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Determination of Iron (Fe) Species in Samples of Canned Packaging Beef

Septi Dwi Haryanti*, Hannuna Dzawinnuha*, Vanadia Adika*
Department of Chemistry Education, Universitas Negeri Yogyakarta

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Corresponding Author:

Septi Dwi Haryanti,
Dep. of Chemistry Education
Universitas Negeri Yogyakarta

Email:
haryantiseptidwi@gmail.com

ABSTRACT

The research aims to know the content of iron metal (Fe) in samples of canned packaging beef. The destruction of the samples prior to breaking the metallic bond with organic compounds in the sample, making them easier to identify the metal content to be analyzed. The analysis of metal content of iron has been done by using Atomic Absorption Specthrophotometer. The level of iron metal contained in beef samples of A brand packaging is 40.0570 mg/kg, in B brand packaging is 25.5175 mg / Kg and in the C brand packaging 22.9600 mg/Kg. When compared to the iron metal threshold in food as contained in SNI 01-7387-2009, then the sample of beef packaging for B and C brand is still safe because the iron content is still below 30 mg/kg. Meanwhile, the beef corned for A brand is not safe because it is higher than 30 mg/kg.

Keyword: *Canned packaging beef, Iron metal*

1. INTRODUCTION

In modern era which goes hand in hand with the rapid development of technology, the emergence of fastfood becomes an element which always gives satisfaction in humans' daily needs of food. One of the examples of that is canned food. Canned food becomes one of the most popular fastfood which is selected frequently by the customers because of its characteristics which are practical and easy to obtain. Canned food is also reliable in terms of its practicality and its freshness than organic food. It is packed in particular way to lengthen its expired date. The packaging in a can uses a metal can which is made of steel and covered and mixed by tin and other kinds of metal. Because of that, there is a probability that canned food can contain and absorb any metal element from its package such as tin (Sn), zinc (Zn), and iron (Fe) from tin sheet, also tin (Sn) and lead (Pb) from patrian (Korfali and Hamdan, 2013).

One example of food which is packed and corned in a form of a can is called corned beef. Kinds of food which is packed in a form of a can will usually loss its freshness and will gain the decreasing amount of nutrition as the result of high temperature cooking (Mahalakshmi et.al., 2012). Furthermore, another thing which will happen in high temperature cooking is the appearance of additional taste such as the taste of tain or similar to the taste of an iron as the result of the lack of coating process of a can (Forrest et. al., 1992).

Contamination of metal will probably occur in the process of packaging and several conditions of marketing (Barone, et al., 2015). The direct contact of food material with its can in packaging process will cause the metal element mixed into the food. The changing of pH into acid on packaging process will accelerate corrosion of coating part of a can.

The damaged of canned food particularly caused by the interaction of metal element of coating part of a can which are Sn and Fe, are undesirable changing such as color changing, off-flavour, Nutrition loss, and the formation of corrosive part of a can. The metal element of the coating part (Sn and Fe) is categorized into heavy metal. Any kind of food product which is contaminated by heavy metal element will cause poison (Mahurpawar, 2015).

Considering the worst probability of the poisonous element which occurs in packaging process of canned food, a study was conducted in order to examine the substance of heavy metal iron (Fe) element in a corned beef. In this study, the writer chose a corned beef branded A, B and C which is well-available in market place.

2. RESEARCH METHOD

2.1. Research Design

The research design is experimental research. The subject of this research is A, B, and C brand canned beef distributed in Supermarkets in Yogyakarta City. The object of this study is the level of iron metal in beef canned packaging in the brand.

The tools needed are Atomic Absorption Spectrophotometer AA 220, analytical balance, watch glass, glassware, electrothermal electric coat, oven, crushed and mortar, Wattman paper no 42. The materials needed are samples of canned beef packaging of A, B, and C brands, HNO_3 65% p.a, H_2SO_4 60% p.a, $FeSO_4$ p.a, H_2O_2, and aquadest.

