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# Comparative Analysis Of Chlorine Levels ($Cl_2$) In Rice Before And After Cooking With The Iodometry Method

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**ABSTRACT**

This study aims to determine the ratio of chlorine levels in rice before and after it is cooked using the iodometric method. This research was conducted on June 12 - July 7 2023 at the ITKeSMU Sidrap Chemistry Laboratory. The type of research conducted is laboratory experimental research to investigate certain symptoms or substances through tests and tests with quantitative examination using the iodometric method. Sampling in this study was carried out randomly by taking rice that has a intact shape, is not easily broken, rice has just been milled. The method test and the calculation of the average chlorine content in rice samples before and after cooking. The results showed that there was a large difference between the chlorine content in rice before cooking, which was an average of 127,16% and after cooking, which was an average pf 48,323%

Keywords: Rice, Chlorine, Iodometric Titration

## I. INTRODUCTION

The rice plant is thought to have originated in Bangladesh in South Asia. The rice plant is an annual grass that can produce a number of fine branches that end with one grain wrapped in husk. Rice milled into rice is a very important cereal and is the staple food for half the earth's population in general and most of Indonesia's population in particular. Consumption of rice in the form of rice is a basic need that cannot be denied.

According to Ismail Marzuki (2019), as much as 75% of people's daily calorie intake in densely populated Asian countries, especially Bangladesh, Myanmar, Cambodia, China, Indonesia, Korea, Laos, the Philippines, Sri Lanka, Thailand, and Vietnam comes from rice. More than 50% of the world's population depends on rice as its main source of calories. The attachment of rice as a staple food is because it is easy and quickly processed, provides pleasure when eaten, and is safe in terms of health. However, this safety is compromised by the issue of the presence of harmful chemicals in rice.

According to the Regulation of the Minister of Health of the Republic of Indonesia No. 033/2012, food additives (BTP) are ingredients added to food to change the nature or appearance of food. Meanwhile, food additives (BTP) are ingredients added to food to change the nature or form of food, as stated in the Regulation of the Head of BPOM RI No. 4 of 2014.

According to PERMENKES RI Number 722 / Menkes / per / IX / 1988 Food and Drug Administration sets the threshold of chlorine, which is described by sodium hypochlorite or calcium hypochlorite, which must not exceed 0.0082 pounds (3.72 grams) and 0.0036 pounds (1.633 grams) of chlorine per pound of dry food (1 pound 453.59 grams). In other words, in 100 grams of food, chlorine levels (described as sodium hypochlorite or calcium hypochlorite)

should not exceed 0.82 grams and 0.36 grams. Chlorine in rice can harm the respiratory system and will erode the intestines in the stomach (corrosive), as a result the stomach will be prone to ulcer disease, and in the long run chlorine will cause liver and kidney cancer.

Rice with a pure white color is more in demand by the public. With the advancement of food processing technology, many food distributors have taken the initiative to add food additives (BTM) to food. One of them is adding Chlorine ($Cl_2$) to rice (Rehamn and Sultana 2009). This is intended so that the color of the rice becomes whiter and shinier.

In the bleaching process used to make paper and garments, chlorine is a must. In addition, metal chloride plants, chlorinated solvents, insecticides, and refrigerants all use chlorine as a chemical reagent. sodium hypochlorite, which is a substance used to make bleach, cleaning products, and disinfectants for swimming pools (Bunyanis and Lidiawati 2021).

the results of preliminary research we conducted, it is known that some rice samples that have been polished from the factory do not contain chlorine. Therefore, a mixture of rice and chlorine will be carried out with a ratio of 20 liters of rice given 30 mg of chlorine by soaking for approximately 10 minutes (Millati, Alhakim, and Febriana 2021).

According to Rebeka Fani 2018, chlorine is soluble in water, making it easy to use in various applications. However, when exposed to steam, chlorine will turn into hypochlorous acid (HClO) and hydrochloric acid (HCl), which can then form trihalometans (THMs).

Based on references from the results of research by Restu, et al in 2012 "Food Safety Analysis on the Study of Chlorine Content" of 16 types (brands) of rice sold in one of the stores in the Wonokromo rice center market Surabaya, there are 10 brands of rice that are positive for chlorine. As for the results of Dia Nora Silalahi's research in 2018 on "Analysis of Chlorine Substances in Rice Sold at the Padang Bulan Medan Afternoon Tax Argentometrically", from 5 rice samples tested, 2 rice samples were positive for chlorine. The amount of chlorine content in rice is 6.09% – 10.51%. Therefore, we are interested in conducting research with the aim of determining the difference in chlorine levels in rice before and after cooking by iodometric method (Aminah, Marzuki, and Rasyid 2019).

## II. METHODS

### Location and Time of Research

The study was conducted from June 12 to July 7, 2023. at the ITKeS Muhammadiyah Sidrap chemistry laboratory.

### Tools and Materials

The tools used in this study were Erlenmeyer 250 ml, measuring cup 50 ml, Beaker 50 ml, Pipette scale 1 ml, Measuring flask 250 ml, Burette, Stative and clamps, Bunsen, Funnel, Test tube and Tube rack, Analytical balance. The ingredients used in this study were Rice, Concentrated Hydrochloric Acid, Sodium Bicarbonate, Potassium Dichromate, 0.1 N Sodium Thiosulfate raw solution, 0.5% Amylum Indicator, pure Chlorine, Aquadest, Filter paper, and Aluminum foil.

