



## A Case study on Detection of Formalin in seafood from fresh markets in Bangkok, Chachoengsao, and Khon Kaen

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### Abstract

Fresh seafood is popular among Thai people. We consume a lot of fresh seafood because of its good taste and nutritional value. Formalin contaminants have been identified in fresh seafood in many regions over different periods. It's seen that formalin is smuggled to use in seafood which is harmful to the health of consumers. This study aimed to detect formalin in seafood by using a formalin test kit from the Department of Medical Sciences was used to examine 200 samples of seafood soaked in water, randomly sampled from the Bangkok area, Chachoengsao, and Khon Kaen Province. From 200 seafood samples, formalin was detected in 22 seafood samples or 11%. According to an analysis by region, Formalin was found in 17 samples sold in the Bangkok area, representing 77.27%, and 5 seafood samples sold in Chachoengsao Province, representing 12.73%, did not find formalin contaminated in the water-soaked seafood samples sold in the area of Khon Kaen. From 22 samples of seafood soaked with formalin contaminated, all 22 samples were crispy squid.

Keywords: seafood, formalin, formaldehyde, food safety.

**Keywords:** NIL

### Introduction

The ingredient of fresh seafood can be used to cook many kinds of food with good taste, nutrition, and is rich in good protein significantly, it also has a high amount of calcium that helps maintain strong bones. It is an important source of Iodine for the body and among consumers. The trend of fresh seafood consumption continues to grow which is affected by commercial fisheries for domestic consumption and export<sup>1-3</sup>. Therefore, the Logistics of seafood from source to various areas until the consumer by keeping the seafood fresh and appetizing is of the utmost importance in terms of food quality and attractive physical appearance. The cost of seafood transportation and preservation is relatively high compared with the transportation and preservation of other types of food<sup>4</sup>, some operators have illegally

used formalin to help preserve the condition of fresh seafood before it reaches the consumer. Formalin contamination in seafood can be caused by fishing boats at sea that took a long time to return to shore, without any tools to maintain the condition of the captured fish. This causes the use of formalin to maintain the freshness of seafood as well as transporting, transporting, and storing seafood by entrepreneurs and traders may be smuggled with formalin. This leads to contamination when fresh seafood is shipped to consumers<sup>5-6</sup>. If the consumers absorb the formalin, it may affect various body systems.

Notification of the Ministry of Public Health No. 151 (B.E. 2536) stated that "Formalin is forbidden to be used in food" since formalin will cause severe abdominal pain, diarrhea, vomiting, pain in the throat

and stomach, gastritis, and ulcers in the stomach, liver, kidneys, heart, and brain are destroyed, the lining of the internal organs is inflamed. If it enters the body by 60 - 90 ml, it can cause death. In case of breaking this rule, there will be a punishment from the imprisonment of not more than 2 years or a fine of not more than 20,000 baht, or both<sup>7-8</sup>. From a study on the detection of formalin in seafood soaking in the Nakhon Ratchasima market<sup>9</sup>, of 35 samples, it was found that 17.14% of formalin was detected in the seafood soaking sample<sup>10</sup>. From the study on the determination of formalin in seafood market area, 75% of the number of shops randomly inspected in U-Thong District, Suphan Buri Province was found that Formalin was contaminated in seafood samples. While the report on the monitoring of formalin contamination in fresh aquatic animals, the fiscal year 2019 by the Aquaculture Industry Technology Research and Development Division, found that the trend of detecting formalin contamination in fresh aquatic animals sold in Bangkok and Pathum Thani is low, no more than 0.82% in 2017, 0% in 2018 and 0.35 % in 2019<sup>11</sup> indicating that formalin is still used in seafood in some areas including Bangkok and other provinces.

The researcher was interested in the detection of formalin in seafood at the fresh markets in Bangkok, Chachoengsao, and Khon Kaen Province, where the members of the research team live, to provide information for making decisions about seafood for consumption. To detect formalin in seafood soaking in water from fresh markets where fresh seafood is distributed to consumers.

## Material and Methods

### Population and Sampling

#### Seafood Sampling

Random Sampling from the seafood market In Bangkok, Chachoengsao, Trang, and Khon Kaen Province, seafood soaking in water samples were collected from 31 fresh seafood shops as follows: 6 blue crab samples, 15 clams, 6 cockles, 15 cuttlefish samples, dolly fish 5 samples, jellyfish 5 samples,

mackerel 24 samples, mussels 26 samples, squid 3 samples, oyster 1 sample, crispy squid 25 samples, snapper 4 samples, 25 prawn samples, 25 splendid squid samples and 20 samples of squid, a total of 200 samples, which were purchased all together. When the samples have been purchased, the seafood samples are placed in a sterile plastic bag, close the bag tightly and attach labels showing the details of the samples. A bag of water for soaking seafood packed in Styrofoam boxes that are contained and covered with ice again then perform the analysis and analysis immediately.

