

A Case study of Situation of Formaldehyde Contamination in Seafoods in Bangsue District, Bangkok

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Abstract:

Formaldehyde or formalin is a chemical substance that is prohibited from being added to food due to its harmful effects on the body. However, formaldehyde is often illicitly used to preserve the freshness of food. Therefore, this research is a comprehensive study aimed at presenting the results of the analysis to detect formaldehyde content present in seafood sold in the Bang Sue district market, Bangkok. The study involved collecting a total of 61 samples of seafood for analysis. By conducting a random selection, seafood of 4 types were chosen, including 15 cuttlefish samples, 19 Splendid Squid samples, 2 Soft cuttlefish samples, 13 Crispy Pickled Squid samples and 12 Octopus samples. The testing was carried out using the GPO Pharmaceutical Organization's formaldehyde testing kit for food. The results indicated that there were 11 (18.03%) samples containing formaldehyde. Formaldehyde was found in 3 (15.79%) Splendid Squid samples out of 19 samples and 8 (61.50%) Crispy Pickled Squid samples out of 13 samples.

Keywords — Formaldehyde, seafoods, squid, octopus

Background

Food is a necessity for human life, as it is one of the four essential factors that support and contribute to the growth and survival of the human body. Properly preserved and visually appealing food will attract consumers and encourage them to make choices. However, the use of various chemicals in food preservation, while enhancing the longevity of food, can also be detrimental to human health. Some chemicals can be harmful, and in some cases, their consumption can even be fatal. [1] Formaldehyde or formalin is a substance used to kill pathogens and prevent decay. Formaldehyde (CH₂O) is a synthetic chemical compound that is one of the most highly produced among the 25 types of chemicals in the chemical industry worldwide. Formaldehyde or formaldehyde solution refers to a solution composed of gas. Formaldehyde solution typically contains around 37 - 40 percent. In water, there is approximately 10-15 percent methanol present to prevent formaldehyde from transforming into paraformaldehyde, which is more toxic than formaldehyde. In the medical field, formaldehyde is used to prevent bodies from decomposing rapidly, to kill pathogens and fungi, and for sanitizing patient rooms. Formaldehyde is utilized for its industrial benefits in chemicals, plastics, and textiles. Hence, formaldehyde, a toxic vapor, can be encountered in synthetic materials and various electrical appliances, such as adhesives (scientifically). Prefabricated ceilings, synthetic fiber fabrics, gas stoves for cooking, house paint, wood varnish, surface materials, furniture, particle boards, synthetic carpets, tissue paper, cleaning solutions, and more. [2] Formaldehyde vapor is classified as an air pollutant, leading to air pollution. If formaldehyde is present in significant amounts, it can pose risks to those exposed to it. This is because formaldehyde has properties that inhibit decay and is cost-effective. Consequently, some business operators and individuals

without awareness or knowledge might use it to prevent spoilage of fresh food. [3] However, due to the toxicity of formaldehyde, individuals exposed to it can experience adverse effects. Abnormal respiratory system responses can occur. Some people may ingest it to the extent of vomiting and excessive bleeding, even resulting in fatality. This is because formaldehyde can cause irritation to the digestive tract, leading to internal bleeding when consumed in acidic form or in high concentrations. It can cause acidosis, shock, blood pressure drop, and ultimately lead to death. Direct contact with the skin can result in itching rashes and reddish rashes resembling allergic reactions, possibly progressing to the skin turning white if prolonged contact occurs. [4] Due to this reason, the WHO and the Ministries of Health of various countries have designated formaldehyde or formalin as substances prohibited for use in food. In Thailand, this is specified in the Ministry of Public Health Announcement No. 151 (B.E. 2536). Relevant authorities are required to conduct screening tests to detect covert use of formaldehyde in food, utilizing the formaldehyde testing kit provided by the Department of Medical Sciences, Ministry of Public Health (Ministry of Public Health, 2011). The test kit has a sensitivity of 0.5 ppm. If the aforementioned substance is found upon testing, legal actions must be pursued. Offenders could face imprisonment of up to 2 years or a fine of up to 20,000 Baht, or both. [5] However, in Thailand, there are still business operators who lack awareness and knowledge about the harmful effects of formaldehyde on human health. Therefore, preliminary observation and vigilance against contamination with formaldehyde in food are necessary. Initial indicators include seafood with abnormally dark or fresh colors, even when not refrigerated. There might be instances where formaldehyde has been used in refrigeration, so such items should not be purchased or consumed. [6] In this study investigate the situation of formaldehyde contamination in seafoods in Bangsue district, Bangkok, Thailand

Study Methods

This study is a descriptive research that investigates the contamination of formaldehyde in samples of 5 different types of squid available for sale in both fresh markets and supermarkets in the Bang Sue district of Bangkok.

Sampling

The sample group was selected using a Simple Random Sampling Method. The study focused on 5 different types of squid: Cuttlefish, Splendid Squid, Soft cuttlefish, Crispy Pickled Squid and Octopus. These squid types were obtained from both large fresh markets and supermarkets in the Bang Sue district, as outlined in Table 1.

