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### FOODS CONTAINING FORMALIN AND CHLORINE IN THE EAST SURABAYA AREA

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#### ABSTRACT

**Background:** Safe and nutritious food is very important for our body. Unfortunately not all foods meet food safety requirements. Some traders use prohibited food additives such as formalin and chlorine. Increasing competition and desire to increase financial benefits make some traders use that way. Therefore this study was conducted to provide an overview of the situation of illegal use of food additives. The results of the study are expected to be used as a reference for the Government to control the use of food additives in Indonesia. The purpose of this study is to identify foods containing formalin and chlorine in East Surabaya Area.

**Methods:** This descriptive-observational research use purposive sampling technique. The samples consist of 16 foods for formalin test and 16 foods for chlorine test. It is obtained from food traders suspected of selling food containing those substances in East Surabaya. Tests were conducted in the Environmental Health Laboratory of Universitas Airlangga Surabaya. Formalin and chlorine tests are carried out qualitatively, using test kits to see the formalin content and color reaction test to see the chlorine content. The results of data analysis is presented descriptively in the form of table and figure.

**Results:** The results show 12.5% samples (salted fish and white tofu) are containing formalin. While chlorine test results show 75% samples (white cracker, rice, noodle, salt, wheat flour, white tofu and tea dye samples) are positive of chlorine.

**Conclusions:** There are some foods containing formalin and chlorine in East Surabaya area. Health institutions are advised to conduct regular inspection and investigation of food content. In addition, regular education and coaching needs to be done to food vendors to improve their knowledge regarding the use of formalin and chlorine.

**Keywords:** Formalin, chlorine, food, East Surabaya

#### INTRODUCTION

Nutrients such as carbohydrates, proteins, fats, vitamins, and minerals contain benefits for the body if the production process until the distribution goes well and correctly. Otherwise it will reduce the nutrients of food and impact on human health. One of the actions that adversely affect human health is the addition of chemicals, such as formalin and chlorine. In 2011, BPOM took 4,808 food samples from 866 elementary schools spread over 30 cities in Indonesia to test its contents. Test results showed that 1,705 samples (35.46%) did not meet food safety requirements [1]. The results of testing hazardous

chemicals in foods such as formalin and chlorine were carried out in 3,206 samples and 1.34% of which contained formalin [2].

Formalin is the name of saturated (37%) formaldehyde solution. Formaldehyde (CH<sub>2</sub>O) itself is the simplest aldehyde [3]. Formalin has characteristics similar to ordinary water, slightly acid, pungent and corrosive smell, decomposes when heated and releases formic acid. Formalin used for some materials such as disinfectant, a preservative specimen (fixative), an adhesive to a plywood product, and a germicide. This substance should be used with caution because the risks associated with this material are considerable. If swallowed, formaldehyde may cause burning of the mouth and throat, if inhaled the risk of developing nasal cancer, and genetic disorders in humans. Irresponsible food producers often add formalin to foods such as wet noodles, salted fish, chicken pieces, and tofu [4].

The use of formalin as a food preservative is prohibited in Indonesia, it is stated in the Regulation of the Minister of Health of the Republic of Indonesia No.1168/Menkes/Per/X/1999 [5], Regulation of the Minister of Industry Number 24 /M-Ind/Per/5/2006 [6] and Government Regulation of the Republic of Indonesia Number 28 of 2004 [7].

Aside from formalin, one of the other food additives is chlorine. Chlorine is not favorable if used excessively in food or drink. Chlorine is usually used for hygiene and disinfectants in household life [8]. The Regulation of the Minister of Health of the Republic of Indonesia No.472/Menkes/Per/V/1996 states that chlorine is one of the hazardous substances that are toxic and cause irritation [9]. Chlorine can cause irritation of the eyes, upper respiratory tract, and lungs [8]. Humans may be exposed when consuming foods or beverages containing chlorine and contact with objects that are bleached or disinfected with it [10]. Chlorine must be used properly and correctly. Otherwise, it can cause various negative impacts, both for health and the environment.

