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Analysis of Formaldehyde Content in Tofu Products as an Indicator of Food Safety in Pidie Regency

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Abstract: This study aimed to identify the presence of formaldehyde in white tofu circulating in Pidie Regency as an indicator of food safety. The research employed a descriptive design with an exploratory approach, using qualitative testing through two techniques: the use of red dragon fruit peel filtrate as a natural indicator in the initial stage and a rapid test kit as a confirmatory method. The samples consisted of 48 white tofu samples collected from 12 sub-districts, with each sub-district represented by four samples obtained from different producers. Sampling was conducted purposively by considering market activity level, number of vendors, and ease of site access. The samples were prepared through a homogenization process prior to testing. The presence of formaldehyde was determined based on color change, reaction time, and color intensity observed during the testing process. The results showed that 12 samples (25%) were positively detected as containing formaldehyde, while the remaining 36 samples (75%) tested negative. Positive samples were generally found in areas with relatively high distribution and trading activity. Based on these findings, it can be concluded that formaldehyde is still present in a proportion of white tofu sold in Pidie Regency. Therefore, enhanced monitoring and education for business actors are needed. In addition, red dragon fruit peel filtrate shows potential as a simple, economical, and environmentally friendly preliminary screening method.
Keywords: Formaldehyde, white tofu, red dragon fruit peel filtrate, rapid test kit, food safety

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INTRODUCTION

Tofu is a soybean-based food product widely consumed in Indonesia due to its favorable nutritional profile, particularly as a source of plant-based protein, calcium, iron, and B vitamins (Widjajaseputra et al., 2020; Syahfitri, 2020). However, its major drawback is its relatively short shelf life, primarily because of its high moisture and protein content, which makes it highly susceptible to microbiological spoilage within a short time at room temperature (Yang et al., 2020). This condition presents a significant challenge for distribution, especially in traditional markets, which generally lack refrigerated storage facilities.

Formalin, which contains formaldehyde, is a reactive aldehyde compound that is toxic and prohibited for use in food products (Badan Pengawas Obat dan Makanan, 2023). Chemically, formaldehyde has a simple molecular structure with a highly reactive carbonyl group, enabling it to interact readily with various biological molecules such as proteins and nucleic acids through addition reactions and cross-link formation (Biology Insights, 2025). Biochemically, formaldehyde can bind to amino groups in proteins, forming cross-links that inhibit enzyme activity and suppress the growth of spoilage microorganisms (Kurniawidjaja et al., 2021). As a result, tofu becomes more durable, but this preservation effect poses serious health risks in both the short and long term, including organ damage and an increased risk of cancer (World Health Organization, 2019; Yulianti, 2021).

Various methods have been developed to detect formalin in food products, including laboratory-based chemical analyses and the use of rapid test kits. However, these methods generally involve relatively high costs and are not always easily accessible to the public (Putri et al., 2024). Therefore, an alternative approach that is simpler, more economical, and environmentally friendly is needed. One promising strategy is the use of natural materials such as red dragon fruit peel (*Hylocereus polyrhizus*), which contains anthocyanin pigments with chemical indicator activity (Sari et al., 2024; Novianty, 2023).

Anthocyanins are flavonoid compounds with a flavylium ion structure that is highly sensitive to changes in the chemical environment. In a biochemical context, anthocyanins can interact with aldehyde compounds such as formaldehyde through alterations in the electronic structure of their conjugated double-bond system. This interaction causes a shift in the wavelength of light absorption (bathochromic shift), which is visually indicated by a color change in the solution (Sulistyorini et al., 2022; Fitrianingsih, 2019). This mechanism suggests that anthocyanins have strong potential to serve as natural indicators for detecting formalin in food products.

Although numerous studies on formalin detection have been conducted, most have focused on conventional chemical methods or the separate use of rapid test kits. Studies combining natural indicators derived from organic waste with rapid confirmation methods remain limited. In addition, the use of dragon fruit peel waste as a natural indicator in food products such as tofu, particularly in traditional market settings, has rarely been reported (Sari et al., 2021; Salsabila, 2024). Therefore, this study proposes a more environmentally friendly and cost-effective detection approach through the use of dragon fruit peel waste as a preliminary indicator combined with a practical confirmation method.

Based on these considerations, research is needed not only to identify formalin in food products but also to develop a detection method that is simple, inexpensive, and easily applicable by the wider community. Such an approach is expected to support independent food safety monitoring efforts, particularly in areas with limited laboratory facilities (Afriani et al., 2022). Accordingly, this study aims to analyze the presence of formalin in white tofu marketed in Pidie Regency using a natural indicator method based on red dragon fruit peel filtrate, with a rapid test kit employed for confirmation.

