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IDENTIFICATION OF FORMALIN CONTENT IN SOME FRESH SALTWATER FISH AT X TRADITIONAL MARKET, PAYAKUMBUH

Identifikasi Kandungan Formalin pada Beberapa Ikan Laut Segar di Pasar Tradisional X, Payakumbuh

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Abstract

Fish is a food source with high protein content and is relatively more affordable compared to other animal-based protein sources. A common issue is the misuse of hazardous substances to prevent quality deterioration and increase profit, such as formalin. This study aimed to identify the presence of formalin in fresh marine fish sold at Traditional Market X, Payakumbuh, to ensure food quality and safety for public consumption. Formalin testing was conducted on 10 samples, each weighing 10 g. Twenty milliliters of aquadest were added to each sample, followed by homogenization using a stomacher. The samples were then centrifuged at 3000 rpm for two minutes. After centrifugation, 10 mL of the supernatant from each sample was transferred into test tubes. Each tube was added with 3 drops of 0.5% phenylhydrazine, 2 drops of 5% sodium nitroprusside, and 3 drops of 10% NaOH, and the results were observed. The results showed that none of the samples contained formalin, as indicated by the absence of color change; all samples remained reddish-orange after reagent addition. Therefore, fresh marine fish sold at Traditional Market X Payakumbuh, were confirmed to be free from formalin and safe for consumption. Routine monitoring by the government is recommended to prevent the misuse of hazardous substances such as formalin in food products.

Keywords: Preservative, formalin, fresh fish, food safety

Abstrak

Ikan merupakan bahan pangan yang memiliki kandungan protein yang tinggi dan memiliki harga yang relatif lebih murah jika dibandingkan dengan sumber protein hewani lainnya.

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Masalah yang sering ditemukan yaitu sering ditemukan bahan berbahaya demi menghindari penurunan kualitas dan meningkatkan profit, seperti penggunaan formalin. Tujuan penelitian ini adalah untuk mengidentifikasi kandungan formalin pada ikan laut segar di Pasar tradisional X, Payakumbuh sebagai salah satu upaya untuk menjaga kualitas dan keamanan pangan yang dikonsumsi oleh masyarakat. Pengujian formalin ini dilakukan dengan cara menimbang 10 sampel dengan berat masing-masing sampel 10 gram, kemudian pada masing-masing sampel ditambahkan 20 mL aquadest lalu di*stomacher*. Selanjutnya, sampel dimasukkan kedalam tabung kemudian disentrifus dengan kecepatan 3000 rpm selama dua menit. Selanjutnya, ambil 10 mL supernatan masing-masing sampel dan masukkan kedalam tabung reaksi. Tambahkan masing-masing tabung 3 tetes 0,5% fenilhidrazin, 2 tetes 5% sodium nitropusit dan 3 tetes 10% NaOH kemudian amati hasil pengujian. Dari hasil pemeriksaan 10 sampel yang diuji, tidak terdapat kandungan formalin pada ikan laut segar yang dijual di Pasar Tradisional X Payakumbuh, dibuktikan dengan sampel yang diuji tidak mengalami perubahan warna yaitu tetap berwarna orange kemerahan setelah ditetesi reagen. Oleh sebab itu, ikan laut segar yang dijual di Pasar Tradisional X, Payakumbuh tidak mengandung formalin dan aman dikonsumsi oleh masyarakat. Perlu dilakukan pemeriksaan rutin terhadap ikan laut segar oleh pemerintah agar tidak terjadi penyalahgunaan bahan berbahaya, seperti formalin yang digunakan sebagai bahan tambahan pangan.