Short-term exposure of chlorine through the digestive tract can irritate the esophagus. Also, drinking a concentrated hypochlorite solution can cause disturbances in the upper gastrointestinal tract and even death. This effect usually arises from the caustic nature of hypochlorite solution, not from molecular chlorine. While the effects of chlorine exposure in the long term through the human digestive tract are unknown for sure [11].

Various efforts should be done to control the addition of harmful chemicals into food or beverages in order not to cause health problems, one of them through research. This research was conducted in Surabaya (eastern region) which is the second largest city in Indonesia and the capital of East Java Province. The city has a full range of facilities, including educational facilities like Play Groups, Early Childhood Group, High School and Colleges. The high activity in East Surabaya also increased the number of food or beverage providers. However, the high quantity is not always matched with high quality. Therefore this study was conducted to describe foods or beverages exposed to formalin and chlorine at selected research sites. The results of this research can be utilized by various parties, especially the government, especially in making policy related to food additives.

## **METHODS**

The type of this research is descriptive observational. The study time ranges from sampling to data analysis for three months (March to May). The study was conducted by sampling the food traders in East Surabaya. The sample testing location in Environmental Health's Laboratory in Faculty of Public Health Airlangga University. Data collection techniques by observation and testing of food samples.

The population is all food traders located in East Surabaya includes 32 food samples were consisting of 16 samples for the formalin test and 16 samples for chlorine test. Purposive sampling was used to select samples on food traders with criteria allegedly sold foods containing food additives such as formalin and chlorine that many discussed in previous research. Data analysis is presented in table and figure form and explained descriptively.

Formaldehyde and chlorine testing are performed by qualitative methods looking at color changes through portable food test kit. Food samples contain positive formaldehyde when discoloration becomes red or purplish. The color change comes from the reaction between formaldehyde and 4-amino-3-hydrazine 5-mercapto-1,2,4-Triazole. While food samples contained positive chlorine when levels exceeded 0.0 mg /l seen from a comparator shift between glasses A and B until the appropriate color was obtained.

## RESULTS

### *Formalin Test*

The results of food samples test formalin in East Surabaya area can be seen in the table below.

Table 1. Results of food samples test formalin in East Surabaya area

Formalin Test Result	Amount (n)	Percentages (%)
Positive	2	12.5
Negative	14	87.5
Total	16	100.0

Based on Table 1, shows that the total food samples test formalin is 16. 2 (12,5%) food samples positive contain formalin. Another food samples 14 (87,5%) negative contain formalin.

Table 2. Name of food samples test formalin in East Surabaya area

No	Food samples	Location	Samples Colour	Result
1	Thin rice noodles	Mojo Arum market	Transparent	Negative
2	Salted fish	Manyar market	Purplish	Positive
3	Mujair fish	Pacar Keling market	Brown	Negative
4	White tofu	Karamenjangan market	Purplish	Positive
5	Noodles	Mulyorejo market	Yellow	Negative
6	Fish cake	Mulyorejo small shop	White	Negative
7	Noodles	Supermarket B	Yellow	Negative
8	Thin rice noodles	Mulyorejo shop	Transparent	Negative
9	Salted fish	Pacar Keling market	White	Negative
10	Mujair fish	Sukolilo small shop	White	Negative
11	White tofu	Kertajaya Small shop	White	Negative
12	Ayam fish (Abalistes stellar)	Supermarket A	Transparent	Negative
13	Fish cake	Supermarket C	White	Negative
14	Grouper fish	Supermarket D	Transparent	Negative
15	Steamed flavor with fish	Mulyorejo small shop	White	Negative
16	Salted fish	Sutorejo market	Transparant	Negative

Based on Table 2. shows that food samples positive contain formalin is salted fish and white tofu, which discoloration into purplish color.