2.2. Research Procedure

2.2.1 Sample Preparation

Beef canned baked at temperature 110^0C first until constant dry weight obtained. The beef fluid contained in the sample was filtered with Wattman 42 paper.

2.2.2 Destruction Process

Take one sample of canned packaging beef, the beef are destructed with wet destruction. Samples were weighed quantitatively as much as 5 g then the samples were put into the destructive flask. After that, 5 ml of concentrated HNO_3 and 5 ml of concentrated H_2SO_4 were added into the flask. After being left for one night in a closed state, the solution was heated over a medium-temperature heating mantle of 60°C for 30 minutes to form a black precipitate and then cool it down. 10 ml HNO_3 was added to the mixture, then heating continued at high temperatures of 120-150°C until formed black precipitate (done in a fume hood). Last 1ml H_2O_2 was added into the mixture and the mixture was heated again. The solution obtained from the destruction was filtered and put in a 50 ml flask. The solution was diluted with aquades to the boundary mark. Then the sample was ready to be analyzed.

2.2.3 Determination of Iron Metal Concentration

1) The standard iron solution was prepared with concentration 0; 0.01; 0.03; 0.05; 0.07; 0.10 ppm
2) The absorbance of standard solution and sample solution was measured at 248.3 nm wavelength.
3) The calibration curve was made.
4) The iron concentration in each sample solution was calculated from the calibration curve.

2.2.4 Data Analysis Technique

2.2.4.1 Determination of Regression Lines

The regression line equation is obtained from the calibration curve made based on absorbance data of standard solutions at various concentrations. The relationship between absorbance and concentration can be expressed by the equation;

$y = ax + b$

With a is the intercept on graph; b is gradient on the curve and x is the concentration of metal solution

2.2.4.2 Determination of Iron metal in sample

Determination of heavy metals in the sample can be done by substituting the results of sample absorbance measurements into the regression equation of each metal y = a + bx. Thus, the concentrations of each metal in the sample can be calculated by the formula,

$$x = \frac{y-a}{b}.$$

2.2.4.3 Determination of the actual concentration of Fe metals

Calculation of iron content (Fe) in a sample of beef canned packaging can use the following equation:

$$Actual\ C = \frac{C\ (mg/liter)\ x\ V\ (liter)}{mass\ of\ sample\ (kg)}$$

3 RESULTS AND ANALYSIS

3.1 Optimization of equipment

In determining concentration of iron metal in canned packaging beef was used wavelength at 248,3 nm. This wavelength is strongest wavelength to electronic transition from ground state to excited state.

3.2 Optimization of the calibration curve

Standard solution of iron was made from $FeSO_4$ 1000 ppm. Standard solution of iron is made with concentration 0; 0,01; 0,03; 0,05; 0,07 and 0,1 ppm. In determination of standard solution absorbance was used Atomic Absorbtion Spectrophotometer. Absorbance showed the ability of sample to absorb electromagnetic radiation in maximum wavelength. The curve of iron (Fe) metal standard solution calibration is

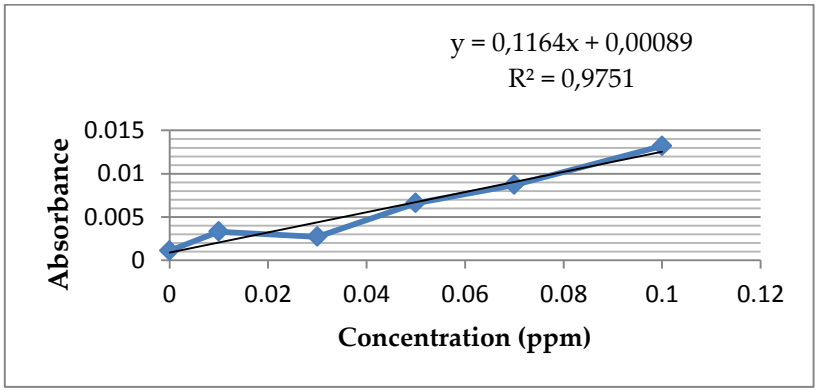

Figure 1 : Calibration curve of standard solution

From the graph, it is shown that higher concentration cause higher absorbance. The linear equation is y = bx+a, with y = 0,1164x + 0,00089, with correlation coefficient is 0,9751. Where y is absorbance, b is slope, and x is concentration and a is intercept.

