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# Formaldehide Content in White Shrimp After Formalin Soaking with Different Doses

**Okky Hermawan[1*], Ahmad Taufiq Mukti[2] and M. Yasin[3]**
[1]Fisheries and Marine Biotechnology Study Program, Faculty of Fisheries and Marine, Airlangga University, Surabaya
[2]Department of Fish Health Management and Aquaculture, Faculty of Fisheries and Marine, Airlangga University, Surabaya
[3]Department of Physics, Faculty of Science and Technology, Airlangga University

*Correspondence :
okkyhermawan2192@gmail.com

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## Abstract

White shrimp is one of the leading export commodities in Indonesia. White shrimp is also one of the high perishable fishery commodity products. Because of that, it requires a process to minimize spoilage. Preservation is one way to reduce decay. The idea that is often used to maintain quality or preserve a fishery product is to use ice cubes. However, many business people consider it impractical, and the price is relatively high, eventually using formalin for the preservation process. The use of formalin in food can be harmful to humans if exposed to more than the threshold. Besides, the use of formaldehyde as a preservative in food is also not allowed, both domestic and foreign regulations. This study aims to determine the formaldehyde content of white shrimp after being soaked in formalin with different dosages. The formaldehyde detection was carried out in Health Laboratory Center (BBLK), Surabaya, using UV-Vis spectrophotometry. From the research, it was obtained the results of a linear function, the higher concentration of formalin given, then higher formaldehyde contained in white shrimp with the most top result of 430.2 ppm in 5% soaking treatment for one hour.

## INTRODUCTION

Shrimp is one of the leading export commodities in Indonesia. White shrimp needs in the international market are dominated by products in fresh form and meet export quality standards but are still difficult to be fulfilled. One type of shrimp that develops in Indonesia, which has export quality, is white shrimp (*Litopenaeus vannamei*). White shrimp (*Litopenaeus vannamei*) is a kind of crustacean commodity originating from Latin America. This shrimp is widely spread from the southern part of Peru to northern Mexico. In 2001, white shrimp was released in Indonesia. In addition to tiger shrimp (*Penaeus monodon*) and banana prawn (*Penaeus merguiensis*), white shrimp is an alternative commodity of shrimp that has high economic value and easily cultivated in Indonesia (Purnamasari *et al*., 2017).

White shrimp is a highly perishable fishery product. This can be seen in the quality of shrimp meat when wrongly handled in the post-harvest. Shrimp will experience damage accompanied by the establishment of toxic compounds. There is a process to minimize the damage by using a preservation process (Tuyu *et al*., 2014). In the process of preserving shrimp, generally using ice cubes, but the use of ice cubes is considered impractical and relatively expensive. This has caused some businessmen to use hazardous chemicals; one of them is formaldehyde (Suryadi and Kurniadi, 2014).

Formalin is still used to preserve food, especially fishery products, and is evenly spread in the community. Therefore the government makes a policy to prohibit it. Prohibition of the use of formalin in food has been regulated in Permenkes RI No.1168/Menkes/Per/X/ 1999. The regulation explains that formaldehyde (formalin) is one of the additives which is prohibited from being used in food. International laws also regulate the ban on the use of formaldehyde, which is, according to the IPCS (International Program on Chemical Safety), is a specialized institution about the safety of chemical use. Formalin has a safe threshold in the body by 1 milligram per liter and can enter the body in the form of food for adults is 1.5 mg to 14 mg per day (Jannah *et al*., 2014).

Formalin is a chemical that only used as a preservative of dead bodies, disinfectants, insecticides, and also often used in the textile industry. If formalin is used in food, it can cause acute and chronic effects. Acute and chronic effects that can interfere with the respiratory tract, digestive tract, headaches, hypertension (high blood pressure), convulsions, to the most severe, can cause consumers to be unconscious or comatose. Other acute effects can damage organs in the human body, namely the liver, heart, brain, spleen, pancreas, nervous system, central and kidney. If formalin is consumed sustainably and chronically, it can cause cancer (Zakaria *et al*., 2014).