### Work Procedure

Samples (rice and rice) weighed as much as 10 grams, then put into erlenmeyer then added 50 ml aquadest, then filtered using filter paper and added 5 ml HCl 2 N. then the sample was stored in a dark place for 10 minutes, then the sample was titrated using a solution of Na2S2O3 until it produces a light yellow color, then add 2 ml of amylum indicator and then continue

titration until the blue color disappears (clear). Last noted titration volume. Each ml of solution $Na_2S_2O_3$ 0.1 N is equivalent to 35.46 mg $Cl_2$ (Wongkar 2014)

## III. RESULTS AND DISCUSSION

Results of comparative analysis of chlorine (Cl2) levels in rice before and after cooking using the Iodometric Method

**Table 1.** Test Results Of Chlorine Levels In Rice Before Cooking

| No | Filtrate (ml) | Initial Volume (ml) | Final Volume (ml) | Titran Volume (ml) | Chlorine Content (%) | Information |
|---|---|---|---|---|---|---|
| 1 | 50 | 0 | 9 | 9 | 137,34 | Clear |
| 2 | 50 | 9 | 18 | 9 | 137,34 | Clear |
| 3 | 50 | 18 | 25 | 7 | 106,8 | Clear |

**Table 1.** Test Results Of Chlorine Levels In Rice Sehave Been Cooked

| No | Filtrate (ml) | Initial Volume (ml) | Final Volume (ml) | Titran Volume (ml) | Chlorine Content (%) | Information |
|---|---|---|---|---|---|---|
| 1 | 50 | 0 | 5 | 5 | 76,3 | Clear |
| 2 | 50 | 5 | 8 | 3 | 45,78 | Clear |
| 3 | 50 | 8 | 9,5 | 1,5 | 22,89 | Clear |

Chlorine is not listed as a food additive (BTP) in the list of permitted bleaches and flour roasters, as stated in the Regulation of the Minister of Health of the Republic of Indonesia No. 033/Menkes/Per/IX/2012 (ATSDR 2012), but in this study the determination of levels was still carried out because many types of chlorine-containing rice were found freely sold in the market, so this study aims to determine whether rice contains chlorine after going through the heating process will stay safe.

Sample A is a sample of uncooked rice, and Sample B is a sample of cooked rice. Then, the iodometric method is used to determine the levels in each sample, the results of analysis using iodometry will produce blue warrants as a result of oxidation:

$$Cl_2 + 2I^- + C_6H_{10}O_5 \rightarrow 2Cl^- + I_2 \quad \text{(Blue)}$$

After that, the resulting iodine is titrated with sodium thiosulfate solution; The volume of sodium thiosulfate used as a titrant is proportional to the amount of iodine produced. By reaction as follows:

$$I_2 + 2S_2O_3^- \rightarrow S_2O_6^{2-} + 2I^- \quad \text{(Clear)}$$

With the addition of coride acid, the solution is titrated in an acidic atmosphere, because iodine is easily oxidized by light and air, it is difficult to titrate using sodium thiosulfate. Adding hydrochloric acid serves to ensure that iodine reacts with the hydroxide of hydrochloric acid and will become iodide ions. The erlenmeyer container containing iodine solution is covered with aluminum foil and stored in a dark room. In iodometric titration, amylum is used as an indicator to indicate the end point or equivalent point, which is indicated by a color shift from blue to colorless. When the titration reaches the end point, an amylum indicator solution is applied (Aulia Yude, Lestari, and Endrinaldi 2016).

In this study, rice that had been confirmed not to contain chlorine in the intact state was used to assess the ratio of chlorine levels. First of all, rice is mixed with chlorine in a ratio of

50 ml of distilled water added to the rice to which 10 grams of chlorine has been added (Ulfa 2015).

Samples (rice and rice) weighed as much as 10 grams, then put into erlenmeyer then added 50 ml aquadest, then filtered, and 5 ml HCl 2 N added to the filtrate, and covered using aluminum foil and left in a dark place for 10 minutes.

Furthermore, titration using a standard solution of sodium thiosulfate and producing a greenish-yellow color is then added 2 ml of 0.5% Amylum indicator. The purpose of using amylum indicators is to ensure that the titration endpoint is accurate. Titration is continued until the blue color disappears (clear). Each ml of solution $Na_2S_2O_3$ 0.1 N is equivalent to 35.46 mg $Cl_2$

Based on the calculation results, it can be seen that the first rice sample had 137.34% chlorine, 137.34% chlorine in the second titration, and 106.8% chlorine in the third titration with an overall average of 127.16%. For the second rice sample cooked into rice, the first titration result was 76.3%, the second titration result was 45.78%, and the third titration result was 22.89% with an overall average of 48.323% (Tilawati, Agustina, and Arrosyid 2015).

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The results of making amylum indicators that will be used in this research are very important because a bad indicator manufacturing method will prevent the formation of blue.

## IV. CONCLUSION

Based on the research data that has been obtained. It can be concluded that the difference between the chlorine content in rice before cooking is an average of 127.16% and after cooking is an average of 48.323%.

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