3.3 Measurement of iron metal asborbance in the sample

The analysis of corned beef sample used Atomic Absorbtion Spectrophotometry. The result of iron (Fe) metal absorbances in canned packaging beef in brand A is 0,1874, in brand B is 0,1197 and in the brand C is 0,1070.

3.4 Determination of iron metal concentrate in the sample

Based on the regression equation, the iron content in samples of canned packaging beef is deterninated.

Table 1. The iron content in samples of canned packaging beef.

Sample	Concentration (ppm)	Actual concentration (mg/kg)
A	1,6023	40.0570
B	1.0207	25. 5175
C	0.9116	22.7900

3.5 Discussion

The purpose of this research is to know the content of metal iron (Fe) element in canned packaging beef. The instrument that used is Atomic Absorption Spectrophotometry (AAS). The samples of canned packaging beef were chosen in a supermarket in Yogyakarta City. Sample selection was based on the availability amount of product in market place so this product reputed often used by consuments. The sample of analysis a metal element in a sample using Atomic Absorption Spectrophotometry (AAS) must be in a solution form and this is usually need a destruction to break the bonding of Fe with organic elements in a sample (Harvey, 2000).

In sample preparation phase, the organic compounds in sample must be destructed. The function of destruction is to break the bonding of organic compounds and metal element that will be analyzed. The destruction used in this study is wet destruction because commonly the wet destruction can used to determine the elements with low concentration. In this analysis of canned packaging beef, it was used HNO_3 65% and H_2SO_4 60% as the destructor. Then it was added with H_2O_2 to clear the solution. After that, the solution was diluted with aquadest. The solution was analyzed using AAS.

The concentration of sample can be determined based on the regression that obtained with using subtitution the value of sample absorbance (Y) so the equation become:

$$X = \frac{Y - b}{a}$$

Iron (Fe) metal in canned packaging beef brand B and C were not more than maximum limit that written in SNI 01-7387-2009, which is 30 mg/kg. Although the iron (Fe) metal that contained in corned beef sample is in amount that not more than maximum limit (low concentration), but the concuments need to be aware because it can caused poisoning in consumption canned food continuously. Meanwhile, the beef corned for A brand is not safe for human health because it is higher than 30 mg/kg.

4 CONCLUSION

Based on the research, it was obtained that the concetration of iron in canned beef in the A brand packaging is 40.0570 mg/kg, in B brand packaging is 25.5175 mg/kg and in the C brand packaging is 22.9600 mg/kg

REFERENCES

Forrest, J.C., Aberle E.D., Hedrick H.B., Judge M.D., & Merkel R.A. (1992). *Principles of Meat Science*. San Fransisco: W.H. Freeman and Company.

Harvey, D. (2000). *Modern Analytical Chemistry*. USA: The McGraw-Hill Companies.

Barone, C., Bolzoni, L., Caruso, G., Parisi, S., Steinka, I. (2015). *Food Packaging Hygiene*. http://www.springer.com/978-3--319-14826-7

Korvali, S. I. & Hamdan, W.A. (2013).Essential and Toxic Metals in Lebanese Marketed Canned Food: Impact of Metal Cans. *Journal of Food Research* Vol. 2 No. 1, 19-30.

Mahalakshmi, M., Balakrishman, S., Indira, K., & Srinivasan, M. (2012). Characteristic Levels of Heavy Metals in Canned Tuna Fish. *Journal of Toxicology and Environmental Health Sciences* Vol. 4(2), 43-45

Mahurpawar, M. (2015). Effects of Heavy Metals on Human Health. *International Journal of Research-Granthaalayah*, 1-7.