Formalin is a formaldehyde compound in water with an average concentration of 37% and 15% methanol, and the rest is water. Formaldehyde has a tendency that is very soluble in water. Formalin will be easily absorbed in fish meat if given to fish. Formalin has a volatile character because it has a boiling point of 21°C. Formalin also has very reactive in an alkaline atmosphere and is a potent reducing agent (Hastuti, 2010). Lack of knowledge about formalin and the negative impact of its use in food is one of the causes of still widespread use of this ingredient in cooking. The low price of formalin and ease of getting it on the market has caused the level of awareness to the danger of formalin by fishery product processing entrepreneurs decreased (Adisasmita *et al*., 2017).

Formalin contained in a fishery commodity can be tested through two methods, namely qualitatively and quantitatively. The qualitative approach is seen based on the presence or absence of formaldehyde content in a product, while the quantitative method can see what the value of formaldehyde content in a commodity is. This study aims to determine the content of formaldehyde contained in white shrimps after given formalin soaking treatment with different doses.

## METHODOLOGY

### Place and Time

This research was conducted in March-September 2019. Sample preparation and testing of formaldehyde levels in white shrimp took place at the sensor and optical fiber development laboratory, physics department, faculty of science and technology, Airlangga University, Surabaya. Formaldehyde testing using UV-Vis spectrophotometry was carried out in Health Laboratory Center (BBLK), Surabaya.

### Research Material

The equipment used in this research included pipettes, 1000 ml measuring flasks, Erlenmeyer, jerry cans to make formalin dilution, scales for weighing animal tests, styrofoam for shrimp transportation, plastic containers for soaking animal tests in formalin solution and fishnet for catching shrimp. The materials used in this study were 37% formalin, distilled water as a solvent, and white shrimp (*Litopenaeus vannamei*).

## Research Design

This is experimental research in a laboratory. Animal samples used in this study were white shrimp (*Litopenaeus vannamei*) that had been soaked in formalin solution. The parameters in this study were the levels of formalin contained in white shrimp. This study aimed to determine the residual formalin in white shrimp after being soaked using formalin solution at different dosages, between 1%, 2%, 3%, 4%, and 5% for one hour long.

Determination of the soaking time is based on research by Sanger and Montolalu (2008) as well as Purawisastra and Sahara (2011). Sanger and Montolalu (2008) conducted research on skipjack tuna soaked in formalin by 2% and 4% for 1 hour, and the results of the study found the results of formaldehyde on skipjack tuna soaked for 1 hour at a dose of 2% was 0.0307% and with a treatment of 4% is 0.0397%.

## Work Procedures

The research procedure in this study first prepares a solution of formalin. Preparation of formalin standard solution using a 1000 ml measuring flask. 37% concentrated solution of formalin was put in a measuring flask with different sizes. Dissolve it using the dilution formula V1. N1 = V2. N2, so to obtain the concentration of 1% formalin in the volume of 1,000 ml, 37% formalin or 27.02 ml is needed. The amount is then multiplied for other treatments up to 5%. The diluted solution is then put and stored in jerry cans and labeled according to the concentration and volume of formaldehyde in jerry cans and stored in a cool place.

The second step is to prepare the test animals. The selection of test animals based on their weight measurements and then recorded. White shrimp have weighed as much as 250 gr for each treatment. Formalin solution that has been made poured into a container containing 250 grams of white shrimp. White shrimp were soaked in distilled water as a control, formalin solution with different dosages of 1%, 2%, 3%, 4%, and 5%. The shrimp are soaked for one hour. After one hour of soaking, the waste solution in the form of distilled water and formalin is removed, and the sample can be sent to Health Laboratory Center (BBLK) for quantitative testing using UV-Vis spectrophotometry.

