QUALITATIVE IDENTIFICATION OF BORAX CONTENT IN MEATBALL SNACKS USING TURMERIC PAPER AND SHALLOT EXTRACT

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ABSTRACT

Borax as a food additive chemical is very dangerous. Borax is prohibited from being used in food because it can cause various diseases such as cancer, kidney damage, and even death. This study aims to identify the borax content in the meatballs sold in Meulaboh City. The study design uses purposive sampling with a total of 20 meatball samples from each seller collected and continued by a qualitative test using turmeric paper and shallot extract. The study results show that all samples tested were free of borax. This can be seen from the absence of changes in turmeric paper and shallot extract. Therefore, it can be concluded that the meatballs sold in Meulaboh do not contain borax and are safe to consume.

Keywords: Meatball, Borax, Qualitative test, Turmeric

INTRODUCTION

Meatball is known as type of heavy snack which often sold on the side of the road and very popular in all levels of society. Bakso or meatball is a processed meat that commonly found in Indonesian dishes. It is generally made from a mixture of ground beef or other livestock with tapioca flour. Meatball is usually served with soup and other complementary foods such as vermicelli, tofu, rice cake, fried foods, etc. Previous research has established that, the best beef meatball is obtained when the composition of the meatball consists of 29% tapioca flour, 3% porang flour with the addition of 6% salt. Based on the composition, the meatball has 72.2% water content, 2.21% ash content, 7.53% starch content, 6.85% fat content, 413.61 Kcal/g calories, 1.21% crude fiber content, 0.99% oxalate content, and 2.86% glucomannan content (Sari and Widjanarko, 2015).

Meatball is one of the processed foods that often use Food Additives Ingredients (FAI). FAI is a mixture that is added to food in the manufacture, processing, preparation, treatment, packing, packaging, storage, or transportation of food to produce (directly or indirectly) the nature or form of the food according to what is expected (Muharrami, 2015). Additional food additives are generally not used as food; may or may not have a nutritional value which is intentionally added to food to circumvent the preparation, packing, treatment, and storage. Some additional food additives that are prohibited from being used in food are regulated in the regulation of Minister of Health of RI No. 772/Menkes/Per/IX/88, including borax, formalin, brominated vegetable oils, chloramphenicol, potassium chlorate, diethylpyrocarbonate, nitrofurazone, P-Phenethylcarbide, salicylic acid, and all its salts (Cahyadi in Yulianto, 2013).

Borax or Na$_2$B$_4$O$_{10}$·10H$_2$O is a borate compound that is very easy to find. Borate Compounds are the result of combining the boron elements and oxygen. Borax is commonly found in the form of a white crystalline powder and is colorless and very soluble in water. Borax is B3 (Bahan Beracun dan Berbahaya or Toxic and Hazardous Materials) because it can cause toxic effects, but the mechanism is different from formalin. This is because when borax enters the human body, borax will be stored cumulatively in organs such as the brain,
intestines, testes, or liver. Therefore, continuous consumption of borax can cause cancer (Muharrami, 2015).

Borax is a white crystalline compound that is odorless and stable at room temperature. Borax is a chemical compound called sodium tetraborate. If it dissolves in water, it will become hydroxide and borax acid (H$_3$BO$_3$). Borax or borax acid is usually used for making detergents and antiseptics. Consumption of foods containing borax is not directly harmful, but the borax will be absorbed cumulatively in the consumer's body (Tubagus, Citraningtyas, and Fatimawali, 2013). The use of borax for a long time and in large quantities can cause cancer. However, food manufacturers still often violate regulations.

Increasing the dose of borax can result in edema, cell inflammation, neovascularization, and very high doses which result in sudden death (Kabu, Tosun, Elitok, and Akosman, 2015). The danger of borax to health has a negative impact because it has a toxic effect that can harm the metabolic system of human health such as irritation of the respiratory tract, skin, eyes, and target organs such as blood, kidneys, heart, respiratory system, central nervous system, liver, lymph, digestive system, eyes, reproductive system, and skin (Aseptianova, Afriansyah, and Astriani, 2017). However, some sellers are still stubborn about adding borax with the excuse of making a profit. This attitude is shown mostly by the meatball sellers who only have low education so that their level of knowledge about the dangers of borax is still doubtful or insufficient (Erniati, 2017).