Kata kunci: pengawet, formalin, ikan segar, keamanan pangan

INTRODUCTION

Indonesia continues to face challenges related to food safety, which are closely associated with limited knowledge, technical capacity, and a lack of responsibility among food and beverage producers regarding food quality and safety, particularly within small-scale and household enterprises (Supardan, 2020). Fish is one of the most widely traded food commodities in both developed and developing countries (Bellmann *et al.*, 2016). Freshly caught or fresh fish refers to fish that has not undergone any preservation process, except for chilling using ice. The characteristics of freshly caught fish resemble those of live fish, including appearance, odor, taste, and texture. Without proper handling, the quality of freshly caught fish deteriorates rapidly. Fish handling encompasses all activities from the time of capture until the product is received by consumers (Al Fatich *et al.*, 2023).

Fish is the second most important source of animal protein after meat, milk, and eggs. Its high protein content and essential amino acids are crucial for human health (Bhowmik *et al.*, 2022; Mikołajczak *et al.*, 2022; Oktavianawati *et al.*, 2016; Taipale *et al.*, 2022). In addition, fish is generally more affordable than other protein sources (Natsir, 2018). Despite its high nutritional value and favorable quality, various issues persist within the fisheries industry. One common problem is the fraudulent practice of adulterating or contaminating fish with hazardous substances to prevent quality deterioration and increase profits, such as the use of formalin (Adisasmita *et al.*, 2017; Purba *et al.*, 2017; Rosida & Awandhana, 2015; Utari & Agustin, 2024).

Formalin is not classified as a food additive; however, it is frequently misused in food products. Its selection is often associated with low cost and its ability to extend shelf life (Kusumaningsih, 2023), while maintaining product integrity, functionality, and preservation efficiency (Ruslan *et al.*, 2016; Lathifah *et al.*, 2019). This misuse is further driven by limited awareness of the health risks of formalin, low public health literacy, and its affordability and ease of access (Tarumingi *et al.*, 2021). Among various preservatives, formaldehyde stands out due to its low cost and ease of incorporation into food products (Mudawaroch *et al.*, 2024).

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Regardless of its original industrial purpose, some producers intentionally add formalin to food products such as noodles, fish, and meatballs (Dewi, 2019; Margata & Siagian, 2021; Mudawaroch *et al.*, 2024; Sulistiyorini, 2024; Yuliana *et al.*, 2023). This practice poses serious health risks, as formalin can react with mucosal tissues in the gastrointestinal and respiratory tracts. The use of formalin in food has significant adverse health effects (Jayadi *et al.*, 2023; Nurdin & Utomo, 2018). Short-term exposure to formalin may lead to significant increases in mean serum levels of urea, uric acid, albumin, total protein, and electrolytes (Asyfiradayati *et al.*, 2019; Lema & Jacob, 2020). Toxic effects of formalin include symptoms such as vomiting, lethargy, acute gastric disturbances, and circulatory disorders (Asyfiradayati *et al.*, 2019; Iftriani, 2016; Ihim *et al.*, 2025; Kang *et al.*, 2021; Nopiyanti *et al.*, 2018; Purba *et al.*, 2017; Sammulia *et al.*, 2020; Zain *et al.*, 2019). Long-term consumption of formalin-contaminated food may result in infertility due to a reduction in spermatogenic cell numbers (Dhalila *et al.*, 2017). Repeated or high-dose exposure may also cause organ damage and increase the risk of cancer (Furi & Harahap, 2015).

Studies on the use of formalin in fresh marine fish have predominantly focused on major urban areas, while rural regions and traditional markets remain relatively underexplored, particularly in West Sumatra Province. Given the risks associated with formalin use in food products, it is essential to identify whether fresh marine fish sold at Traditional Market X, Payakumbuh, are contaminated with formalin. Therefore, this study aims to identify the presence of formalin in fresh marine fish marketed at Traditional Market X, Payakumbuh, as part of efforts to ensure food quality and safety for consumers.

RESEARCH METHODS

Ethical Considerations

This study did not involve any experimental intervention in live animals. The samples analyzed consisted of fresh marine fish purchased from Traditional Market X, Payakumbuh, followed by laboratory examination.