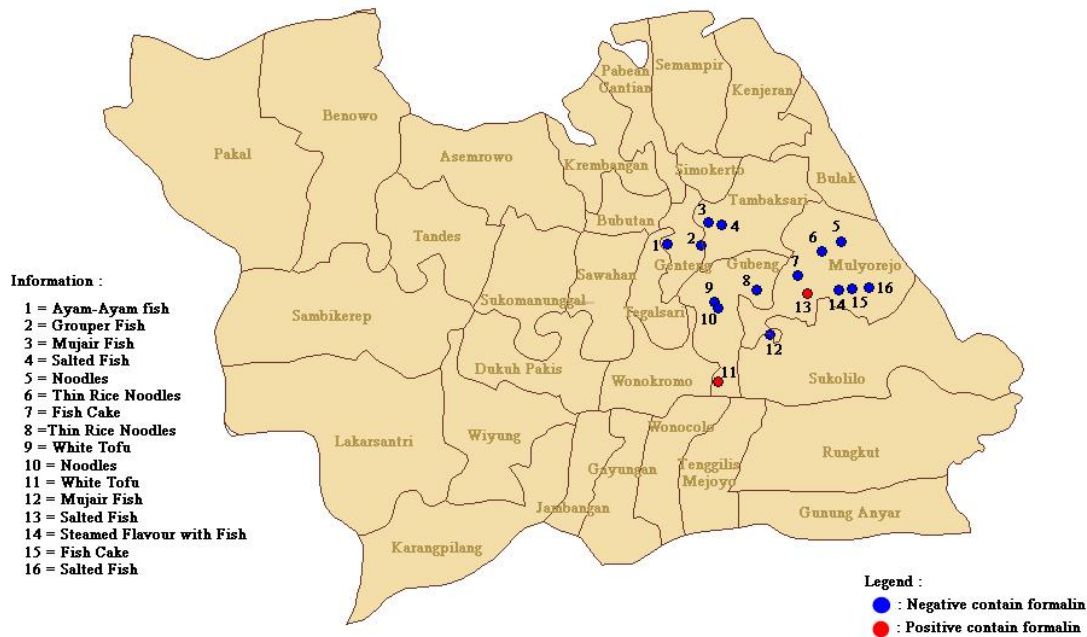


Figure 1. Mapping of food samples test formalin in East Surabaya area

Based on figure 1, shows that food samples that not qualify or positive contain formalin found in Manyar and Karangmenjangan market.

#### Chlorine Test

The results of food samples test chlorine in East Surabaya area can be seen in the table below.

Table 3. Results of food samples test chlorine in East Surabaya area

Chlorine Test Result	Amount (n)	Percentages (%)
Positive	12	75.0
Negative	4	25.0
Total	16	100.0

Based on table 3, shows that total food samples tested chlorine is 16. 12 (75%) food sample positive contain chlorine. Another food samples 4 (25.0%) negative contain chlorine.

Table 4. Name of food samples test chlorine in East Surabaya area

No	Food sample	Location	Chlorine content	Results
1	White crackers	North Mulyorejo shop	2.0 mg	Positive
2	Hulled rice	Manyar market	0.2 mg	Positive
3	Thin rice noodles	Pacar Keling market	2.0 mg	Positive
4	Hulled rice	North Mulyorejo small shop	0.3 mg	Positive
5	Salt	Mulyorejo market	2.0 mg	Positive
6	Wheat flour	Center Mulyorejo shop	2.0 mg	Positive
7	White tofu	Pacar Keling market	2.0 mg	Positive
8	Tea bag	Mulyorejo shop	0.0 mg	Negative
9	White crackers	Pacar Keling market	0.0 mg	Negative
10	Hulled rice	Pandugo shop	1.2 mg	Positive
11	Thin rice noodles	Kertajaya small shop	2.0 mg	Positive
12	Sugar	Pandugo shop	0.0 mg	Negative
13	Salt	Pucang market	0.1 mg	Positive

No	Food sample	Location	Chlorine content	Results
14	Wheat flour	Gebang Lor small shop	0.0 mg	Negative
15	White tofu	Mulyorejo Tengah small shop	0.1 mg	Positive
16	Tea bag	Sutorejo market	0.2 mg	Positive

Based on table 4. shows that food samples positive contain chlorine is white crackers, hulled rice, thin rice noodles, salt, wheat flour, white tofu and tea bag. Samples have contained chlorine more than 0.0 mg.