According to Hermana (1991), chemical preservation is a simpler and cheaper technique. Using this method is more beneficial for areas that provide adequate storage facilities. The use of FAI can extend food shelf life (Tomaska and Brooke-Taylor, 2014). The rules for the use of FAI have been stated in the Regulation of the Minister of Health of the Republic of Indonesia No. 1168/Menkes/per/X/1999, which allows the use of FAI that does not pose a health risk and prohibits dangerous FAI such as borax (Sugiyatmi in Aseptianova et al., 2017) and expired ingredients.

The use of borax is caused by several factors, including the lack of knowledge of producers about the dangers of using borax in food and the aim to obtain a lot of profit. Studies on the borax content in meatballs have been carried out in various cities, such as a study by Suseno (2019) which reports that the study on meatballs in Medan City found 8 out of 10 meatball samples analyzed positively containing borax. Nurkholidah, Ilza, and Jose (2012) state that out of 17 sellers of meatball sticks sold in Elementary Schools in Bangkinang District, it is revealed that almost all sellers use borax in the meatball stick products with the highest content of 2.32 mg/g sample.

Meulaboh is a city for people in the West Aceh Regency. In Meulaboh, there are about 20 stalls that provide meatballs, both fried and boiled with noodles. However, no researchers have tested the borax content in meatballs in Meulaboh so far. Therefore, it is necessary to conduct studies on the use of borax in meatballs. This study is a study grant recipient from Ristekdikti on the Penelitian Dosen Pemula (PDP) scheme. This study aims to qualitatively identify the borax content in meatballs using turmeric paper and shallot extract. There are several types of indicators used to detect borax, namely artificial indicators and natural indicators. Natural indicators have the advantage of being more friendly to use and easier to obtain, so that it can be used by the public in general. Types of natural indicators that have been often used in borax analysis include extracts of telang flowers, purple yams, turmeric and shallots (Yuliantini and Winasih, 2019; Rochyani, 2018; Muharrami L K 2015).

**METHODOLOGY**

**Materials**

The materials used in this study were meatballs as study samples, turmeric, and filter paper for preparing turmeric paper, shallots, distilled water, and borax to make a test standard for borax-positive meatballs.
Equipment
The tools used in this study are beakers, measuring flask, dropper, spatula, petri dish, scissors, digital scales, mortar and pestle, charter knife, funnel, blender, and test tube.

Experimental Design
Early study is carried out at the Integrated Laboratory of Teuku Umar University. The sample collection technique is carried out directly by the researchers by paying attention to certain characteristics that can represent the population. A sampling of meatballs is carried out by purposive sampling, i.e. samples are taken deliberately by the researchers following the required sample requirements. 20 Samples were selected from population of all meatball sellers; both served in the form of boiled meatballs and grilled meatballs.

Research Stage
The study stage was started by recording the number of meatball sellers and the types of meatballs sold in the Meulaboh City. After knowing the number of sellers, the next stage was taking meatball samples from each trader. The meatball samples that had been collected were then taken to the integrated MIPA laboratory of UTU and labeled with the name of each meatball. Before conducting the test, the researchers first prepared a test kit, i.e. turmeric paper and shallot extract. Before testing for each sample, testing for borax-positive meatballs that are self-made was carried out. The last stage was the testing for all meatball samples. Borax testing in meatball samples was carried out qualitatively using turmeric paper and shallot extract.

Methods
- Making turmeric paper
  
  Half a kilogram of turmeric was ground using a blender, then it is filtered and the extract obtained is separated. Filter paper is cut into the size of 2x4 cm as many as the sample to be tested. The cut filter paper is then dipped in turmeric extract and then it is aerated to dry. Turmeric paper is ready to use.

