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Analyze of formalin in kolang kaling (Arenga pinnata Merr) and black grass jelly (Mesona palustris BL)

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ABSTRACT

Formalin is a chemical toxic that is abused as a food preservative and prohibited by the Indonesian government. Thus, there is a need for continuous analysis of foodstuffs that are sold in the market. When food containing formaldehyde is consumed, it will interfere with the metabolism of organs and body systems. This study aimed to analyze the presence and absence of formalin content on Kolang Kaling (*Arenga pinnata* Merr) and Black Grass Jelly (*Mesona palustris* BL) sold in Samarinda City Traditional Market, especially Segiri market, Pagi market, and Sungai Dama market. The test of formalin content was performed qualitatively using chromatophilic acid and continued quantitatively using UV-Vis spectrophotometry at the Biochemical MIPA laboratory. The results showed that 9 samples from 18 samples were identified using formalin as a preservative. The levels of formalin obtained were different, the lowest formalin level of 0.0240 mL / L in the Cincau samples (*Mesona palustris* BL) obtained in the Segiri market and the highest formalin level of 0.0531 mL / L in the kolang kaling sample (*Arenga pinnata* Merr) obtained on the Pagi market.

INTRODUCTION

The development of science and technology has led to enormous changes in food processing. Today, many harmful substances are added to food and drink for various purposes. One of them is a preservative used by traders to preserve food. Basically, food does not last long to be stored, especially foods that contain high water content. The relatively short storage of food is certainly detrimental to producers or the food industry. This triggers small and medium industrial producers and home industries to use additives such as preservatives. Regarding food additives, the definition of food additives is material added to food to affect the nature or form of food or food products.[1]

Excessive use of food additives can have long-term and short-term impacts.[2] The use of preservatives in food ingredients is still widely found, especially the use of formalin as a preservative in foodstuffs such as tofu, meatballs, dried fish (salted fish), marine fish which in general can cause poisoning in the human body. Formalin is one of the substances that are prohibited from being in food and toxic chemicals that are classified as carcinogens, namely compounds that can cause cancer.

The results of the research by the Technical Implementation Unit (UPT) of the Health Laboratory of the Gunungkidul Health Service from 33 samples of food ingredients taken at the Playen market, around 0.0003 percent contained preservatives in the form of formalin while 96.96 percent of kolang kaling did not contain formalin.

Kolang kaling and black Cincau are foods that are easily found in traditional markets, even in modern markets, although only the quality of food safety and hygiene makes the difference. According to the Regulation of the Minister of Health Number 033 of 2012 which has been updated from the Regulation of the Minister of Health of the Republic of Indonesia Number: 1168/Menkes/PER/X/1999 the definition of Food Additives (BTP) in general is an ingredient that is not usually used as food and is usually not a component of food additives. special food, having or not having nutritional value, which is intentionally added to food for technological purposes in the manufacture, processing, preparation, treatment, packing, packaging and storage. This ingredient serves to improve color, shape, taste, and texture, and extend shelf life, and is not the main ingredient. The use of additional ingredients also serves to increase or maintain nutritional value, make food ingredients easier to serve, and facilitate food preparation.

In general, in food processing, efforts are always made to produce food products that are liked and of good quality. Food additives are ingredients that are added to food to affect the nature or shape of the food. Food additives themselves have nutritional value, but some do not.[3] Food safety is an important requirement that must exist in the food that will be consumed by every human being.[4] Food that is quality and safe for consumption can come from household kitchens or from the food industry. Therefore, the food industry is one of the determining factors for the development of food that meets the quality and safety requirements set by the government.[5] Now there is a very extraordinary change in food processing because it is supported by the development of science and technology. The number of ingredients that have been added to food and beverages with various specific purposes.[6]

Formalin is a 40% solution of formaldehyde, including the aldehyde or alkanal compound group, which contains one carbon atom. The United States Environmental Protection Agency (EPA) and the International Institute for Cancer Research (IARC) classify formalin as a carcinogenic compound, namely a compound that triggers the growth of cancer.[7] Formalin can also be used as an additional preservative to prevent spoilage[8]. Though this toxic substance is very dangerous if inhaled, on the skin especially if it is swallowed. The purpose of using formalin is to preserve corpses, but people often misuse it as a food preservative to prevent decay. Whereas formalin is one of the prohibited food additives.[9,10] Formalin is classified as one of the causes of human cancer.[11] This happens because harmful substances are included in the manufacture of formalin. In formalin thare is on of substance FA has detrimental effects on the human body.[12] particularly on the ocular and respiratory system, but it also affects the nervous and genital system.

The presence of formaldehyde in food which is very dangerous needs to be studied further. Therefore, this study aims to determine the presence of formalin in foodstuffs that are often consumed by the public and have health benefits[13], kolang kaling and black grass jelly qualitatively and quantitatively.