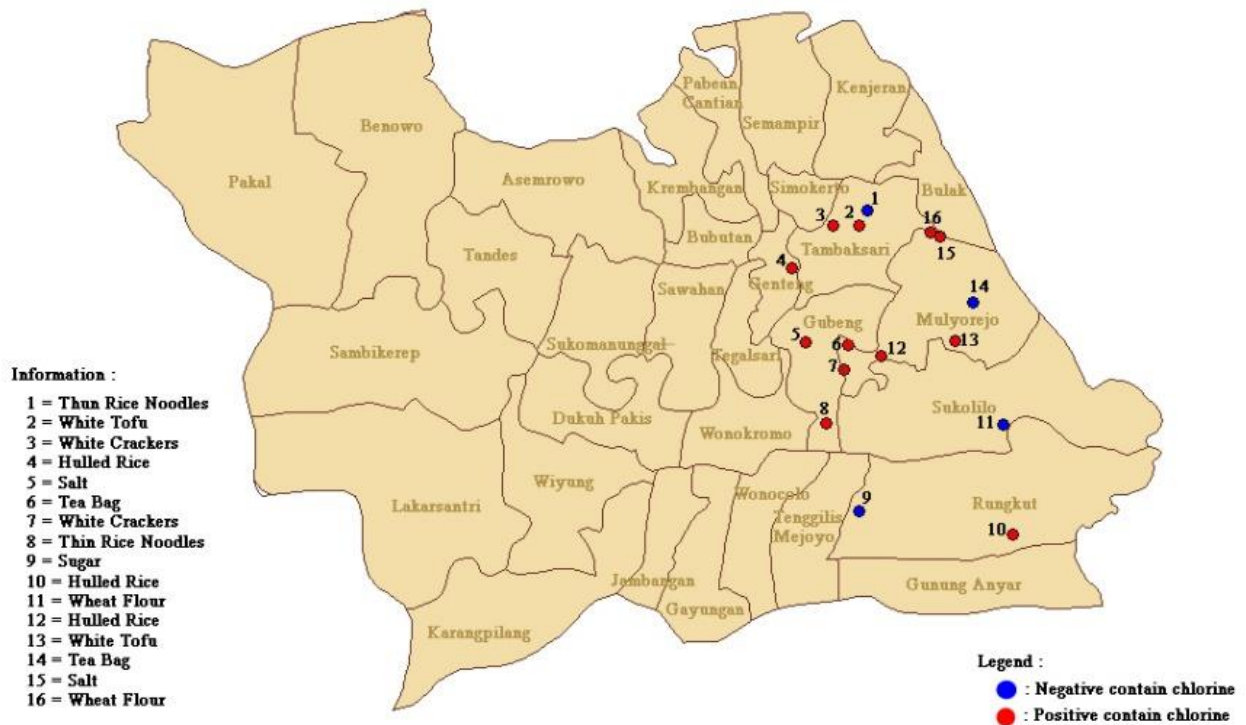


Figure 2. Mapping of food samples test chlorine in East Surabaya area

Based on figure 2, shows that food sample that not qualify or positive contain chlorine found in North Mulyorejo, Center Mulyorejo, Pandugo shop, Manyar, Pacar Keling, Mulyorejo, Pucang, Sutorejo market, and North Mulyorejo, Kertajaya, Center Mulyorejo small shop.

**DISCUSSION**

The use of Food Additives aims to keep the product durable, improve flavor, aroma, appearance, physical and color. In reality, many food producers are using food additives with hazardous chemicals. One of the chemicals abused in food is formalin. Indonesia became one of the countries that prohibit the use of formalin in food.