METHOD

Study Type and Design

This study employed a descriptive design with a qualitative approach to identify the presence of formalin in white tofu as an indicator of food safety. The qualitative analysis was based on color changes observed during testing and was supported by a simple quantitative calculation in the form of the percentage of positive and negative results.

Study Location and Time

Sample collection was conducted in 12 subdistricts of Pidie Regency in October 2025. The procedures for detecting formalin content were carried out at the Multifunctional Laboratory, Faculty of Science and Technology, Ar-Raniry State Islamic University, Banda Aceh.

Population and Sample

The population of this study comprised all white tofu products distributed in traditional markets in Pidie Regency. A total of 48 white tofu samples were collected

from 12 subdistricts, namely Grong-Grong, Indra Jaya, Kembang Tanjong, Kota Sigli, Lamlo, Mutiara Barat, Mutiara Timur, Padang Tiji, Peukan Baru, Pidie, Tangse, and Tiro. Each subdistrict was represented by four samples obtained from different producers.

Samples were collected using purposive sampling, in which samples were intentionally selected based on specific criteria. These criteria included the level of market activity, the number of tofu vendors, and the intensity of product distribution in each area. This technique was chosen to ensure that the samples represented the circulation of white tofu, particularly in areas considered to have a higher potential risk of formalin use.

Instruments and Materials

The equipment used in this study included test tubes, droppers, measuring cylinders, glass stirring rods, a digital balance, a stopwatch, a blender, filter paper, and sample containers such as porcelain dishes or beakers. All instruments were used sequentially at each testing stage to obtain optimal results.

The materials used in this study consisted of white tofu samples as the main test objects, distilled water as the solvent, Formalin-1 and Formalin-2 reagents as chemical testing agents, and red dragon fruit peel filtrate as a natural indicator. All materials were prepared and used according to the established procedures to ensure the validity of the results obtained from the formalin detection process.

Research Procedure

The procedures in this study were divided into two main parts: testing using a rapid test kit with Formalin-1 and Formalin-2 reagents and testing using a natural method with red dragon fruit peel filtrate. The procedures were as follows.

1. Sample Collection

A total of 48 white tofu samples were collected from several traditional markets in Pidie Regency. Sampling was conducted in 12 subdistricts distributed across different parts of the regency. Four tofu samples from different producers were collected from each market. The research locations included Pidie, Kota Sigli, Mutiara, Mila, Delima, Grong-Grong, Batee, Sakti, Peukan Baro, Tiro, Keumala, and Padang Tiji. These locations were selected purposively by considering market activity level, the number of tofu vendors, and accessibility to the study sites. Since Pidie Regency consists of 23 subdistricts, sampling in 12 subdistricts covered more than 52% of the administrative area. Therefore, the samples were considered sufficiently representative of the distribution of white tofu in the region.

Sample preparation began by weighing 25 g of white tofu from each sample, which was then mixed with 50 mL of distilled water or hot water. The sample was subsequently chopped and crushed using a glass stirring rod until evenly dissolved, forming a homogeneous tofu solution. Next, 2 mL of the tofu solution was transferred into a test tube for formalin analysis (Labstest, 2025).

2. Formalin Analysis Using the Rapid Test Kit Method

Formalin testing was performed using Formalin-1 and Formalin-2 reagent solutions, which react with formaldehyde. A total of 2 mL of the homogenized tofu solution was placed in a test tube, followed by the addition of 1 drop of Formalin-1 reagent and 3 drops of Formalin-2 reagent. The mixture was then gently stirred until homogeneous. After mixing, the test tube was allowed to stand for 5 to 15 minutes, timed with a stopwatch. The resulting changes were then observed. A bright pink or dark pink color appearing within this period indicated the presence of formalin in the tofu sample. In contrast, the absence of any color change during the observation

period indicated a negative result for formalin. This method is considered a rapid and simple qualitative test based on direct visual observation of color change (Labstest, 2025).

3. Formalin Analysis Using a Natural Method (Red Dragon Fruit Peel Filtrate)

The natural testing method used filtrate from red dragon fruit peel (Hylocereus polyrhizus), which is rich in anthocyanin compounds that function as natural colorants sensitive to chemical changes. The filtrate preparation began by peeling the dragon fruit and separating the hard outer peel from the inner reddish-purple layer. The inner peel was then cut into small pieces to facilitate blending with a small amount of distilled water until smooth. The blended material was filtered using filter paper to obtain a reddish-purple liquid known as red dragon fruit peel filtrate. The filtrate was subsequently stored in a closed container protected from direct sunlight to maintain anthocyanin stability and prevent degradation due to oxidation or heat (Sari, 2024).

