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DETERMINATION OF BORAX CONTENT IN VARIOUS FOOD MATERIALS CIRCULATING IN AMBON CITY

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Abstract

Food safety is a critical issue for public health, especially in developing countries like Indonesia, where the use of unauthorized food additives still occurs frequently. This study aims to analyze the presence of borax, or sodium tetraborate, in food circulating in Ambon City. The methods employed include qualitative analysis using turmeric paper and quantitative analysis through UV-Vis spectrophotometry. Out of 10 samples tested, 4 samples (40%) were positively detected to contain borax in the qualitative test. Quantitative analysis revealed borax concentrations ranging from 2.461 to 3.051 ppm, with the following details: Wayame Market Noodles (2.858 ppm), OM Supermarket Noodles (2.641 ppm), OM Supermarket Meatballs (2.935 ppm), and Mardika Market Meatballs (3.051 ppm). These findings indicate a serious health risk due to the consumption of borax-containing foods, which can lead to various health issues in both the short and long term.

Keywords: Borax, Food Materials, Turmeric Test, UV-Vis Spectrophotometry

Abstrak

Isu pangan adalah hal yang sangat penting bagi kesehatan masyarakat, terutama di negara berkembang seperti Indonesia, di mana penggunaan bahan tambahan pangan yang tidak diizinkan masih sering terjadi. Penelitian ini bertujuan untuk menganalisis keberadaan boraks, atau sodium tetraborat, dalam makanan yang beredar di kota Ambon. Metode yang digunakan mencakup analisis kualitatif dengan kertas turmerik dan analisis kuantitatif melalui spektrofotometri UV-Vis. Dari 10 sampel yang diuji, 4 sampel (40%) terdeteksi positif mengandung boraks dalam uji kualitatif. Analisis kuantitatif menunjukkan konsentrasi boraks berkisar antara 2,461 hingga 3,051 ppm, dengan rincian sebagai berikut: Mie Pasar Wayame (2,858 ppm), Mie Swalayan OM (2,641 ppm), Bakso Swalayan OM (2,935 ppm), dan Pentolan Pasar Mardika (3,051 ppm). Temuan ini mengindikasikan adanya risiko kesehatan yang serius akibat konsumsi makanan yang mengandung boraks, yang dapat menyebabkan berbagai masalah kesehatan dalam jangka pendek maupun panjang.

Kata Kunci: Boraks, Bahan Makanan, Uji Tumerik, Spektrofotometri UV-Vis

1. Introduction

Food safety is a crucial aspect of public health, especially in developing countries like Indonesia, where the practice of using unauthorized food additives is still frequently encountered. One substance that is often misused in food is borax, or sodium tetraborate, which is commonly used in non-food industries as a wood preservative, detergent, and in glass manufacturing (Harjadi, 2006). In food products, borax is often added to provide a chewier texture or longer shelf life, particularly in processed products such as meatballs, noodles, rice cakes, tofu, and various street foods. This practice is certainly advantageous for traders, as it makes products appear more appealing and extends their shelf life. However, the risks posed by the consumption of borax in food are very high and can have long-term health impacts (Irianto & Susanti, 2014).

Research by Nugraha (2019) states that prolonged consumption of borax can lead to various serious health disorders, including liver and kidney damage, nervous system issues, and an increased risk of cancer. Additionally, the toxic effects of borax can cause irritation to the digestive

tract, reproductive system disturbances, and hormonal disruptions, which are particularly dangerous for children and adolescents who are more vulnerable to toxic substances. Unfortunately, borax is difficult for consumers to detect directly, and public ignorance is often exploited by irresponsible traders.

This situation is exacerbated by the lack of consistent monitoring of food products in traditional markets. The Food and Drug Monitoring Agency (BPOM) periodically conducts inspections and finds food products containing borax; however, with the high volume of products and food distribution in Indonesia, existing monitoring is often insufficient to cover all areas. In Ambon City, for example, borax-containing food products are still found in traditional markets and supermarkets despite existing bans and socialization regarding the dangers of borax (BPOM, 2019). This indicates the need for further research to determine the extent of borax usage in food materials in Ambon City.