- Preparing shallot extract
  
  A total of 300 grams of peeled shallot is washed and added with 50 ml of distilled water, and then it is blended until smooth. The refined shallots are then filtered using a funnel lined with filter paper, left until the shallot extract is filtered out.

- Preparing borax standard solution
  
  The standard solution was made with various concentrations, namely 5 ppm, 10 ppm, 15 ppm, 20 ppm, and 25 ppm.

Procedures of Analysis
The first step was to test the test equipment, namely turmeric paper, using borax standard solutions. 5 sheets of turmeric paper are dipped in each of the standard solutions, namely 5 ppm, 10 ppm, 15 ppm, 20 ppm, and 25 ppm and they are observed. Next, 2 sheets of turmeric paper were given by 1 gram of borax-positive meatballs and borax-negative meatball samples for each, then the change in the color of the turmeric paper was observed.

  Testing using shallot extract, i.e. 3 ml of shallot extract was piped into 7 test tubes, then 1 ml of borax standard solutions of 5 ppm, 10 ppm, 15 ppm, 20 ppm, and 25 ppm respectively are piped into each tube of 1, 2, 3, 4, 5, and then observed. The sixth tube is added with 1 gram of borax-positive meatballs and the seventh tube was added with borax-negative meatballs, then they are observed.

  After observing the measuring instrument test with standard solution and control samples, the next stage is conducting tests on each sample. The turmeric paper test was carried out by placing 1 gram of the meatball sample on the turmeric paper, leaving it for 1-2 minutes, and observing it. The test uses shallot extract, i.e. 3 ml of shallot extract was added into a test tube and added with 2 grams of meatball sample, and left for 1-2 minutes and a change in the color of the shallot extract is observed.
RESULTS AND DISCUSSION

1. Standard Solution

Figure 1. Standard Turmeric Solution Test; a. 5ppm, b. 10 ppm, c. 15ppm, d. 20ppm, e. 25ppm

Standard solution testing is carried out to determine the approximate limit of borax construction that could be detected by the test equipment, i.e. turmeric paper and shallot extract. From the results of the turmeric paper test in Figure 1, it can be seen that the change in turmeric paper at the 5 ppm concentration is still low, meaning that the reddish-brown color has not been seen as well as the 10 ppm concentration which is also slightly brown. However, when immersed in 15 ppm borax solution, the color change in turmeric paper becomes very deep reddish-brown, when the 20 ppm and 25 ppm concentrations are very visible reddish-brown color. This means that turmeric paper can detect the presence of borax in samples that have a borax concentration above 15 ppm.

Figure 2. Standard Solution Test of Shallot Extract; a.5 ppm, b.10 ppm, c.15 ppm, d.20 ppm, e.25 ppm

A similar testing is conducted using the shallot extract, at 5ppm and 10 ppm concentrations have not shown a greenish-yellow change. However, at a 15 ppm concentration, the color of the shallot extract changes to a slightly yellow color, although it is
not too clear. However, 20 ppm concentration has a very clear color change. This shows that the sensitivity of shallot extract to borax content occurs at concentrations above 15ppm as can be seen in Figure 2.

2. Control Sample Qualitative Test

![Figure 3. Turmeric Paper Control. A) Borax- Negative, B) Borax- Positive](image)

The test results on the control sample show that the sample added with borax has the changed color, that is, when the turmeric paper is given with a borax-positive sample, the color changes to brownish red. The borax content in the control sample changes the yellow color of the turmeric on turmeric paper to brownish red. The color change occurs when curcumin compounds are acidic and will change to brownish red in alkaline conditions. Borax is an alkaline compound so that when it reacts with curcumin, it will form a boro-curcumin complex compounds (Muharrami, 2015). The boro curcumin compound will form a brownish-red color. The reaction that occurs is

\[
\text{Na}_2\text{B}_4\text{O}_7 + \text{C}_{21}\text{H}_{20}\text{O}_6 \rightarrow \text{B}[\text{C}_{21}\text{H}_{20}\text{O}_6]_2\text{Cl}
\]