Next, 2 mL of the filtered tofu solution was transferred into a test tube, and 3–5 drops of red dragon fruit peel filtrate were added. The mixture was gently stirred until homogeneous and then left to stand for 5 to 15 minutes, with the time monitored using a stopwatch, to observe any changes. The reaction between anthocyanin and formalin was indicated by a color change to bright pink or dark pink, showing a positive result for formalin in the tofu sample. If no color change occurred, the sample was considered negative for formalin. This method is regarded as environmentally friendly, safe, simple, and effective for field testing because it uses natural materials without hazardous chemical reagents (Novianty, 2023).

Data Analysis Technique

Data were analyzed descriptively using a qualitative approach based on visual observation of color changes in the test solutions after mixing with the tofu samples. Two testing methods were applied: the rapid test kit method using Formalin-1 and Formalin-2 reagents and the natural method using red dragon fruit peel filtrate. The observed color changes served as indicators of the presence of formalin in the samples. Samples showing specific color changes were interpreted as positive for formalin, whereas those showing no change were considered negative. All observational results were then grouped according to the sample origin and the testing method used, and subsequently analyzed to determine the extent of formalin contamination in white tofu distributed across the 12 subdistricts of Pidie Regency.

RESULTS AND DISCUSSION

Based on the test results obtained using red dragon fruit peel filtrate and a rapid test kit, 12 of the 48 white tofu samples (25%) were detected as positive for formalin, while the remaining 36 samples (75%) were negative. This percentage indicates that although most products were still safe, the presence of formalin in one-quarter of the samples remains an indicator of a potential food safety risk in Pidie Regency. This finding is consistent with several previous studies reporting formalin contamination in tofu sold in traditional markets within the range of 15–30% (Hutami et al., 2020; Salsabila, 2024; Sari, 2022).

Table 1. Percentage of positive samples

Sample Code	Number of Samples	Positive	Negative	Positive Percentage (%)
Grong-Grong	4	1	3	25%
Indra Jaya	4	2	2	50%
Kembang Tanjong	4	2	2	50%

Sample Code	Number of Samples	Positive	Negative	Positive Percentage (%)
Kota Sigli	4	2	2	50%
Lamlo	4	1	3	25%
Mutiara Barat	4	1	3	25%
Mutiara Timur	4	0	4	0%
Padang Tiji	4	0	4	0%
Peukan Baru	4	2	2	50%
Pidie	4	1	3	25%
Tangse	4	0	4	0%
Tiro	4	0	4	0%

Table 2. Sample testing results

No	Sample Code	Dragon Fruit Indicator	Kit	Result
1.	Grong-Grong 1	Pale pink	Pink	-
2.	Grong-Grong 2	Pale pink	Pink	-
3.	Grong-Grong 3	Bright purple/not uniform	Purple	+
4.	Grong-Grong 4	Pale pink	Pink	-
5.	Indra Jaya 1	Bright purple/not uniform	Purple	+
6.	Indra Jaya 2	Bright purple/not uniform	Purple	+
7.	Indra Jaya 3	Pale pink	Pink	-
8.	Indra Jaya 4	Pale pink	Pink	-
9.	Kembang Tanjong 1	Pale pink	Pink	-
10.	Kembang Tanjong 2	Pale pink	Pink	-
11.	Kembang Tanjong 3	Bright purple/not uniform	Purple	+
12.	Kembang Tanjong 4	Bright purple/not uniform	Purple	+
13.	Kota Sigli 1	Pale pink	Pink	-
14.	Kota Sigli 2	Bright purple/not uniform	Purple	+
15.	Kota Sigli 3	Bright purple/not uniform	Purple	+
16.	Kota Sigli 4	Pale pink	Pink	-
17.	Lamlo 1	Pale pink	Pink	-
18.	Lamlo 2	Bright purple/not uniform	Purple	+
19.	Lamlo 3	Pale pink	Pink	-
20.	Lamlo 4	Pale pink	Pink	-
21.	Mutiara Barat 1	Pale pink	Pink	-
22.	Mutiara Barat 2	Pale pink	Pink	-
23.	Mutiara Barat 3	Bright purple/not uniform	Purple	+
24.	Mutiara Barat 4	Pale pink	Pink	-
25.	Mutiara Timur 1	Pale pink	Pink	-
26.	Mutiara Timur 2	Pale pink	Pink	-
27.	Mutiara Timur 3	Pale pink	Pink	-
28.	Mutiara Timur 4	Pale pink	Pink	-
29.	Padang Tiji 1	Pale pink	Pink	-
30.	Padang Tiji 2	Pale pink	Pink	-
31.	Padang Tiji 3	Pale pink	Pink	-
32.	Padang Tiji 4	Pale pink	Pink	-
33.	Peukan Baru 1	Bright purple/not uniform	Purple	+
34.	Peukan Baru 2	Pale pink	Pink	-
35.	Peukan Baru 3	Bright purple/not uniform	Purple	+
36.	Peukan Baru 4	Pale pink	Pink	-
37.	Pidie 1	Pale pink	Pink	-
38.	Pidie 2	Bright purple/not uniform	Purple	+
39.	Pidie 3	Pale pink	Pink	-
40.	Pidie 4	Pale pink	Pink	-
41.	Tangse 1	Pale pink	Pink	-
42.	Tangse 2	Pale pink	Pink	-
43.	Tangse 3	Pale pink	Pink	-
44.	Tangse 4	Pale pink	Pink	-
45.	Tiro 1	Pale pink	Pink	-
46.	Tiro 2	Pale pink	Pink	-