Efficient and rapid detection methods for borax are essential in this monitoring effort. One practical method that can be applied in the field is the turmeric test, where borax can be detected by a color change on turmeric paper that has been soaked in food samples. This method is considered quite effective for qualitative detection of borax and can be performed without complex laboratory equipment (Maryati & Fardiana, 2017). Furthermore, further analysis can be conducted using UV-Vis spectrophotometry, which can provide quantitative results with high accuracy, assisting in determining the concentration of borax that may be present in samples (Rahman & Santoso, 2015; Winarti & Sari, 2016).

This study is expected to provide an overview of the presence of borax in various types of food in Ambon City, both in traditional markets and supermarkets. The findings of this research can provide direct benefits to the community and the government. For the community, the results of this study can raise awareness of the importance of food safety and health risks associated with consuming borax-containing foods. Meanwhile, for the government, this research is expected to serve as a reference for tightening monitoring and regulations regarding food products circulating in the market. Thus, this research not only contributes academically but also has practical impacts that can support efforts to improve public health quality and food safety in Ambon City and its surrounding areas.

2. Methodology

2.1. Materials

Materials and Equipment
Turmeric paper, test tubes, pipettes, graduated cylinders, beaker glass, mortar and pestle, water bath, UV-Vis spectrophotometer, cuvettes, micropipettes, and analytical balance. The materials used consist of samples of noodles, meatballs, and meatball fillers, sulfuric acid, hydrochloric acid, sodium borate, turmeric solution, and distilled water.

2.2. Methods

Sample Preparation
Food samples, such as meatballs, noodles, and meatball fillers, were collected from several traditional markets and supermarkets in Ambon City. The sample selection was conducted randomly, considering the variation in types and sources of food. The samples of noodles, meatballs, and fillers were ground and extracted using hot water to dissolve any borax that may be present. The filtrate from the extraction was then filtered and analyzed using a UV-Vis spectrophotometer.

Qualitative Test Using Turmeric Test
The prepared samples were tested using the turmeric paper method to qualitatively detect the presence of borax. Turmeric paper was dipped into the sample solution, and any color change on the paper was observed as an initial indicator of borax presence.

Quantitative Test Using UV-Vis Spectrophotometry
Preparation of Borax Standard Solution:
A stock solution of borax (1000 ppm) was prepared by dissolving a specific amount of sodium tetraborate in distilled water. Dilutions were then made with varying concentrations of 0.5 ppm,

1 ppm, 2 ppm, 5 ppm, and 10 ppm. The absorbance spectrum of the standard solutions was measured over a wavelength range of 230 nm. A calibration curve was created by plotting absorbance against borax concentration. From the calibration curve, a regression equation was obtained, which will be used to calculate the concentration of the samples.

Measurement with UV-Vis Spectrophotometry
Measurements were conducted at a wavelength of 230 nm. The absorbance of each sample was recorded and compared with the calibration curve to calculate the concentration of borax in the samples.

Data Analysis
Data from the qualitative and quantitative tests were analyzed to determine the percentage of samples containing borax and its concentration in each type of food. These results were then compared with food safety standards to assess the risk level of borax consumption.

3. Result and Discussion

3.1 Qualitative Analysis Using Turmeric Test

The borax content in food items such as noodles, meatballs, and meatball fillers around Ambon City was analyzed to ensure food safety and compliance with health regulations. The samples were analyzed using the qualitative turmeric paper method. This method was chosen for its simplicity, low cost, and ability to provide rapid results through significant color changes.