Borax + curcumin result in Rosocyanine

![Figure 4. Shallot Extract Control. A) Borax-Negative Control, b) Borax-Positive Control](image)

Figure 4 shows that when the shallot extract is added with borax-positive meatballs, which are alkaline, the color changes to greenish-yellow. This is because shallot contains anthocyanin compounds in a faded pink color which can have the color changed when...
added with alkalis, to a slightly bluish yellow color and if left for a long time, it will turn yellow (Virliantari, Maharani, Lestari, and Ismiyati, 2018).

![Anthocyanin Structures](image)

**Figure 5. Anthocyanin Structures**
Source: Priska et al, 2018

Boraks has a pH of 9-11 and it is categorized as alkaline. One that affects the color of anthocyanins is the level of acidity (pH) of the environment. In which when the anthocyanin has a pH of 8-12, it will be turquoise and yellow if the pH is 13 (Rochyani, 2018).

3. **Qualitative Test of Meatball Samples Using Turmeric Paper and Shallot Extract**

Turmeric paper is made from filter paper dipped in turmeric extract. If the borax sample contains borax, the filter paper will be reddish-brown. This red color is produced from the color of the complex compounds between the curcumin compounds in turmeric and the boron compounds in borax (Halim in Suseno, 2019). Study on the borax content in crackers can also be detected using turmeric paper and then analyzed using a UV-Vis spectrometer, and 11.8 ppm of borax contrast is found (Hartati, 2017).

Analysis of the meatball sample is carried out twice to ensure accuracy or confidence in the experiment. Of the two repetitions, the results are the same. The results of qualitative analysis by using turmeric paper and shallot extract can be seen in Table 1 which shows that all meatball samples collected from various meatball sellers do not contain borax. Sampling from 20 meatball sellers shows negative results. There is a concern that the addition of borax to spices or additives during the process of making meatballs, but after a qualitative test using two indicators i.e. turmeric paper and shallot extract, shows negative results. So it can be said that all meatballs sold by meatball sellers around Meulaboh city are free from the use of borax.

<table>
<thead>
<tr>
<th>No.</th>
<th>Sample Code</th>
<th>Remark</th>
<th>Test result</th>
</tr>
</thead>
<tbody>
<tr>
<td>1</td>
<td>K+</td>
<td>Positive control</td>
<td>Reddish-brown (+)</td>
</tr>
<tr>
<td>2</td>
<td>K-</td>
<td>Negative control</td>
<td>Yellow (-)</td>
</tr>
<tr>
<td>3</td>
<td>1</td>
<td>Mutiara bakso</td>
<td>Yellow (-)</td>
</tr>
<tr>
<td>4</td>
<td>2</td>
<td>Sarena bakso</td>
<td>Yellow (-)</td>
</tr>
<tr>
<td>5</td>
<td>3</td>
<td>Bakso gajah asahan</td>
<td>Yellow (-)</td>
</tr>
<tr>
<td>6</td>
<td>4</td>
<td>Bakso paklek</td>
<td>Yellow (-)</td>
</tr>
<tr>
<td>7</td>
<td>5</td>
<td>Pak agus</td>
<td>Yellow (-)</td>
</tr>
<tr>
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<td>6</td>
<td>Bakso asoe</td>
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</tr>
<tr>
<td>9</td>
<td>7</td>
<td>Bakso bakar jl manekro</td>
<td>Yellow (-)</td>
</tr>
</tbody>
</table>
CONCLUSIONS

The results of qualitative testing using turmeric paper and shallot extract show that as many as 20 meatball samples sold around Meulaboh city were absent of borax. This can be seen from the absence of color change on the two indicators or test equipment, i.e. using turmeric paper and shallot extract.

REFERENCES