MATERIALS AND METHODS

This research was conducted qualitatively and quantitatively to test the formalin content in kolang kaling and black grass jelly. Samples were taken from 3 market locations in Samarinda City, East Kalimantan Province, namely Morning Market, Segiri Market and Sungai Dama Market. The sampling technique was purposive sampling. The inclusion criteria for kolang-kaling were clear white. The exclusion criteria for kolang kaling were slimy and sour smelling. The inclusion criteria in taking grass jelly samples were the texture was not too hard and still jelly-like, dark black in color, and there were no bubbles in the grass jelly. The exclusion criteria for sampling were slimy, moldy and sour smelling.

A qualitative test to determine the presence or absence of formalin in the sample was carried out using the chromatostatic acid method. If the qualitative test results show positive results, further quantitative tests are carried out using UV-Vis spectrophotometry

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to determine the quantity of formalin contained in the sample. The test was carried out at the Biochemistry laboratory of the Faculty of Mathematics and Science, Mulawarman University.

The Instruments needed are UV-Vis spectrophotometry, 150 ml beaker glass, 250 ml beaker glass, 150 ml erlenmeyer, tripod, analytical balance, test tube rack, test tube, pipette, 1000 ml long neck volumetric flask, filler, tong clamp, measuring cup, wire gauze, cuvette, and Bunsen. The materials used in this study were samples of kolang kaling (Arenga pinnata Merr), samples of black grass jelly (Mesona palustris BL), chromatofatic acid ($K_{10}H_8O_8S_2$), sulfuric acid (H_2SO_4), phosphoric acid (H_3PO_4), distilled water, formalin solution 37 %, spirit, filter paper, HVS paper, label paper.

Qualitative Test (Chromatropic Acid Method)

1. Sample preparation
   Cut the samples in the form of grass jelly and kolang kaling separately into small pieces, then grind them and weigh the samples that have been finely weighed as much as 100 grams.
2. Control Making
   Making positive and negative controls aims to determine how the appearance of the given color if the analyzed sample contains formalin or not. A positive control was made by inserting 1 mL of formalin into a test tube and adding 0.1 g of chromotropic acid. Heating using a Bunsen for 15 minutes and observing the color change that occurs will form a purple color. A negative control was made by adding 1 mL of distilled water to a test tube and adding 0.1 g of chromotropic acid. Heating using a Bunsen for 15 minutes and observing the color change that occurs will form a purple color.
3. Identification of samples (kolang kaling and black grass jelly)
   Sample identification begins with preparing tools and materials. Samples were cut into small pieces, each sample of kolang-kaling and black grass jelly were then weighed as much as 10 g using an analytical balance. The weighed sample was put into a 150 mL beaker glass and added to 100 mL of distilled water and then stirred using a spatula until mixed. Prepare a heater and put a 150 ml beaker glass containing the sample on a tripod, the beaker glass is closed using a petri dish. Wait until it produces steam (simple distillation). Repeating up to 18 samples produces steam. Prepare a blank/formalin solution to be used as a comparison solution. Drop the results of the water vapor in the petri dish into a test tube as much as 2 to 3 drops, then add 2 ml of sulfuric acid. Adding chromatophoric acid powder of approximately 0.1 g. Shake the test tube containing the solution until it changes color. If the solution changes color to purplish, then the solution is positive for formalin.

Quantitative Test (UV-Vis spectrophotometry)

1. Preparation of 1000 ppm Formalin Solution from 37% w/v Formalin.
   Make a solution of 1000 ppm formalin (main solution) as much as 1000 mL with the concept of dilution. Formalin 1000 ppm = 1000 mg/L= 100 mg/100 mL= 0.1 g/100 mL= 0.1% w/v
   $V1 \times M1 = V2 \times M2$
   $V1 \times 37\% = 1000\ mL \times 0.1\%$
   $V1 = 2.70\ mL$
   Formalin with a concentration of 37% as much as 2.70 mL was put into a 1000 mL volumetric flask which already contained a small amount of distilled water. The distilled water was added up to the mark and then shaken until homogeneous.
2. Preparation of Formalin Standard Solution

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Standard solution of 50 ppm formalin was made from 250 mL of 1000 ppm formalin solution.

V1 × M1 = V2 × M2

V1 × 1000 ppm = 250 mL × 50 ppm

V1 = 12.5 mL

12.5 mL of formalin was taken from 1000 ppm formalin mother liquor, then put into a 250 mL volumetric flask. The distilled water was added up to the boundary mark then shaken until homogeneous. Furthermore, different concentrations are made, namely 0; 0.5; 1; 1.5; and 2; ppm was made from 50 ppm formalin solution then put into a labeled test tube, then added chromatofatic acid at each different concentration.