Tabel 1. Results of Analysis Using Turmeric Paper

No	Sample	Test Result	Conclusion
1	Wayame Market Noodles	Brick Red	Positive
2	OM Supermarket Noodles	Reddish Orange	Positive
3	Port Front Meatballs	Yellow	Negative
4	OM Supermarket Meatballs	Brick Red	Positive
5	Batu Merah Meatballs	Yellow	Negative
6	Mardika Market Meatballs	Yellow	Negative
7	Mardika Market Fillers	Brick Red	Positive
8	Depok 5 Fillers	Yellow	Negative
9	Cokro Market Fillers	Yellow	Negative
10	Gunung Malintang Fillers	Yellow	Negative

The test results indicate that out of a total of 10 samples tested, 4 samples (40%) showed positive results for borax, as evidenced by the color change of the turmeric paper to brick red and reddish orange. These samples included two noodle samples (Wayame Market Noodles and OM Supermarket Noodles), one meatball sample (OM Supermarket Meatballs), and one meatball filler sample (Mardika Market Fillers). Meanwhile, the remaining six samples (60%) showed negative results for borax, indicated by the turmeric paper remaining yellow.

Turmeric paper is made by soaking filter paper in a solution of turmeric extract or curcumin, and then drying it in open air. This paper can be used for qualitative analysis of borax because the curcumin in turmeric reacts with boron ions from borax to form a red-colored complex compound known as rosocyanin. When turmeric paper comes into contact with a sample containing borax, the color change from yellow to red indicates the presence of borax, making it a simple and effective tool for detection.

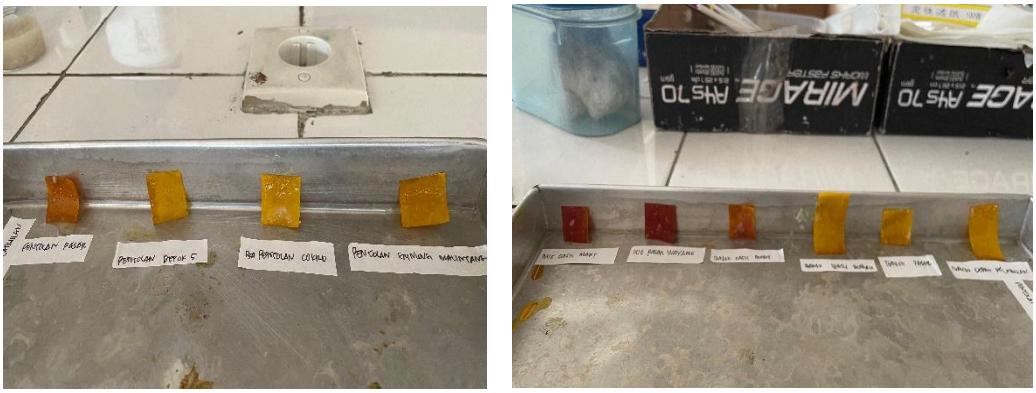

Figure 1. Results of Borax Test Using Turmeric Paper

The testing method using turmeric paper has proven effective in qualitatively detecting the presence of borax. The color change from yellow to reddish orange and then to brick red is a clear indication of borax presence. However, this method has limitations, as it cannot provide quantitative information regarding the borax concentration in the samples. Therefore, for more accurate and detailed results, further analysis using quantitative methods such as spectrophotometry is required.

3.2 Quantitative Analysis Using UV-Vis Spectrophotometry

The determination of borax concentration in samples of noodles, meatballs, and meatball fillers circulating in Ambon City was conducted using the UV-Vis spectrophotometry method. Absorbance measurements were performed at a wavelength of 230 nm. Before measuring the samples, a calibration curve was created by measuring the absorbance of standard borax solutions. The calibration curve yielded the regression equation $y = 0.078x + 0.008$ with an R^2 value of 0.998.

The absorbance measurement results of the food samples were compared with the calibration curve to determine the borax concentration. The data from the measurements are presented in Table 2 below.