No	Sample Code	Dragon Fruit Indicator	Kit	Result
47.	Tiro 3	Pale pink	Pink	-
48.	Tiro 4	Pale pink	Pink	-

The following are the results of formalin content testing in white tofu using the rapid test kit method.

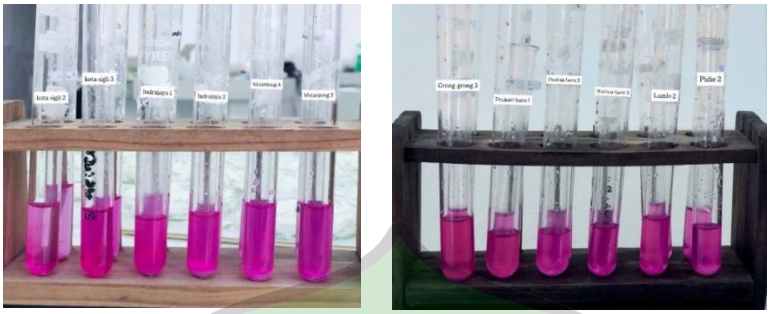

Figure 1. Formalin-negative tofu

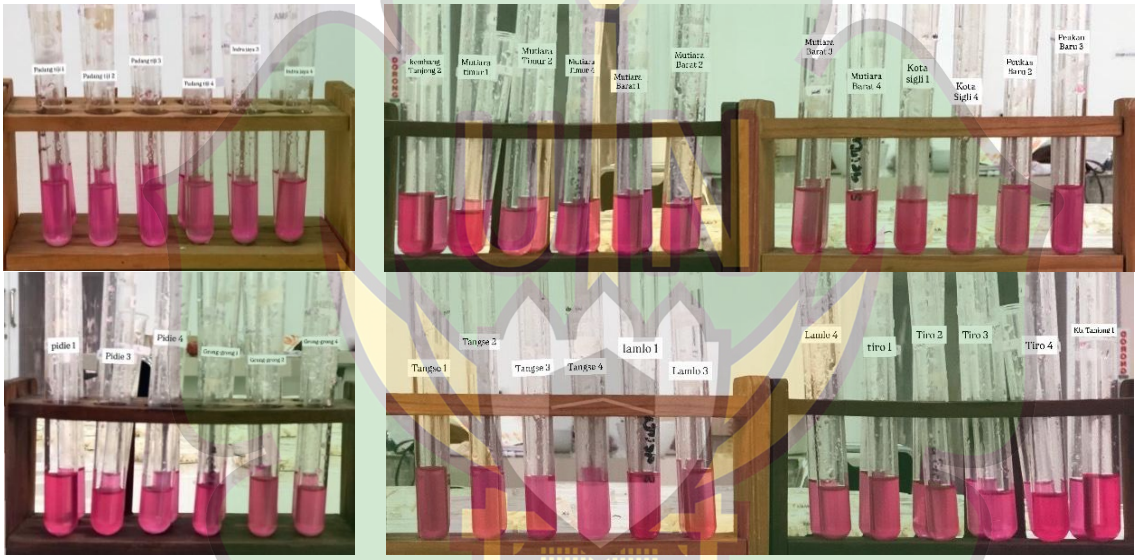

Figure 2. Formalin-positive tofu

The following are the results of formalin content testing in white tofu using a natural indicator in the form of red dragon fruit peel filtrate.

