, medicine, cosmetic production, fungicides, and bacteria. It is used for forming and maintaining certain items, including the physical condition of animals or corpses. In Formalin, the main component is 37% formaldehyde, which, when combined with oxygen in the air, can explode. This gas can occur naturally in food and is decomposed by sunlight and moisture. But if mixed with 10–15% methanol, it will inhibit the paraformaldehyde polymer. Formalin is characterised by clear water, colorlessness, a pungent odour, an irritating effect,

and being highly toxic when entering the body. But nowadays, there are some entrepreneurs who apply formalin to meat, vegetables, and especially seafood due to spoilage in order to remain fresh and last for a long time, therefore, it affects consumers' health. [1] [2] [3]

Health effects from exposure to formalin occur both short-term and long-term. If inhaled, formalin will affect the respiratory system, namely burning the nose, sore throat, cough, suffocation, pneumonia, and lung flooding, and can be fatal if inhaled in large

quantities. In addition to the effect on the respiratory system, it also affects the skin system, which causes rashes until the skin may burn, turning white if in direct contact with formalin for toxicity to the gastrointestinal tract. Eating food contaminated with large amounts of formalin can cause severe headaches, abdominal pain, dryness of the mouth and throat, a fast heartbeat, chest tightness, diarrhea, nausea, vomiting, an inability to urinate or blood in the urine, tiredness, sweating, coldness, and a stiff neck. [4]

In addition to the short-term effects that have obvious symptoms, long-term effects have been reported. Formaldehyde, a compound of formalin, can also cause cancer. Formalin in many vegetable foods, in addition to injecting insecticides, is also soaked in formalin before sale to keep it fresh for a long time. As observed from vegetables in the fresh market that have been sold for 3–4 days, they are still fresh and not wilting despite the hot weather. Vegetables that may be contaminated with formalin include acacia pennata, kale, water mimosa, coriander, garland chrysanthemum, bitter melon, yard-long beans, Chinese cabbage, etc. The formaldehyde content found in the same vegetables is different. For meat, there have been reports of formaldehyde detection in mackerel, stingray, bigeye fish, chicken, beef, pork, and shrimp, even if they are the same type of meat, but if they come from different sources, it was found that the amount of formaldehyde detected was different. Some sources may not be found at all, and there are dried foods that have high levels of formaldehyde, namely dried shiitake mushrooms and dried oyster mushrooms. The high levels were found to exist naturally and, if it was formaldehyde, were naturally present and were not found to pose a health hazard to consumers. [5]

At present, the Ministry of Public Health has banned the use of formaldehyde in food according to Announcement of the Ministry of Public Health No. 151 (B.E. 2536) of the Food Act B.E. 2522. However, from screening with a formalin testing kit and the detection of formalin contaminated by High Performance Liquid Chromatography (HPLC) in fresh seafood, it was still found that formalin is illegally used in food in some areas, especially in provinces that are far from coastal areas. Since fresh seafood has economic value and is very popular for

consumption in Thailand, chilled or frozen transportation to remote provinces in different regions is essential in order to maintain food quality, pointing out that Lampang province, which is far from the coastal area, is one of the provinces most vulnerable to the use of formaldehyde in food. [6] [7]

Furthermore, on December 7, 2022, Lampang Livestock, together with public health officials and officials of the municipality of Lampang, inspected meat premises and randomly collected samples to test for formaldehyde contamination using a formaldehyde testing kit in food, and found that 5 samples of formalin were used in food out of 24 surveys. [8]

This research aims to detect formaldehyde contamination in seafood sold in the area of Mueang Lampang District, Lampang Province, take the information obtained as a case study, and disseminate knowledge to ensure safety for consumers in Lampang Province.

Objectives

1. To examine formaldehyde contamination in fresh seafood in Muang District, Lampang Province
2. To determine the percentage of formaldehyde contamination in fresh seafood in Muang District, Lampang Province

Study Method

This study was a cross-sectional study to detect formalin contaminants in 5 seafood types, including Octopuses, Splendid Squids, Cuttlefish, Crispy Pickled Squids, and Pacific White Shrimps, 12 samples each, totaling 60 samples, using a formaldehyde test kit of the Government Pharmaceutical Organization with the lowest sensitivity of the test kit at 0.5 mg/kg. [9]

Population and Sample

The population in this study consisted of 5 types of seafood: Octopuses, Splendid Squids, Cuttlefish, Crispy Pickled Squids, and Pacific White Shrimps sold in fresh markets and supermarkets in Muang District, Lampang Province, by the convenient sampling method of 12 samples per type, totaling 60 samples.

