IJPPR
INTERNATIONAL JOURNAL OF PHARMACY & PHARMACEUTICAL RESEARCH
An official Publication of Human Journals
ISSN 2349-7203
HUMAN

Human Journals
Research Article
November 2019 Vol.:16, Issue:4

Determination of Borax in Meatballs by UV-Vis Spectrophotometry

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ISSN 2349-7203
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Submission: 25 October 2019
Accepted: 30 October 2019
Published: 30 November 2019

Keywords: Borax, meatballs, turmeric, UV-Vis spectrophotometry

ABSTRACT

Borax or sodium tetraborate ($Na_2B_4O_710H_2O$) is an ingredient that is prohibited for use as food additive in accordance with the regulation of the Indonesian Minister of Health. But until now there are still found as preservatives in processed foods such as meatballs. This study aimed to analyze the levels of borax in meatballs sold in the city of Banjar, West Java, Indonesia. Identification was carried out to determine the presence of borax content in meatball samples by the turmeric method and determination of borax levels by the UV-Vis spectrophotometry method. From the identification results, there are five positive meatballs containing borax samples with the levels of each sample are 1.7%, 1.8%, 0.34%, 2.5%, and 1.2%.

INTRODUCTION

The study of hazardous food additives is a major concern through regulations in various countries and regulated by the Joint FAO / WHO Expert Committee on Food Additives (JECFA). (1) Borax is a chemical compound that is still used as a prohibited food additive. Borax is known as sodium borate, sodium tetraborate or disodium teraborat ($Na_2B_4O_710H_2O$) is a form of salt from boric acid (H_3BO_3). Borax has antiseptic, antibacterial, antifungal, preservative, and as wetting agent in the manufacture of various types of boron silicate glass and lead crystals. (2) Borax in food can extend the shelf life but has harmful and disruptive effects on organs such as the stomach, kidneys, brain, genetic and carcinogenic disorders. Test results in experimental animals show the effects of testicular lession and infertility. (3) Indigestion that may occur due to exposure to borax which causes nausea, vomiting and diarrhea. Indonesia is a country that has concerns about the dangers of borax and prohibits the use of borax in food. (4) It is stated in Minister of Health regulation no.033 of 2012 that borax is an ingredient that is prohibited from being used as food additives. (5)

Food characterization as an effort to guarantee food quality from hazardous substances content both qualitatively and quantitatively can be done through UV-Vis spectrophotometry method. (6) Identification of borax content is carried out using turmeric paper or curcumin. (7) through the color reaction between borax and curcumin to form the rosocyanine complex, which is the complex formed between curcumin and boric acid with a central boron atom in the form of a tetrahedral with two curcumin anions. (8) Quantitative analysis using UV-Vis spectrophotometry using water, ethanol, methanol, glacial acetic acid and hexane. (9) Spectrophotometry consists of a spectrometer and photometer. The spectrometer produces light from a spectrum with a certain wavelength, while the photometer as a measure of the intensity of the light transmitted or absorbed. (10) The parameters obtained in the form of absorbance values obtained from the interaction between molecules and light. The absorbance value of the sample is measured at certain wavelengths in the near ultraviolet range (190-380 nm) and visible range (380-780 nm). (6) Other methods that can be used for borax analysis include the titrimetry (11) and HPLC (12) methods.

Identification of borax in food still needs to be done, because until now people still use it as a preservative in meatballs made as one of the household scale food preparations. It has been found that borax content in meatball samples sold around the Aisyiyah University campus is 3.82 ppm (13) and borax content in meatball samples sold in Medan city is 80% (14).

Meatballs are a popular food, especially in the city of Banjar. However, public concerns about the content of borax are important to study through research on the identification and analysis of borax levels.

MATERIALS AND METHODS

1. Materials:

Sodium tetraborate, Calcium oxide, 5N hydrochloric acid, 1% ethanolic solution of curcumin (or turmeric extract), Oxalic acid. The equipment used consists of laboratory glassware, analytical scales, water heaters, ovens, furnaces, Shimadzu UV-Vis spectrophotometer.

2. Methods

2.1 Sample preparation

The samples used in this study were meatballs which were sold in the Banjar city area as many as 14 samples.

2.2. Qualitative analysis of borax by the turmeric method

Qualitative analysis of borax based on the AOAC Official method 970.33. Each sample was mashed, then added calcium oxide and added distilled water, then carried out ashes at 550^{o}C for 1 hour. Cool and add 5N HCl to acidic pH. Add to porcelain, add 4 drops of oxalic acid solution and 1 ml of turmeric solution, then evaporate. The content of borax can be indicated by the presence of bright red and turns dark green when exposed to ammonia vapor. (15)

2.3 Preparation of 1000 ppm sodium tetraborate standard solution

Weighed the standard sodium tetraborate as much as 100 mg, then put in a 100 ml volumetric flask added distilled water until the mark lines were shaken until dissolved.3.3 Making a series of standard solutions sodium tetraborate standard series solution was made with a concentration of 10 ppm, 20 ppm, 30 ppm, 40 ppm, 50 ppm, and 60 ppm by taking from the mother liquor as much as 0.5 ml, 1 ml, 1.5 ml, 2 ml respectively 2.5 ml and 3 ml were then put into a 50 ml volumetric flask, 10 ml of 1% curcumin solution was added in ethanol. Add 5N HCl to acidic pH, and 10 ml of ethanol, heated at a temperature of 55-60^{o}C then added distilled water to the boundary line and measured its absorbance, at a wavelength of 500-600nm.