3. Determination of the Wavelength that Provides Maximum Absorbance
   A total of 5 mL of a standard solution of 0.5 ppm formalin added 0.1 g of chromatofatic acid reagent. A total of 5 mL of distilled water added 0.1 g of chromatofatic acid reagent as a blank solution. The absorbance of the standard and blank solutions was measured at a wavelength of 553 nm, then an absorbance versus wavelength curve was made (A vs). The wavelength (λ) that produces the largest absorbance is determined as the maximum .
4. Calibration Curve Creation
   Formalin standard solution 0; 0.5; 1; 1.5; and 2; ppm is taken as much as 5 mL each. Measuring the absorbance of the standard solution and the blank solution at a wavelength of 553 nm, then a curve of the absorbance relationship and the concentration of the solution was made.
5. Test of Formalin in Samples by UV-Vis Spectrophotometry
   Taken as much as 5 mL of sample filtrate, then added 0.1 g of chromatofat acid reagent. A blank solution was prepared by replacing 5 mL of the sample filtrate with 5 mL of distilled water. The absorbance of the standard and blank solutions was measured at a wavelength of 553 nm.

RESULT AND DISCUSSION

1. Formalin qualitative test results

The results of testing on kolang kaling (Arenga pinnata Merr) and black Cincau (Mesona palustris BL) qualitatively on the formalin content were carried out by testing the color on the sample using chromatophoric acid reagent. If the color changes to purple, the solution is positive for formalin.

Table 1. Results of Qualitative Test of Formalin on Kolang Kaling in Segiri Market, Pagi Market, Sungai Dama Market

No	Sample	Color	Test results	Description
1	Positive Control	Purple	+	The color changes to purple
2	Negative Control	Yellow	-	There is no change in color to purple
3	Sample A1S	Yellow	-	There is no change in color to purple
4	Sample A2S	Yellow	-	There is no change in color to purple
5	Sample A3S	Yellow	-	There is no change in color to purple
6	Sample A1P	Dark Purple	+	The color changes to purple
7	Sample A2P	Dark Purple	+	The color changes to purple
8	Sample A3P	Dark Purple	+	The color changes to purple
9	Sample A1SD	Yellow	-	There is no change in color to purple
10	Sample A2SD	Yellow	-	There is no change in color to purple
11	Sample A3SD	Purple	+	The color changes to purple

Description:
A = Kolang Kaling
S = Segiri Market
P = Pagi Market
SD = Sungai Dama Market

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Table 2. Results of Qualitative Test of Formalin on Black Cincau in in Segiri Market, Pagi Market, Sungai Dama Market

No	Sample	Color	Test results	Description
1	Positive Control	Purple	+	The color changes to purple
2	Negative Control	Yellow	-	There is no change in color to purple
3	Sample B1S	Dark Purple	+	The color changes to purple
4	Sample B2S	Dark Purple	+	The color changes to purple
5	Sample B3S	Yellow	-	There is no change in color to purple
6	Sample B1P	Dark Purple	+	The color changes to purple
7	Sample B2P	Yellow	-	There is no change in color to purple
8	Sample B3P	Dark Purple	+	The color changes to purple
9	Sample B1SD	Purple	+	The color changes to purple
10	Sample B2SD	Yellow	-	There is no change in color to purple
11	Sample B3SD	Yellow	-	There is no change in color to purple

Description:
B = Black Cincau
S = Segiri Market
P = Pagi Market
SD = Sungai Dama Market

2. Formalin quantitative test results

Quantitative testing aims to determine the content of formalin in the samples of kolang kaling (Arenga pinnata Merr) and black Cincau (Mesona palustris BL) which were tested using UV-Vis spectrophotometry. UV-Vis spectrophotometry is often used to determine the level of formalin in the material. The results of a quantitative examination of the use of formalin in kolang kaling (Arenga pinnata Merr) and black Cincau (Mesona palustris BL) which are sold in three traditional markets in the city of Samarinda which were tested at the MIPA Laboratory of the Biochemistry section are obtained as shown in table 4.