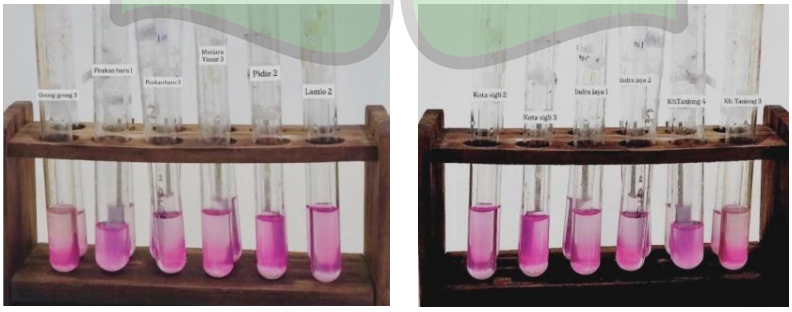

Figure 3. Formalin-negative tofu

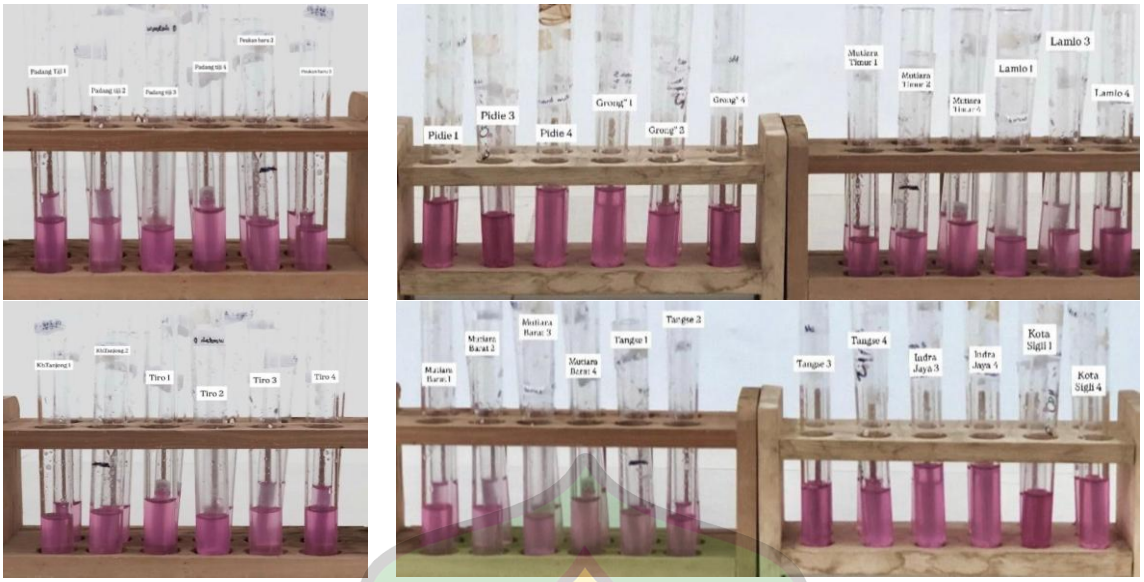

Figure 4. Formalin-positive tofu

The distribution of results showed that formalin-positive samples were not randomly distributed, but rather tended to be concentrated in areas with high trading intensity, such as Kota Sigli, Peukan Baru, Kembang Tanjong, and Indra Jaya. These areas function as food distribution centers and therefore face greater pressure to maintain product quality and extend shelf life. This condition suggests that logistical factors, such as distribution distance, transportation time, and limited cold-storage facilities, contribute to the illegal use of formalin as a preservative. In addition, this pattern indicates a tendency toward repeated practices in certain areas that may serve as potential risk hotspots. These findings are in line with previous studies showing that distribution and storage systems are key factors driving the misuse of chemicals in wet food products (Fan et al., 2024; Mawandari, 2024).