2.4 standard linear curves

absorbance values of standard series solutions using UV-Vis spectrophotometry and then plotted to make equations based on the Lambert-Beer formula which states the linear relationship between the concentration of standard solutions with absorbance values, where the concentration of solution as a function of x and the value of absorbance as a function of y, in order to obtain an equation:

$$y = bx + a$$

Information:

a = regression constant (intercept)

b = Regression coefficient (slope)

c = absorbance value (readable)

x = concentration

2.5 Determination of borax levels in the sample

Weighed two grams of each sample then mashed, added calcium oxide and 5 ml of distilled water, then filtered and taken the filtrate, put into a 50 ml volumetric flask. HCl 5N was added to acidic pH, 4 drops of oxalic acid solution and 10 ml of 1% turmeric solution, and heated at a temperature of 55ºC – 60ºC, then added ethanol to the mark limit. The absorption is measured in UV-Vis spectrophotometry, and the levels are calculated using a standard linear curve equation.

RESULTS AND DISCUSSION

Turmeric test for the identification of borax in meatballs samples From the qualitative test results with the turmeric method obtained 5 samples of meatballs containing borax are marked by the red color on turmeric paper and after being subjected to ammonia vapor the color changes to dark green. The color that arises is due to the complex reaction between curcumin and boron atoms in meatball samples. Giving ammonia vapor aims to strengthen the colors that arise. Positive meatball samples through a qualitative reaction with the turmeric method then determined the levels of borax with visible spectrophotometry at a

wavelength of 540 nm. In determining the operating time at minute 40 after the constant absorbance value is obtained. Sample preparation is done by weighing 2 grams each, after smoothing and taking the filtrate added with calcium oxide. Addition of 5N HCl to obtain samples at acidic pH. The addition of 1% turmeric solution aims to obtain a red rosocyanin complex solution obtained from the reaction between borax and curcumin, so it can be analyzed by UV-Vis spectrophotometry at a wavelength of 540 nm. Borax content is calculated by entering the absorbance value of the measurement results into the standard linear curve equation, with the graph below:

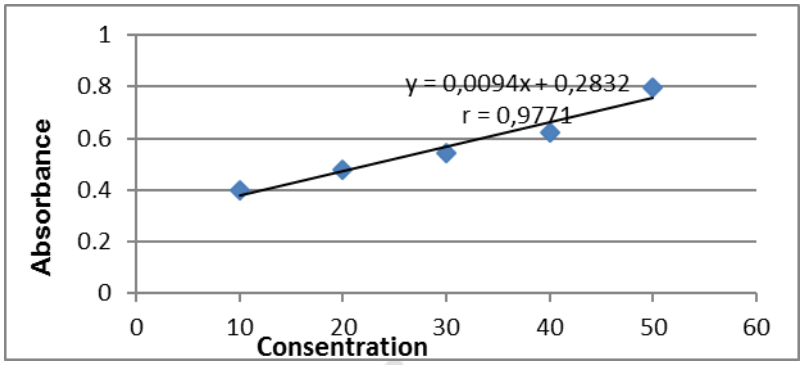

Figure No. 1: Standard Linear curve

Borax levels obtained from five samples were 1.7%, 1.8%, 0.34%, 2.5% and 1.2%, respectively. The presence of borax content in meatballs sold in the city of Banjar shows that there is still misuse of hazardous food additives, this can be caused by lack of awareness or lack of knowledge, especially producers who use borak as a preservative in meatball products. Borax as a food additive that is prohibited according to Permenkes No. 033 of 2012, can be harmful to the body if consumed even in small amounts, but in the long run, it will accumulate and cause physical damage and have an effect on nervous system disorders.

CONCLUSION

From the results of this study it can be concluded that there is a borax content in meatballs as many as 5 samples out of 14 samples that were analyzed qualitatively by the turmeric method and quantitatively by spectrophotometry-Vis obtained levels of each were 1.7%, 1.8%, 0, 34%, 2.5% and 1.2%. With the discovery of borax content in meatball samples sold in the city of Bajar, it is necessary to be careful of consumers in choosing safe foods and there is an effort from the local government to supervise the use of hazardous food additives.

ACKNOWLEDGMENT

Authors would like to thanks to STIKes Muhammadiyah Ciamis and the D-III Pharmacy Lecturer in STIKes Muhammadiyah Ciamis for their help and facilities in research and writing this article.

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