The test for aqueous formalin was done by using test kits provided by the Ministry of Public Health and transparency plastic cups were used as testing containers<sup>(12-13)</sup>

### Test procedure

The test kit contains 3 bottles of chemicals labeled 1, 2, and 3.

3.1 The water samples were poured into bottle 1 until it was filled  $\frac{1}{3}$  way, the bottle was then capped and shaken until all solids were dissolved.

3.2 Contents from bottle 1 were poured into bottle 2. The bottle was capped and shaken until all solids were dissolved.

3.3 Contents from bottle 2 were mixed with the liquid in bottle 3 then shaken. Results displayed by mixing the 2 bottles show whether or not the sample has been contaminated with formalin.

3.4 If formalin is detected, we repeat the test procedure to reconfirm the result.

### Result Interpretation

The mixing of contents in bottles 2 and 3 showed whether or not the sample was contaminated with formalin. After mixing, if the liquid changes color to red/pink, is it a positive result (+), meaning the sample is contaminated. If no color change takes place then the test is negative (-), meaning the sample has not been contaminated. (Picture 1)

**Picture 1. Illustrate formalin detection in the test sample**



**Result**

From the detection of residual formalin in 200 seafood samples, 22 samples of formalin in the crispy squid were found. Of the 25 samples, 88% of them were in the crispy squid ink samples, which were randomly purchased from the Bangkok region. 17 samples from a total of 20 samples, accounting for

85%, and 5 samples of pickled squid ink were purchased at random from Chachoengsao Province, representing 100%. Other samples consisted of blue crab soaking water, clams, cockles, cuttlefish, dolly fish, jellyfish, mackerel, mussels, octopus, oysters, snapper, squid, and squid, Formalin was not detected.

**Table 1. Detection of formalin in seafood soaking in water by formalin test kit by type of sample (N=200)**

Type	Location	Total Sample	Result		
			Positive	Negative	% of sample detected formalin
Blue Crab	<b>Blue Crab Total</b>	<b>6</b>	<b>0</b>	<b>6</b>	0.0%
	Bangkok	0	0	0	0.0%
	Chachoengsao	5	0	5	0.0%
	Khon Kaen	1	0	1	0.0%
Clam	<b>Clam Total</b>	<b>15</b>	<b>0</b>	<b>15</b>	0.0%
	Bangkok	15	0	15	0.0%
	Chachoengsao	0	0	0	0.0%
	Khon Kaen	0	0	0	0.0%
Cockle	<b>Cockle Total</b>	<b>6</b>	<b>0</b>	<b>6</b>	0.0%
	Bangkok	5	0	5	0.0%
	Chachoengsao	0	0	0	0.0%
	Khon Kaen	1	0	1	0.0%

Cuttlefish	<b>Cuttlefish Total</b>	<b>15</b>	<b>0</b>	<b>15</b>	0.0%
	Bangkok	10	0	10	0.0%
	Chachoengsao	0	0	0	0.0%
	Khon Kaen	5	0	5	0.0%
Dolly Fish	<b>Dolly Total</b>	<b>5</b>	<b>0</b>	<b>5</b>	0.0%
	Bangkok	0	0	0	0.0%
	Chachoengsao	5	0	5	0.0%
	Khon Kaen	0	0	0	0.0%
Jellyfish	<b>Jelly Total</b>	<b>5</b>	<b>0</b>	<b>5</b>	0.0%
	Bangkok	0	0	0	0.0%
	Chachoengsao	5	0	5	0.0%
	Khon Kaen	0	0	0	0.0%
Mackerel	<b>Mackerel Total</b>	<b>24</b>	<b>0</b>	<b>24</b>	0.0%
	Bangkok	20	0	20	0.0%
	Chachoengsao	0	0	0	0.0%
	Khon Kaen	4	0	4	0.0%
Mussel	<b>Mussel Total</b>	<b>26</b>	<b>0</b>	<b>26</b>	0.0%
	Bangkok	20	0	20	0.0%
	Chachoengsao	5	0	5	0.0%
	Khon Kaen	1	0	1	0.0%
Octopus	<b>Octopus Total</b>	<b>3</b>	<b>0</b>	<b>3</b>	0.0%
	Bangkok	0	0	0	0.0%
	Chachoengsao	0	0	0	0.0%
	Khon Kaen	3	0	3	0.0%
Oyster	<b>Oyster Total</b>	<b>1</b>	<b>0</b>	<b>1</b>	0.0%
	Bangkok	0	0	0	0.0%
	Chachoengsao	0	0	0	0.0%