## Data Analysis

The data obtained was in the form of a linear graph about data of formalin content in white shrimp after soaking for one hour with different concentrations.

## RESULTS AND DISCUSSION

Soaked shrimp in formalin with different concentrations were also measured using UV-Vis spectrophotometry. This is done to determine the concentration level absorbed by white shrimp if soaking with varying doses at the same time as an hour. This test uses a wavelength of 415 nm to get the expected results in Table 1.

Table 1. Result of UV-Vis spectrophotometry test.

| Formalin concentration (%) | Study sample results (ppm) |
|---|---|
| 0 | <LoD 0.01 |
| 1 | <LoD 0.01 |
| 2 | 141.9 |
| 3 | 278.4 |
| 4 | 384.4 |
| 5 | 430.2 |

That graph image describes UV-Vis spectrophotometry test in white shrimp shows the higher the dose given. It is directly proportional to the higher formalin contained in white shrimp also can be detected. The graphic image can be seen in Figure 1 below.

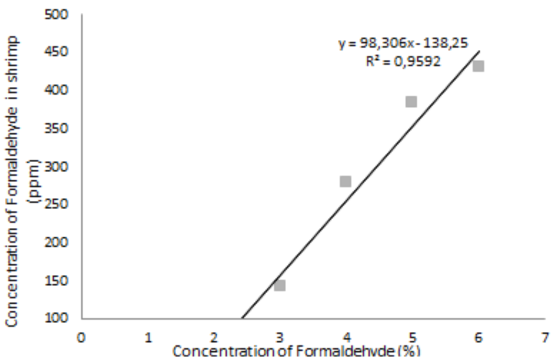


Figure 1. Formalin concentration graph in white shrimp uses UV-Vis spectrophotometry test.

The results of research conducted on white shrimp using UV-Vis spectrophotometry gave different results from each treatment. The higher the concentration of formalin used to soak white shrimp, the higher the content of formaldehyde contained in shrimp. This is due to the osmosis process. The difference in osmotic pressure between the meat cell liquid and the soaking solution, formalin, causes the transfer of formalin molecules into shrimp meat so that formalin will diffuse and dissolve into the shrimp and cause shrimp to contain formalin. Osmosis is an event where water moves from a high concentration place to a low concentration place. If osmosis occurs, then fluid from outside the cell will enter the cell (Febrinawati, 2017).

The formaldehyde content in fish and shrimp can cause a decrease in meat shrimp quality and, if consumed by humans, can be dangerous. Decreased shrimp quality is characterized by protein damage caused by formaldehyde. Formaldehyde has the ability to modify or denature a protein and nucleic acid through an alkylation process between the $-NH_2$ and -OH groups of proteins and nucleic acids with the hydroxymethyl group from formaldehyde to form methylene compounds (-NCHOH), so that protein content in the shrimp will be reduced. The more formaldehyde used, the more protein is bound (Wikanta *et al.*, 2011).

Formalin is a compound that can be used as a preservative but is very dangerous if used beyond the threshold. Formalin can function to inhibit the growth of microbes so that fish become more durable. Formalin can suppress the growth of spoilage bacteria but provides the destruction process of fish protein. Proximate test results showed that tilapia meat soaked in formalin 1% contained lower protein (16.13%) compared to tilapia meat soaked with seaweed extract solution. Formalin can inactivate protein either by condensing free amino acids in the protein into another form, so bacterial growth is inhibited. Formalin destroys amine protein groups in fish as a bacterial growth medium so that bacterial growth is inhibited (Tjahyaningsih *et al.*, 2013).-$NH_2$ and -OH groups of proteins and nucleic acids with the hydroxymethyl group from formaldehyde to form methylene compounds (-NCHOH) so that protein content in the shrimp will be reduced. The more formaldehyde used, the more protein is bound (Wikanta *et al.*, 2011).