The test results obtained using the natural indicator and the rapid test kit showed consistency in detecting formalin in tofu samples. Samples identified as positive by both methods exhibited a similar color change, from pink to purple, indicating the occurrence of a chemical reaction with formaldehyde. This finding suggests that red dragon fruit peel filtrate has strong potential as an initial screening method. Biochemically, this color change is caused by the interaction between anthocyanin compounds and reactive formaldehyde. Formaldehyde can modify the flavylium ion structure of anthocyanins, thereby altering the electron conjugation system and producing a shift in absorption wavelength (bathochromic shift), which appears as a visible change in solution color (Fitrianingsih, 2019; Sulistyorini et al., 2022). In contrast, in the rapid test kit method, the color change occurs through the formation of a colored complex resulting from a specific reaction between formaldehyde and certain chemical reagents, giving this method higher accuracy as a confirmatory test (Putri et al., 2024). The consistency of results between these two methods strengthens the validity of using a natural indicator as a practical preliminary detection tool.

Based on the diagram visualization, negative samples predominated at 75%, whereas positive samples accounted for 25%. Although the overall prevalence of formalin was relatively low, the uneven distribution of positive samples indicates a localized pattern in certain areas. This suggests that the risk of formalin exposure cannot be evaluated solely on the basis of the total percentage, but must also consider its spatial distribution. Therefore, even a limited presence of formalin has important implications for food safety, particularly for communities consuming products from

areas with higher contamination levels (Hutami et al., 2020; Salsabila, 2024; Ayu, 2024).

The following diagram presents the percentage of formalin test results in the tofu samples analyzed in this study (n = 48). This visualization compares the number of samples identified as formalin-positive and formalin-negative based on testing with red dragon fruit peel filtrate and a rapid test kit.

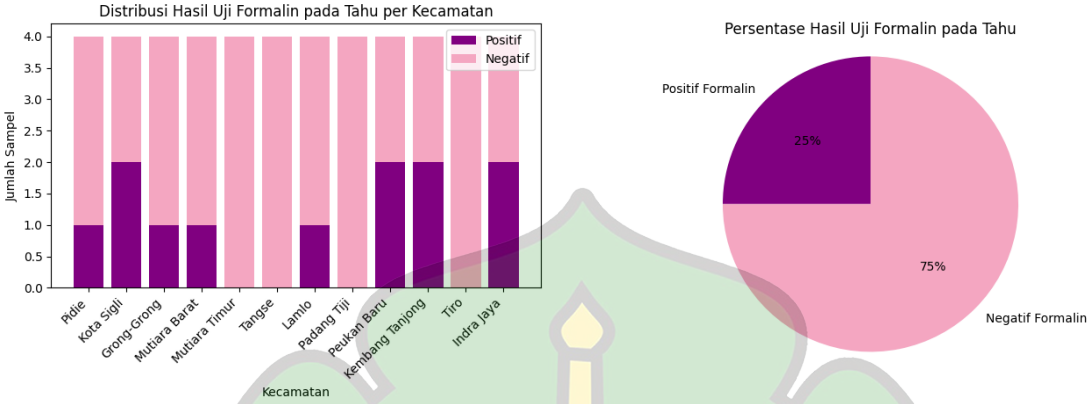

Figure 5. Comparison diagram of positive and negative formalin test results

The use of red dragon fruit peel filtrate as a natural indicator offers several advantages, including relatively low cost, ease of application, and environmental friendliness due to the utilization of organic waste. This method also does not require complex laboratory equipment, making it potentially suitable for widespread community use as a simple detection tool. The use of natural materials as chemical indicators has been widely reported as effective for the practical and safe detection of hazardous substances (Enjelina & Erda, 2022; Novianty & Yulianzah, 2023; Sari et al., 2024). Nevertheless, this method also has limitations that should be considered, particularly the subjectivity involved in observing color changes, which depends on the visual perception of the observer. In addition, the sensitivity of natural indicators tends to be lower than that of reagent-based methods, creating the possibility of detection errors, especially at low formalin concentrations (Pratiwi et al., 2019). Therefore, this method is more appropriately used for preliminary screening and should be combined with confirmatory methods such as rapid test kits to improve result accuracy.

Scientifically, these findings indicate that the use of anthocyanin-based natural indicators is not only relevant in the context of analytical chemistry, but is also closely linked to biological and food safety aspects. The interaction of formaldehyde with proteins through a cross-linking mechanism can inhibit enzymatic activity and microbial growth, thereby slowing the spoilage process in tofu (Kurniawidjaja et al., 2021). However, from a public health perspective, the presence of formalin in food remains a serious threat because long-term exposure may cause organ damage, disrupt biological systems, and increase cancer risk (World Health Organization, 2019; Yulianti, 2021). This underscores the importance of developing detection methods that are not only accurate, but also accessible to the wider community as part of food safety risk mitigation efforts.