Table 2. Results of Quantitative Analysis Using UV-Vis Spectrophotometry

No	Sample	Absorbance	concentration (ppm)
1	Wayame Market Noodles	0,215	2,858
2	OM Supermarket Noodles	0,198	2,641
3	Port Front Meatballs	0,006	Not Detected
4	OM Supermarket Meatballs	0,221	2,935
5	Batu Merah Meatballs	0,007	Not Detected
6	Mardika Market Meatballs	0,006	Not Detected
7	Mardika Market Fillers	0,230	3,051
8	Depok 5 Fillers	0,007	Not Detected
9	Cokro Market Fillers	0,008	Not Detected
10	Gunung Malintang Fillers	0,005	Not Detected

Quantitative analysis using UV-Vis spectrophotometry revealed that there are 4 food items in Ambon City that contain borax, specifically in noodles, meatballs, and meatball fillers obtained from Wayame Market, OM Supermarket, and Mardika Market. The detected borax concentrations ranged from 2.461 to 3.051 ppm. Meanwhile, 6 other food items were not detected to contain borax.

From a toxicological perspective, the presence of borax in food is very dangerous. Borax is known to cause health disturbances, including gastrointestinal irritation, kidney damage, and chronic toxic effects such as reproductive and nervous system disorders if consumed continuously over the long term. According to information from BPOM, the use of borax as a preservative in food is

prohibited. Although there is a legal limit set for borax in food at 1 g/kg, the maximum allowable concentration of borax in the body is 7 µg/mL. In cases of poisoning, borax concentrations can reach between 20-150 µg/mL, while death can occur at concentrations between 200-15,000 µg/mL. Therefore, the four tested samples do not meet food quality standards and exceed the safe limit for borax usage (Rahma, D. A., Sari, E. M., & Nurfajriah, S., 2023)

4. Conclusion

The research results regarding the borax content in food in Ambon city showed that out of 10 tested samples, 4 samples (40%) were positively detected to contain borax through the qualitative turmeric paper method, with significant color changes. Quantitative testing using UV-Vis spectrophotometry confirmed these findings, where 4 samples also showed borax concentrations ranging from 2.461 to 3.051 ppm. Meanwhile, the other 6 samples were not detected to contain borax. These findings emphasize the serious health risks associated with the consumption of food containing borax, which can lead to various health disorders. Therefore, it is important to enhance monitoring and educate the public about the dangers of using borax in food.

References

Harjadi, P. (2006). Keamanan Pangan dan Bahaya Bahan Tambahan Pangan. Jakarta: Penerbit Buku Kompas.

Irianto, S., & Susanti, D. (2014). Dampak Konsumsi Boraks Terhadap Kesehatan. Jurnal Kesehatan Masyarakat, 9(1), 12-20.

Nugraha, S. (2019). Pengaruh Boraks Terhadap Kesehatan: Tinjauan Literatur. Jurnal Kesehatan Lingkungan, 15(2), 100-110.

Badan Pengawas Obat dan Makanan (BPOM). (2019). Laporan Pengawasan Pangan: Temuan Boraks di Produk Makanan. Jakarta: BPOM.

Maryati, S., & Fardiana, Y. (2017). Deteksi Boraks Dalam Makanan Menggunakan Uji Kertas Kunyit. Jurnal Kimia dan Pendidikan, 2(1), 45-52.

Rahman, A., & Santoso, H. (2015). Metode Spektrofotometri UV-Vis untuk Analisis Boraks Dalam Makanan. Jurnal Sains dan Teknologi, 14(3), 201-207.

Winarti, E., & Sari, R. (2016). Analisis Kuantitatif Boraks Dalam Makanan Menggunakan Metode Spektrofotometri. Jurnal Analisis Kimia, 10(2), 120-128.

Yulianti, A., & Nugroho, A. (2018). Pentingnya Pengawasan Pangan untuk Meningkatkan Kualitas Kesehatan Masyarakat. Jurnal Pangan dan Gizi, 6(1), 85-92.

Peraturan Menteri Kesehatan Republik Indonesia. (2012). *Peraturan Menteri Kesehatan Republik Indonesia Nomor 33 Tahun 2012 tentang bahan tambahan makanan.*

Rahma, D. A., Sari, E. M., & Nurfajriah, S. (2023). Identifikasi kandungan boraks pada bakso yang beredar di pasar tradisional Kecamatan Tambun Selatan. Jurnal Riset Ekonomi dan Bisnis, 5(1), 59-66.