	Khon Kaen	1	0	1	0.0%
Pickled squid	<b>Pickled squid Total</b>	<b>25</b>	<b>22</b>	<b>3</b>	<b>88.0%</b>
	Bangkok	20	17	3	85.0%
	Chachoengsao	5	5	0	100.0%
	Khon Kaen	0	0	0	0.0%
Sea bass	<b>Sea Bass Total</b>	<b>4</b>	<b>0</b>	<b>4</b>	<b>0.0%</b>
	Bangkok	4	0	4	0.0%
	Chachoengsao	0	0	0	0.0%
	Khon Kaen	0	0	0	0.0%
Shrimp	<b>Shrimp Total</b>	<b>25</b>	<b>0</b>	<b>25</b>	<b>0.0%</b>
	Bangkok	20	0	20	0.0%
	Chachoengsao	0	0	0	0.0%
	Khon Kaen	5	0	5	0.0%
Splendid Squid	<b>Splendid Total</b>	<b>20</b>	<b>0</b>	<b>20</b>	<b>0.0%</b>
	Bangkok	15	0	15	0.0%
	Chachoengsao	0	0	0	0.0%
	Khon Kaen	5	0	5	0.0%
Squid	<b>Squid Total</b>	<b>20</b>	<b>0</b>	<b>20</b>	<b>0.0%</b>
	Bangkok	15	0	15	0.0%
	Chachoengsao	5	0	5	0.0%
	Khon Kaen	0	0	0	0.0%
<b>Total</b>		<b>200</b>	<b>22</b>	<b>178</b>	<b>11.0%</b>

From the detection of residual formalin in 200 seafood samples, categorized by provinces that randomly purchased fresh seafood samples for testing. Formalin was found in the water 5 of the 30 samples of fresh seafood were randomly purchased from Chachoengsao Province, representing 16.7%. Formalin was found in the water of 17 fresh seafood samples randomly purchased from Bangkok. A total of 144 samples, or 11.8% of the fresh seafood samples randomly purchased from Khon Kaen province, did not detect formalin.

**Table 2. Detection of formalin in seafood soaking in water by formalin test kit by location (N=200)**

Location	Type	No. of sample	Result		% of sample detected formalin
			Positive	Negative	
<b>Bangkok</b>	Blue Crab	0	0	0	0.0%
	clam	15	0	15	0.0%
	Cockle	5	0	5	0.0%
	Cuttlefish	10	0	10	0.0%
	Dolly Fish	0	0	0	0.0%
	Jellyfish	0	0	0	0.0%
	Mackerel	20	0	20	0.0%
	Mussel	20	0	20	0.0%
	Octopus	0	0	0	0.0%
	Oyster	0	0	0	0.0%
	Pickled squid	20	17	3	85.0%
	Sea Bass	4	0	4	0.0%
	Shrimp	20	0	20	0.0%
	Splendid Squid	15	0	15	0.0%
	Squid	15	0	15	0.0%
<b>Total</b>		<b>144</b>	<b>17</b>	<b>127</b>	<b>11.8%</b>
<b>Chachoeng sao</b>	Blue Crab	5	0	5	0.0%
	Clam	0	0	0	0.0%
	Cockle	0	0	0	0.0%

	Cuttlefish	0	0	0	0.0%
	Dolly Fish	5	0	5	0.0%
	Jellyfish	5	0	5	0.0%
	Mackerel	0	0	0	0.0%
	Mussel	5	0	5	0.0%
	Octopus	0	0	0	0.0%
	Oyster	0	0	0	0.0%
	Pickled squid	5	5	0	100.0%
	Sea Bass	0	0	0	0.0%
	Shrimp	0	0	0	0.0%
	Splendid Squid	0	0	0	0.0%
	Squid	5	0	5	0.0%
	<b>Total</b>	<b>30</b>	<b>5</b>	<b>25</b>	<b>16.7%</b>
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	Blue Crab	1	0	1	0.0%
Khonkaen	Clam	0	0	0	0.0%
	Cockle	1	0	1	0.0%
	Cuttlefish	5	0	5	0.0%
	Dolly Fish	0	0	0	0.0%
	Jellyfish	0	0	0	0.0%
	Mackerel	4	0	4	0.0%
	Mussel	1	0	1	0.0%
	Octopus	3	0	3	0.0%