Study Object

The study objects were fresh marine fish samples obtained from Traditional Market X, Payakumbuh. The study population comprised all fresh marine fish sold by fish vendors at Traditional Market X during the study period. Fresh marine fish samples were selected using a simple random sampling technique, ensuring that each member of the population had an equal opportunity to be included in the study. A total of ten fresh marine fish samples were collected. Each sample was labeled and transported to the laboratory for further analysis.

Study Design

This study employed an observational research design. Observations were conducted on fresh marine fish sold at Traditional Market X, Payakumbuh.

Data Collection Method

Formalin testing was conducted by weighing 10 g of each sample, followed by the addition of 20 mL of distilled water (aquadest). The mixture was homogenized using a stomacher. The homogenate was then transferred into centrifuge tubes and centrifuged at 3,000 rpm for two minutes.

For the positive control, 10 mL of 1% formaldehyde solution was placed into a test tube, while the negative control consisted of 10 mL of distilled water used as a substitute for the supernatant. Subsequently, 10 mL of the supernatant from each sample was transferred into separate test tubes. Each tube was then supplemented with three drops of 0.5%

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phenylhydrazine, two drops of 5% sodium nitroprusside, and three drops of 10% NaOH. The test results were observed visually, with a dark blue color indicating a positive result and an orange to red color indicating a negative result (Permadi *et al.*, 2024).

Data Analysis

Data obtained from the analysis of formalin content in fresh marine fish were analyzed descriptively, with reference to the Regulation of the Minister of Health of the Republic of Indonesia No. 722/MenKes/Per/IV/88 concerning food additives prohibited for use.

RESULTS AND DISCUSSION

Results

Based on the test results, all ten samples examined showed negative results for the presence of formalin. The findings are presented in Table 1. No color change was observed in the sample solutions from reddish orange to dark blue, indicating that none of the fresh marine fish samples sold at Traditional Market X, Payakumbuh, contained detectable formalin. According to Suryadi *et al.* (2010), the color reaction results from a condensation reaction between formaldehyde and phenylhydrazine, which during oxidation produces a weak base. In the presence of a strong acid, this weak-base forms a salt that undergoes hydrolytic dissociation upon dilution, producing a red-colored complex.

Formalin is a hazardous additive that is still misused by irresponsible traders. In addition to its low cost, its liquid form contributes to its frequent misuse (Warsyidah, 2019). Traders typically use formalin to maintain color and texture and to extend the shelf life of food products (Auladiyah & Fauzan, 2021).

The findings of this study are consistent with those reported by Khulukhi *et al.* (2024), who stated that samples free of formalin do not exhibit color changes and retain the original color of the solution. In contrast, Rahma *et al.* (2025) reported positive identification of formalin in 36 samples of two fish species, mackerel and ribbonfish, collected from several traditional markets in the city of Cilacap, as indicated by a color change to purple.

Several studies on formalin contamination in fresh fish products have reported positive findings (Asyfiradayati *et al.*, 2019; Mardiyah & Jamil, 2020; Riani *et al.*, 2024; Ritonga *et al.*, 2024; Rovita & Wulandari, 2022; Sahrianti *et al.*, 2021; Setyowat *et al.*, 2020; Simanjuntak & Silalahi, 2022; Utari & Agustin, 2024). According to the Regulation of the Minister of Health of the Republic of Indonesia No. 722/MenKes/Per/IX/1988, formalin content in food must be zero or negative.

Discussion

The results of this study are in line with those reported by Razi, Syahputra, Fakhrurrazi, and Aswadi (2022), who found that all fish samples tested were negative for formalin contamination. Similar findings were also reported by Mardiana and Zulfikri (2020), Sulistiyorini (2024), Tatuh (2016), and Yohanista *et al.* (2022), suggesting a relatively good level of awareness among communities, fishers, and traders regarding the health risks associated with formalin.