Table No. 1 Displays the types of squid and the sources of sample acquisition.

No.	Sample Type	Total No. of Sample
1	Cuttlefish	15
2	Splendid Squid	19
3	Soft cuttlefish	2
4	Crispy Pickled Squid	13
5	Octopus	12
	Total	61

Instrument

Samples of squid were subjected to formalin contamination testing using a formalin detection kit provided by the Department of Medical Sciences, Thailand. [7]

Equipment

1. Test substance 1: 1 bottle
2. Test substance 2: 1 bottle
3. Test substance 3: 1 bottle

Procedure [7]

- 1) Pour a portion of the suspected food sample into the test substance bottle 1, filling it to approximately one-third of the bottle's height. If no food sample is available for soaking, but you suspect it has been treated with formalin, use a small amount of clean water to rinse the suspected food, collecting enough liquid for testing. Close the cap of the bottle and shake it vigorously until the test substance inside the bottle is fully dissolved.
- 2) Transfer the liquid from test substance bottle 1 into test substance bottle 2. Close the cap of the bottle and give it a gentle shake.
- 3) Transfer the liquid from test substance bottle 2 into test substance bottle 3 and quickly seal the cap. Gently sway the bottle to mix the liquids thoroughly and observe the resulting color.

Interpretation

If a color develops ranging from pink to red, it indicates the presence of formalin in the water. On the other hand, if the color remains clear, it suggests the absence of formalin contamination, as shown in figure no. 1



Figure No. 1. The picture showed color metric to interpret result of formaldehyde detection [7]

Statistical Analysis

The statistics used for data analysis are descriptive statistics, including frequency and percentage.

Results

From a total of 61 seafood samples, a formaldehyde test was conducted and results indicated that there were 11 (18.03%) samples containing formaldehyde. Formaldehyde was found in 3 (15.79%) Splendid Squid samples out of 19 samples and 8 (61.50%) Crispy Pickled Squid samples out of 13 samples.

Table No. 2 Results of formaldehyde test in seafood samples (n=61)

No.	Sample Type	Total No. of Sample	Formaldehyde Detected n (%)
1	Cuttlefish	15	0 (0.00)
2	Splendid Squid	19	3 (15.79)
3	Soft Cuttlefish	2	0 (0.00)
4	Crispy Pickled Squid	13	8 (61.50)
5	Octopus	12	0 (0.00)
	Total	61	11 (18.03)

Discussion

The results showed that from a total of 61 samples, 11 (18.03%) samples detected formaldehyde. The analysis could be divided into the following issues: In terms of seafood, there is a multitude of bacteria that cause seafood to spoil. Coupled with Thailand's hot climate, bacteria grow rapidly. Another issue pertains to sellers and business operators who use formalin to preserve the quality of seafood. This could stem from a lack of conscience or inadequate understanding of the situation, leading to the use of formalin to maintain the freshness of squid. This results are in line with the study conducted by ThanakornFaiphet [8] an examination of formalin in a sample of 48 seafood items was carried out in the AoUthong District, SuphanBuri Province, during the year 2020. The study revealed that formalin was present in the seafood samples at a rate of 10.42%. This is also consistent with the study conducted by Wipalak Bua-si-yod and et al. examining formalin in 35 seafood samples in Nakhon Ratchasima Province during the year . The study found that formalin contamination was present at a rate of 17.14% [9]

Formaldehyde was detected in 3 (15.79%) Splendid Squid samples out of 19 samples. This could be because seafood is susceptible to spoilage, especially when exposed to higher temperatures. Simply refrigerating squid might not be sufficient if the temperature is too high. Therefore, business operators often use formalin to preserve the freshness of squid and enhance its appealing appearance, as consumers often base their choice of fresh food on its visual characteristics. The results of the examination revealed the presence of formalin in the squid samples. This follows a similar trend to many previous studies that have examined the presence of formalin in seafood. In other words, the study found traces of formalin contamination in the samples of squid-based seafood. [8,9]

Formaldehyde was also detected in 3 (61.50%) Crispy Pickled Squid sample out of 8 samples. This could be attributed to Crispy squid is a type of food that requires its flesh to be both tender and chewy, yet also crispy. Therefore, producers or cooks may add formalin to achieve these desired textures without fully understanding the consequences.[10] This is in accordance with the findings of a study by JantanaLeesawasdichai [9] that examined seafood in the Lamphun Province region between October 2558 and January 2559. The study analyzed 75 samples and found that crispy squid samples contained formalin contamination at a rate of 14.5%. This corresponds with the results of a study by PumpapasPutthapakungwipol and colleagues[11] that examined seafood in the Ekkachai community, Pathum Thani Province. The study analyzed 36 samples and found that crispy squid samples contained formalin contamination at a rate of 13.9%.

Conclusion

From a total of 61 seafood samples, a formaldehyde test was conducted and results indicated that there were 11 (18.03%) samples containing formaldehyde. Formaldehyde was found in 3 (15.79%) Splendid Squid samples out of 19 samples and 8 (61.50%) Crispy Pickled Squid samples out of 13 samples

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