Table 4. Results of the Quantitative Test of Formalin on Kolang Kaling and Black Cincau

No	Sample	Level (mL/L)
1	Sample A1 P	0.0459
2	Sample A2 P	0.0278
3	Sample A3 P	0.0531
4	Sample B1 P	0.0310
5	Sample B3 P	0.0259
6	Sample B1 S	0.0256
7	Sample B2 S	0.0240
8	Sample A3 SD	0.0375
9	Sample B1 SD	0.0366

Description:
A = Kolang kaling, B = Black Cincau
P = Morning,
S = Segiri,
SD = Dama River

Formalin or formaldehyde is synthesized by the oxidation of methanol and used as an antiseptic, disinfectant, histologic fixative, and general-purpose chemical reagent for laboratory applications (https://pubchem.ncbi.nlm.nih.gov/compound/Formaldehyde). It can be commonly found in water, air, and soil[14]. Formalin is a compound that is naturally present in the body of living things such as as a result of metabolism[15] as well as from bacteria and enzyme reactions [16], but in small amounts. Consumption in small amounts

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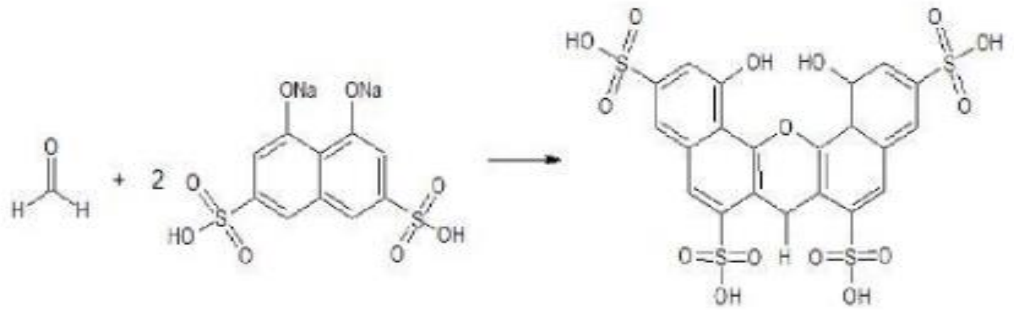
does not cause acute effects[17]. In addition, the presence of formalin in food can be caused by exposure from food processing and storage sites[18] and intentionally using it as a preservative in food[8,19]. Many food manufacturers use formalin as a preservative because it is cheap, easy to obtain and does not need special skills in its use[8]. The use of formaldehyde in household products, cosmetics and food as preservatives to prevent the growth of microorganisms[14].

There are regulations that prohibit the use of formalin to be added to food and beverages in several regions[10,19,20], including in Indonesia according to the Regulation of the Minister of Health Number 1168/Menkes/PER/X/1999[21]. This rule relates to various studies that show the dangers of exposure to large amounts of formalin to living things. Formalin can cause skin allergies[22], irritate the digestive tract[18], trigger tumors in the respiratory tract[18], and is a carcinogen[17].

The study used a qualitative test in the form of a chromotropic acid test and a quantitative test using a spectrophotometric method. The presence of formalin in food can be detected through various tests, such as the chromotropic acid test[23], paper-based tritation[24], N-CDs based on the mirror reaction[20], colorimetric method by Schryver reagent[25], HPLC-PLSD[17], and spectrophotometric method using the UV-.Vis spectrophotometer[826]. The results of qualitative and quantitative tests showed that some samples of kolang kaling and black grass jelly contained formalin. These results are in line with research showing that formalin is found in various other food ingredients, such as packaged baby food[17], fish products[15,21], noodles[8,26], fruits and vegetables[27].

Positive results of the presence of formalin in kolang kaling and black grass jelly were indicated by the presence of a purple color in the chromatopathic acid test. Formalin reacts with chromatopic acid to produce a purplish-red complex[21]. Quantitative test using a spectrophotometer showed that the formalin content in food was the highest in the kolang kaling sample, which was 0.0531mL/L and the lowest was 0.0278 mL/L. The highest formalin content in the black grass jelly sample was 0.0366 mL/L and the lowest was 0.0240 mL/L. The formalin content in kolang kaling makes it durable, not easily sour and slimy. Formalin black grass jelly has a longer storage period.



Picture 1. Reaction of formalin and chromatopathic acid[21, 23]

These findings indicate that there are several food producers who violate the regulations of the ministry of health by using formalin to preserve food. People can be more selective in choosing food to avoid exposure to formalin in processed foods such as kolang kaling and black grass jelly.

CONCLUSION

Based on the research results of the formalin content test in kolang kaling (*Arenga pinnata* Merr) and black Cincau (*Mesona palustris* BL) which are sold in the traditional market of Samarinda city, it can be concluded that of the 18 samples that have been tested at the MIPA Laboratory of the Biochemistry section, there are 9 positive samples

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containing hazardous materials in the form of formalin include 4 samples of kolang kaling (*Arenga pinnata* Merr) and 5 samples of black Cincau (*Mesona palustris* BL) which are sold in traditional markets in Samarinda. The presence of formalin was identified as indicated by the formation of a purple color when reacted with chromotropic acid. The lowest formalin level was 0.0240 mL/L in the black Cincau sample obtained at the Segiri market and the highest formalin level was 0.0531 mL/L in the kolang kaling sample obtained at the Pagi market.

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