Table No.1: Illustration of number of sample, types and source

No.	Sample Type	Quantity	Supermarket	Fresh Market
1	Octopuses	12	3	9
2	Splendid Squids	12	3	9
3	Cuttlefish	12	3	9
4	Crispy Pickled Squids	12	1	11
5	Pacific White Shrimps	12	3	9
	Total	60	13	47

Experimental Equipment [9] [10]

Test Kit for Formalin in Food from the Government Pharmaceutical Organization (GPO) Thailand, consisting of

Reagent bottle 3 bottles

Formalin testing in food

Experimental Procedure [9]

1. Pour the suspected food-soaking water into reagent bottle 1 until the height of the liquid is about 1/3 of the bottle, close the bottle cap, and shake until the test substance in the bottle is completely dissolved.
2. Transfer the liquid from reagent bottle 1 to bottle 2, close the bottle cap, and shake slightly.
3. Transfer the liquid from reagent bottle 2 to bottle 3, and quickly close the bottle cap. Gently swinging the liquids together. Observe the colour that occurs.

Interpretation

After pouring the liquid into the reagent bottle 3, and observe the colour of the liquid inside the bottle.

1. If the resulting colour is pink-red, the liquid is contaminated with formalin.
2. If it is any colour other than pink-red, it indicates that the liquid is not contaminated with formalin.

Formalin-contaminated liquid [9]



The liquid that is not contaminated with formalin[9]



Result

Picture No.1 Test result of Splendid Squid



Picture No.2 Test result of Crispy Pickled Squid



From a total of 60 seafood samples tested for formalin contamination, consisting of each 12 sample of Octopus, Splendid Squid, Cuttlefish, Crispy Pickled Squid, and Pacific White Shrimp, 11 samples, accounting for 18.33% of all samples, were formalin-detected, including 8 samples of Crispy Pickled Squid, representing 80% of all Crispy Pickled Squid samples, and 3 samples of Splendid Squid, representing 25% of all Splendid Squid samples, and there was no formalin in each sample of Octopus, Cuttlefish, and Pacific White Shrimp (Table No.2).

Table No.2: Amount and Percentage Determination of contaminated formalin in seafood soaking water of samples consisting of Octopus, Splendid squid, Cuttlefish, Crispy Pickled Squid, and Pacific White Shrimp (n = 60)

Type of samples	Amount of samples	Percentage Determination	
		Formalin-Detected n (%)	Not Detected Formalin n (%)
Octopus	12	0 (0.00)	12 (100.00)
Splendid Squid	12	3 (25.00)	9 (75.00)
Cuttlefish	12	0 (0.00)	12 (100.00)
Crispy Pickled Squid	12	8 (60.00)	4 (30.00)
Pacific White Shrimp	12	0 (0.00)	12 (100.00)
Total	60	11 (18.33)	49 (81.67)

From 11 samples that detected formalin, consisting of 8 samples of Crispy Pickled Squid and 3 samples of Splendid Squid, which were classified by the source, it was found that 10 of the formalin-detected samples were from the fresh market, representing 90.90%, and 1 sample was from the supermarket, representing 9.09%. The 8 samples of Crispy Pickled Squid that detected formalin were 100% from the fresh market, 1 sample of Splendid Squid was from the supermarket, representing 33.33%, and the other 2 samples were from the fresh market, representing 66.67% (Table No.3).

Table No.3: Amount and Percentage Determination of contaminated formalin in seafood soaking water samples, which were classified by the source

No.	Type of samples	Positive	Supermarket		Fresh market	
			No. of Samples	Positive n (%)	No. of Samples	Positive n (%)
1	Splendid Squid	3	3	1 (33.33.)	9	2 (22.22)

2	Krispy Pickled Squid	8	1	0 (0.00)	11	8 (72.72)
	Total	11		1 (9.09)		10 (90.90)

Discussion

A total of 60 seafood samples were tested for formalin contamination, consisting of each 12 sample of Octopus, Splendid Squid, Cuttlefish, Crispy Pickled Squid, and Pacific White Shrimp. 11 samples, accounting for 18.33% of all samples, were formalin-detected, including 8 samples of Crispy Pickled Squid, representing 80% of all Crispy Pickled Squid samples, and 3 samples of Splendid Squid, representing 25% of all Splendid Squid samples.