Compared with previous studies, the results of this study show a similar trend in the level of formalin contamination, while also providing a novel contribution through an integrative approach that combines a natural indicator derived from organic waste with a rapid confirmatory method. This approach not only offers a more economical and environmentally friendly solution, but also has high practical value, particularly in

areas with limited laboratory facilities. Thus, this study contributes to the development of a simpler, more sustainable, and community-oriented formalin detection method to support food safety monitoring.

CONCLUSION

This study showed that 12 out of 48 white tofu samples (25%) collected from several subdistricts in Pidie Regency were positive for formalin, while 36 samples (75%) were negative. Although most samples were classified as safe, the detection of formalin in one-quarter of the samples indicates that food safety risks remain present and require serious attention. The findings also demonstrated that red dragon fruit peel filtrate has good potential as a natural indicator for the preliminary detection of formalin in white tofu. The consistency of results between the natural indicator and the rapid test kit suggests that this organic waste–based material can serve as a simple, low-cost, and environmentally friendly screening method. However, because its interpretation still depends on visual observation and its sensitivity is lower than that of chemical reagent–based methods, its use is more appropriate for initial screening rather than definitive confirmation.

In addition, the distribution of positive samples tended to be concentrated in areas with higher trading and distribution activity, indicating that logistical and storage factors may contribute to the illegal use of formalin as a preservative. Therefore, the development and use of accessible early detection methods, combined with confirmatory testing and strengthened food safety monitoring, are important steps to reduce the risk of formalin exposure in the community. Overall, this study contributes to the development of a practical, sustainable, and community-oriented approach to formalin detection in food products.

RECOMMENDATION

Based on the findings of this study, the red dragon fruit peel filtrate method can be used as a simple and affordable preliminary screening test for detecting formaldehyde in tofu. However, a rapid test kit is still required as a confirmatory method to ensure more accurate results. Therefore, monitoring and educational efforts targeting producers and vendors should be strengthened to prevent the distribution of tofu containing formaldehyde.

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REFERENCES

Afriani, D., Muzafri, A., & Alfiah, L. N. (2022). Identifikasi Formalin Pada Tahu Putih Di Pasar Tradisional Kabupaten Rokan Hulu. *Jurnal Sungkai*, *10*(1).

Ayu. 2024. Analisis Kualitatif Kandungan Formalin Pada Tahu Sutra Yang Beredar Di Pasar Baru Porong Sidoarjo. *PRIMER : Jurnal Ilmiah Multidisiplin* 2 (3): 189–95. https://doi.org/10.55681/primer.v2i3.340.

Badan Pengawas Obat dan Makanan. (2023). *Bahan Baku yang dilarang dalam Pangan Olahan dan Bahan yang dilarang digunakan sebagai Bahan Tambahan Pangan*.

Biology Insights. 2025. Formaldehyde: Molecular Geometry, Bonds, and Orbital Hybridization.

Enjelina, W., & Erda, Z. (2022). Bahan Organik Rumah Tangga sebagai Pendeteksi Formalin pada Makanan. *GALENICAL: Jurnal Kedokteran Dan Kesehatan Mahasiswa Malikussaleh*, *1*(4), 102–110.

Fan, L., Duan, Y., Huang, Z., Zhao, D., Zhao, L., He, W., Zhang, X., Li, M., Lin, Y., & Chen, Y. (2024). Storage stability and shelf-life of soymilk obtained via repeated boiling and filtering: A predictive model. *Food Science and Nutrition*, *12*(3), 1973–1982. https://doi.org/10.1002/fsn3.3893

Fitrianingsih. 2019. Penetapan Kadar Formalin Pada Tahu Di Pasar X Dengan Metode Spektrofotometri Visible. *CERATA Jurnal Ilmu Farmasi* 10 (1): 10–17. https://doi.org/10.61902/cerata.v10i1.69

Hutami, R., Kurniawan, M. F., & Khoerunnisa, H. (2020). Analisis Kandungan Mikroba, Formalin, dan Timbal (Pb) Pada Tahu Sumedang Yang Dijual Di Daerah Macet Cicurug, Ciawi, Dan Cisarua Jawa Barat. *Jurnal Agroindustri Halal*, *6*(1), 87–96.