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## CONCLUSION

Based on the result, it can be concluded that the detection of formalin using UV-Vis spectrophotometry showed the higher concentration of formalin given, the higher the formaldehyde contained in white shrimp and got the highest result of 430.2 ppm in the 5% soaking treatment for one hour.

## REFERENCES

Adisasmita, A.P., Yuliawati, S. and Hestiningsih, R., 2017. Survey of Formaldehyde Existence In Fresh Sea Fisheries Product Sold At Traditional Market Of Semarang City. *Jurnal Kesehatan Masyarakat (e-Journal)*, *3*(3), pp.109-119.

Febrinawati, F., 2017. Contamination Profile of Pb, Formaldehyde and Microbes in Products Kepala Batu Salted Fish, Smoked Fish and Shrimp Paste in District Dente Teladas Tulang Bawang. *Jurnal Teknologi & Industri Hasil Pertanian*, *22*(1), pp.33-39.

Hastuti, S., 2010. Analisis kualitatif dan kuantitatif formaldehid pada ikan asin di Madura. *Agrointek: Jurnal Teknologi Industri Pertanian*, *4*(2), pp.132-137.

Jannah, M., Ma'ruf, W.F. and Surti, T., 2014. Efektivitas Lengkuas (Alpinia galanga) Sebagai Pereduksi Kadar Formalin Pada Udang Putih (Penaeus merguiensis) Selama Penyimpanan Dingin. *Jurnal Pengolahan dan Bioteknologi Hasil Perikanan*, *3*(1), pp.70-79.

Purawisastra, S. and Sahara, E., 2011. Penyerapan The Adsorption Of Formaldehyde By Some Foodstuffs And Its Elimination By Soaking Them In Hot Water. *Penelitian Gizi dan Makanan (The Journal of Nutrition and Food Research)*, *34*(1), pp.63- 74.

Purnamasari, I., Purnama, D. and Utami, M.A.F., 2017. Pertumbuhan udang vaname (litopenaeus vannamei) di tambak intensif. *Jurnal Enggano*, *2*(1), pp.58-67.

Sanger, G. and Montolalu, L., 2008. Metode Pengurangan Kadar Formalin Pada Ikan Cakalang (Katsuwonus pelamis L). *WARTA WIPTEK*, (32), pp.6-10.

Suryadi, H. and Kurniadi, M., 2014. Analisis Formalin Dalam Sampel Ikan dan Udang Segar dari Pasar Muara Angke. *Pharmaceutical Sciences and Research (PSR)*, *7*(3), pp.16-31.

Tjahyaningsih, W., Alamsjah, M.A. and Abdillah, A.A., 2013. Potential Use of Red Algae Ethanol Extract (Kappaphycus Alvarezii) as Formalin Substitute Natural Preservative in Meat Fish. *Jurnal Ilmiah Perikanan dan Kelautan*, *5*(2), pp.123-128.

Tuyu, A., Onibala, H. and Makapedua, D.M., 2014. Studi Lama Pengeringan Ikan Selar (selaroides sp) asin Dihubungkan dengan Kadar air dan nilai Organoleptik. *Jurnal Media Teknologi Hasil Perikanan*, *2* (1), pp. 20 -27 .

Wikanta, W., Abdurrajak, Y., Sumarno, S. and Amin, M., 2011. Pengaruh Penambahan Belimbing Wuluh (Averrhoa Bilimbi L.) dan Perebusan terhadap Kadar Residu Formalin dan Profil Protein Udang Putih (Letapenaeus Vannamei) Berformalin Serta Pemanfaatannya sebagai Sumber Pendidikan Gizi dan Keamanan Pangan pada Masy. In *Prosiding Seminar Biologi* (Vol. 8, No. 1).

Zakaria, B., Sulastry, T. and Sudding, S., 2014. Analisis Kandungan Formalin pada Ikan Asin Katamba (Lethrinus lentjan) yang Beredar Di Kota Makassar. *CHEMICA*, *15*(2), pp.16-23.