The decline in fish quality leading to the post-rigor stage can occur within one day. This deterioration may be triggered by contamination with protozoa, fungi, worms, and bacteria, as well as by enzymatic activity in fish muscle. Freshly caught fish cannot remain in good condition if left for several days at sea (Wulandari *et al.*, 2019). Therefore, appropriate measures are required to maintain fish freshness and shelf life, such as the use of ice or other

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preservation methods. Unfortunately, some individuals misuse hazardous chemicals such as formalin to artificially prolong fish shelf life (Lema & Jacob, 2020).

The use of formalin in food products is a serious concern because it can cause acute poisoning. Symptoms of formalin intoxication include nausea, severe abdominal pain accompanied by vomiting, bloody diarrhea, as well as disturbances of the nervous system and blood circulation. At high doses, formalin exposure may result in bloody diarrhea, hematuria, hematemesis, and potentially death (Warsyidah, 2019).

The hazardous nature of formalin lies in its ability to damage protein structures or RNA, which are essential for DNA formation in humans. Disruption or alteration of DNA structure can trigger the development of cancer cells. The adverse effects of formalin may not be immediately apparent, as the pathological process often requires a prolonged period to manifest (Nopiyanti *et al.*, 2018). However, continuous daily consumption of formalin-contaminated food substantially increases the risk of cancer (Sukmawati, 2018).

Professional education efforts are essential and can be implemented by providing information to the public and food vendors that formalin is not a food preservative but a hazardous substance that poses significant health risks to consumers. It is also important for the public to recognize the characteristics of fresh fish that do not contain formalin, such as fish that are not excessively stiff or rigid and have gills that are not pale in color (Utari & Agustin, 2024; Wijayanti & Lukitasari, 2016). In addition, vendors should be informed about the use of safe natural or organic preservatives as alternatives.

According to the Regulation of the Minister of Health of the Republic of Indonesia No. 033 of 2012, the use of formalin in food products is strictly prohibited. However, in practice, some groups continue to misuse formalin as a food preservative, including in fishery products. The amount of formalin permitted to enter the human body through food is approximately 1.4–1.5 mg/day. Formalin also occurs naturally in various foodstuffs, including fruits and vegetables (3–60 mg/kg), milk and dairy products (1 mg/kg), meat and fish (6–20 mg/kg), and shellfish (1–100 mg/kg) (Simanjutak *et al.*, 2022).

Several factors contribute to the continued use of formalin as a food preservative, including its significantly lower cost compared with other preservatives, the smaller quantities required, ease of application due to its liquid form, shorter processing time, widespread availability in chemical supply stores, and limited knowledge among food producers regarding its health hazards (Yulia, 2017). Ensuring the safety of fishery products is therefore a critical aspect of fisheries sector development, particularly as fish consumption is expected to continue increasing in line with growing public awareness of the nutritional value of fish for health and cognitive development.

CONCLUSIONS AND RECOMMENDATIONS

Conclusions

The results of this study indicate that all ten fresh marine fish samples sold at Traditional Market X, Payakumbuh, were free from formalin contamination and are therefore safe for consumption.

Recommendations

Routine monitoring and inspection of fresh marine fish by government authorities are necessary to prevent the misuse of hazardous substances, such as formalin, as food additives. Public education should be strengthened to increase awareness of food safety and to improve understanding of the characteristics of fresh fish that may indicate formalin contamination. Fish

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vendors are encouraged to continue maintaining the quality and freshness of marine fish sold at Traditional Market X, Payakumbuh.

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Table

Table 1. Results of formalin detection in fresh marine fish muscle

No.	Sample	Test result	Color
1	Sample 01	Negative	Reddish orange
2	Sample 02	Negative	Reddish orange
3	Sample 03	Negative	Reddish orange
4	Sample 04	Negative	Reddish orange
5	Sample 05	Negative	Reddish orange
6	Sample 06	Negative	Reddish orange
7	Sample 07	Negative	Reddish orange
8	Sample 08	Negative	Reddish orange
9	Sample 09	Negative	Reddish orange
10	Sample 10	Negative	Reddish orange

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