Kurniawidjaja, M., Lestari, F., Tejamaya, M., & Ramdhan, D. H. (2021). *Konsep Dasar Toksikologi Industri*. Fakultas Kesehatan Masyarakat Universitas Indonesia. www.fkm.ui.ac.id

Labstest. (2025). *Rapid Test Kit Formalin (Formaldehida)*. Labstest Indonesia.

Mawandari. (2024). Analisis Kandungan Formalin Dan Gambaran Higiene Sanitasi Pedagang Tahu Putih Yang Terdapat Di Pasar Anduonohu Kota Kendari. *Jurnal Kesehatan Lingkungan Univ Haluoleo*, *5*(3).

Novianty, & Yulianzah, R. (2023). Deteksi Formalin pada Tahu Menggunakan Ekstrak Antosianin dari Kulit Naga (Hylocereus polyrhizus). *Masker Medika*, *11*(1), 190–194. https://doi.org/10.52523/maskermedika.v11i1.535

Pratiwi, D., Wardaniati, I., & Dewi, A. P. (2019). Uji Selektifitas dan Sensitifitas Pereaksi untuk Deteksi Formalin pada Bahan Pangan. *Pharmaceutical Journal of Indonesia*, *16*, 1693–3591.

Putri, A. R., Awidarta, K., Ihsan, B. R. P., & Khaerunisa, I. (2024). Formaldehyde Content in Indonesian Food and the Analysis Method: A Review. *Journal of Food and Pharmaceutical Sciences*, *12*.

Formaldehyde Content in Indonesian Food and the Analysis Method: A Review. *Journal of Food and Pharmaceutical Sciences* 12:28–37. https://doi.org/10.22146/jfps.10060.

Salsabila, Ainun Nisa Zella. 2024. Analisis Kualitatif Dan Kuantitatif Kandungan Formalin Pada Tahu Di 5 Pasar Tradisonal Kabupaten Sleman." *Nautical : Jurnal Ilmiah Multidisiplin Indonesia* 3 (2): https://doi.org/10.55904/nautical.v3i2.1182.

Sari, A. N., Lestari, S. D. A., Ardiansyah, F., & Sabila, F. (2024). Identifikasi Kandungan Formalin pada Ikan Asin Menggunakan Filtrat Kulit Buah Naga (Hylocereus polyrhizus). *Ar-Raniry Chemistry Journal* , *6*(1), 45–50.

Sari, Adinda Novita, Rahmadani Rahmadani, and Nur Hidayah. 2021. Identifikasi Kadar Formalin Pada Tahu Mentah Yang Dijual Di Pasar Tradisional Kota Banjarmasin. *Journal Pharmaceutical Care and Sciences* 2 (1): 5–14. https://doi.org/10.33859/jpcs.v2i1.124.

Sari, Ayu Nirmala. 2022. Uji Kandungan Formalin Pada Tahu Putih Di Kota Banda Aceh Dan Kabupaten Aceh Besar. *AMINA* 4 (1): 1–6. https://doi.org/10.22373/amina.v4i1.2466.

Sulistyorini, E., Kirana Nugrahayu Lizansari, & Kholilah Febriyanti. (2022). The Role of Anthocyanin Substances from Dragon Fruit Skin Extract in Formalin Content Testing in White Tofu. *SEAS (Sustainable Environment Agricultural Science)*, *6*(1), 10–15. https://doi.org/10.22225/seas.6.1.4757.10-15

Syahfitri. 2020. Characterization of Micronutrients in Tofu from Several Cities in Java Island Indonesia. *Journal of Nutritional Science and Vitaminology* 66:S262–66. https://doi.org/10.3177/jnsv.66.S262.

Widjajaseputra, A. I., Widyastuti, T. E. W., Suprijono, M. M., & Trisnawati, D. C. Y. (2020). Peran Jenis dan Konsentrasi Koagulan pada Karakteristik Tahu dan Tingkat Penerimaan Konsumen. *Jurnal Teknologi Pangan Dan Gizi*, *19*(2), 114–122.

World Health Organization. (2019). *Formaldehyde Health and Safety Guide*.

Yang, X., Wang, Y., Hao, M., & Li, L. (2020). Synergistic effect of the lactic acid bacteria and salt coagulant in improvement of quality characteristics and storage stability of tofu. *Journal of Oleo Science*, *69*(11), 1455–1465. https://doi.org/10.5650/jos.ess20102.

Yulianti, C. H. (2021). Perbandingan Uji Deteksi Formalin pada Makanan Menggunakan Pereaksi Antilin dan Rapid Tes Kit Formalin (Labstest). *Journal of Pharmacy and Science*, *6*(1).