Oyster	1	0	1	0.0%
Pickled squid	0	0	0	0.0%
Sea Bass	0	0	0	0.0%
Shrimp	5	0	5	0.0%
Splendid Squid	5	0	5	0.0%
Squid	0	0	0	0.0%
<b>Total</b>	<b>26</b>	<b>0</b>	<b>26</b>	<b>0.0%</b>
<b>Total</b>	<b>200</b>	<b>22</b>	<b>178</b>	<b>11.0%</b>

## Discussion

From the study results of formalin contamination in the water-soaked seafood samples randomly purchased from Bangkok Chachoengsao and Khon Kaen Province. The samples that were soaked in water were randomly examined: blue crabs, clams, cockles, cuttlefish, dolly fish, jellyfish, mackerel, mussels, squid, oysters, crispy squid, sea bass, shrimp, squid, and squid. Formalin was found. 22 samples of seafood were contaminated, representing 11%. Formalin was detected in seafood samples. 17 samples were sold in the Bangkok area, representing 77.27%, and seafood samples. 5 samples sold in Chachoengsao province, representing 12.73%, did not find formalin contaminated in the water-soaked in seafood samples, sold in the area of Khon Kaen. When analyzing the types of seafood, it was found to be contaminated with formalin, all 22 samples were crispy squid.<sup>10</sup> examined formalin in seafood. Market area, U-Thong District, Suphan Buri Province Formalin was found in the sample of crispy ink<sup>9</sup>. From the study on the detection of formalin in water. Out of 35 samples of seafood soaked in water in Nakhon Ratchasima province, formalin was found in 6 samples, 2 samples in crispy squid, 3 samples in squid soaking water, and 1 sample in Pikul fish.<sup>14</sup> conducted a study on the Determination of formalin contamination in fresh Seafood from Fresh Market. From 91 samples tested, 11 samples detected formalin contamination of which were 9 squid

samples and 2 shrimp samples. The illegal use of formalin to preserve seafood continues to occur in various areas. Whether it's near or far from the sea,<sup>15</sup> transportation was much faster currently and more convenient than in the past.<sup>16</sup> particularly during the COVID-19 outbreak. However,<sup>4</sup> transporting and storing seafood is costly compared to other food transportation, especially for small entrepreneurs. This may be one of the reasons why some operators choose formalin to keep their seafood fresh. Therefore, transporting seafood to remote areas is a higher chance of using formalin to maintain seafood conditions than in other areas. This is consistent with a study<sup>14</sup> that found that provinces in the remote seas were more illegally used in seafood than those in the sea.

Report on the monitoring of formalin contamination in fresh aquatic animals, the fiscal year 2019, Aquaculture Industry Technology Research and Development Division<sup>11</sup> conducted fresh aquaculture products sold in fresh markets in Bangkok and Pathum Thani regions. Contaminated water was at a low level of 0.35% in 2019 and tends to decrease. In analyzing the results of this study, it was found that seafood containing formalin. All 22 samples were crispy squid, while in the others, which is fresh seafood, no formalin was detected. The results of the study were in line with the report of formalin contamination monitoring in fresh aquatic animals for the fiscal year 2019. Crispy squid was one of the



top formalin contaminated due to crispy squid producers' misunderstanding that using formalin in it would taste better than not using one<sup>18</sup>

The results of this study found that formalin contamination in 22 samples of seafood, representing 100% of the 22 samples of crispy squid, suggests that this food should be chosen cautiously because there may be a risk of formalin<sup>5-6</sup> which, if exposed to formalin, may cause health risks or, if possible, should avoid food that is at risk of being contaminated with formalin because consumers will perceive whether this food contains formalin or not. It does not require chemical testing which may not be possible in all cases.

### Conclusion

From the detection of formalin contaminants in 200 samples of seafood soaked in water, the samples that were sampled at random were blue crabs, clams, cockles, cuttlefish, dolly fish, jellyfish, mackerel and shellfish, mussels, squid, oysters, crispy squid, snapper, sea prawns, squid and squid randomly purchased from Son Market in Bangkok, Chachoengsao and Khon Kaen Province. A total of 200 samples found formalin contaminated in the water-soaked in 22 seafood samples or 11%. Formalin was found in seafood samples. 17 samples were sold in the Bangkok area, representing 77.27%, and seafood samples. 5 samples sold in Chachoengsao province, representing 12.73%, did not find formalin contaminated in the water-soaked seafood samples sold in the area of Khon Kaen. When analyzing the types of seafood, it was found to be contaminated with formalin, all 22 samples were crispy squid. This research selected the area of study which was the region where the researcher lived. The results of the study may not be representative of other areas or the same area at different times. This study used the examination kit of the Department of Medical Sciences which can detect results to some extent that may be less accurate than laboratory testing. Research on the detection of formalin in Thailand is limited.

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