From the results of this experiment, 11 out of 60 seafood samples were found to be contaminated with formalin, accounting for 18.33%. This contamination might be attributed to Lampang province, which is located in the northern region of Thailand and far from the sea, resulting in extended transportation times for seafood. There could be clandestine formalin used to preserve seafood freshness, consistent with the research by Adun Bunchaleamchai and et al. [7]

The results are consistent with the research conducted by Wipawan Buasriyat and et al., who examined contaminated formalin in seafood soaking water from the market in Nakhon Ratchasima province. They found formalin contamination in seafood samples, accounting for 17.14%, which aligns with the findings of Thinakorn Faipet, who detected formalin in seafood from Utong district, Suphan Buri province, and found that 3 out of 4 seafood vendors had formalin in their products. The study revealed no evidence of any research showing no formalin contamination in seafood samples. [11] [12]

Another factor contributing to the contamination of seafood samples with formalin could be that some food vendors are unaware of the harmful effects and health implications of using formalin in food. [13]

However, retail seafood sellers might not be aware that there is contaminated formalin in the seafood

they receive for sale since there is no quality screening process before selling to consumers.

From the 8 out of 12 detected formalin samples in Krispy Pickled Squid, it could be due to the nature of Krispy Pickled Squid, which requires a flexible and crispy texture. Therefore, some manufacturers or some processors might add formalin to achieve these desired characteristics without fully understanding the potential risks involved. [14] [15]

The results align with the report from the Department of Disease Control for 2021. The survey involved a total of 14046 samples, of which 705 (5.02%) were found to be contaminated with formalin, and the highest incidence was in Krispy Pickled Squid. [16]

From the examination of Splendid Squid samples, 3 out of the total samples were found to be contaminated with formalin, accounting for 25.00%. This is consistent with the practice of adding formalin to fresh seafood, particularly squid, to prevent quick spoilage. It is aligned with the research conducted by Pissabong Deeduangphan. [13] [17]

Based on the tracking of the problematic seafood sources in Lampang province during that period, it was found that the problematic seafood originated from a specific group of wholesalers who supplied Krispy Pickled Squid to large-scale retailers, wholesalers, and numerous restaurants in Lampang province. These wholesalers were not the actual producers or importers but rather middlemen who received seafood from three provinces: Chiang Mai, Bangkok, and Samut Sakhon. This situation made it challenging to control the quality of the seafood entering Lampang Province, resulting in the continued detection of formalin-contaminated Krispy Pickled Squid. [18]

At present, Thailand frequently discovers the use of formalin to soak vegetables, seafood, and certain types of meat before selling them to ensure freshness and prevent rapid spoilage. This practice is due to a

lack of awareness among some food vendors about the dangers of using this chemical. [13]

Conclusion

From a total of 60 seafood samples tested for formalin contamination, consisting of each 12 sample of Octopus, Splendid Squid, Cuttlefish, Crispy Pickled Squid, and Pacific White Shrimp, 11 samples, accounting for 18.33% of all samples, were formalin-detected, including 8 samples of Crispy Pickled Squid, representing 80% of all Crispy Pickled Squid samples, and 3 samples of Splendid Squid, representing 25% of all Splendid Squid samples, and there was no formalin in each sample of Octopus, Cuttlefish, and Pacific White Shrimp.

From 11 samples that detected formalin, insisting of 8 samples of Crispy Pickled Squid, and 3 samples of Splendid Squid, which were classified by the source, it was found that 10 formalin-detected samples were from the fresh market, representing 90.90%, and 1 sample was from the supermarket, representing 9.09%. The 8 samples of Crispy Pickled Squid that detected formalin were 100% from the fresh market, 1 sample of Splendid Squid was from the supermarket, representing 33.33%, and the other 2 samples were from the fresh market, representing 66.67%.

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