The results of this study indicate that there are two positive food samples containing formalin. This corresponds with research conducted by Habibah which shows less than 50.0% of the samples studied positively contain formalin [12]. According to the Minister of Health Regulation Number 033 of 2012 about Food Additives explained that formalin is a chemical that should not exist in food. Formalin control has been regulated in the Joint Regulation of the Minister Home Affairs Republic Indonesia and the Head National Agency of Drug and Food Control Republic Indonesia Number 43 the Year 2013 and Number 2 the Year 2013 about the Control of Dangerous Substances Abused in Food.

The research results (Figure 1) show that two samples are containing formalin, namely salted fish and tofu. Formalin test results are classified as positive if the initial color change becomes pinkish- purple. The use of formalin in salted fish has become commonplace for traders to preserve the fish to last longer than usual. The salted fish samples contain formalin known from white color, clean and though [12]. The results of this study correspond with the study of in Bandung which states that salted fish samples from 5 tested sites, positively containing formalin [13].

In white tofu samples, formalin seen from chewy texture, not solid yet not easily destroy, and the smell of sting formalin [14]. Formalin in tofu contains aldehyde which eases to react with proteins. The aldehyde reaction is indicated by binding the protein elements from the tofu surface to the inside of the tofu which causes the chewy properties of tofu when pressed. The results of this study in line with research Khoerudin (2018) which states that six samples of tofu tested positive to contain formalin.

Traders use formalin due to economic factors. Undisturbed tofu texture encourages traders to add formalin so that it more durable and minimize losses due to remain tofu on production day [15]. Also, the socialization of benefits and hazards of additives to the public is still not maximal, so the knowledge of producers is still lacking [14].

The principle of food preservation for producers divided into three: naturally, biologically, and chemically. These three techniques serve to inhibit microbial growth and reduce or prevent the oxidation process. Natural preservation techniques such as cooking, cooling, freezing, drying, and canning. Biological preservation techniques such as fermentation. Chemical preservation techniques such as Food Additives, organic or inorganic, with a specific dose and safe for health [16].

WHO states that the use of formalin for food preservatives is prohibited because potentially toxic to the human body [17]. Formalin which is added to food will not be lost even after it is cleaned. Formalin is corrosive and can cause severe damage to the digestive system. It is characterized by symptoms of nausea, vomiting blood, diarrhea, and urination accompanied by blood, difficulty breathing, vertigo, failed breath, to cause death. Also, research results prove that long-term formalin has the potential to cause respiratory, digestive, cardiac, neurological, cancer, and even death [18].

The second test was conducted to determine the content of chlorine ( $\text{Cl}_2$ ). Chlorine is a gas with a strong smell. Chlorine is usually used for home cleaning and disinfectant. Currently, chlorine is often misused as food additives. This is inverse Regulation of the Minister of Agriculture Indonesia number 32 of 2007 this policy prohibited use chemical such as chlorine for food, especially on rice.

The results of the test on food showed that 75% positive food samples of chlorine. This research in line with Tjiptaningdyah (2017) shows that more than 50% of samples positively contain chlorine [19]. Chemicals such as chlorine should not be used in food because it will affect consumers' health.

The positive test samples contain chlorine has seven variants such as white crackers, hulled rice, thin rice noodles, salt, wheat flour, white tofu, and tea bags. Positive food samples may contain more than 0 mg /l of chlorine. This Results in line with research Tilawati 2015, which shows that of 8 samples of hulled rice test, two outside positive chlorine. Hulled rice is the most frequently added of chlorine [20]. The characteristics of foods containing chlorine look cleaner and smell the chemicals [21]. In tea bags, the chlorine content comes from a paper bag of tea bags. Tea bag drop in hot water, the bleach in the tea bag will also dissolve [22].

The use of chlorine in materials and food to enhance the image can improve the quality of goods and the selling price [23]. Irresponsible act food producers have the potential to disrupt human health from short-term to long-term effects.

Short-term health effects of chlorine can cause burns of the mouth and throat, gastrointestinal irritation, nausea, vomiting, and diarrhea. Long-term effects of chlorine are decreased cardiac function, lactic acidosis (high levels of lactic acid due to acid-base disorders in the blood), tissue hypoperfusion (lack

of blood flow to the tissues so the body lacks nutrient and oxygen intake), hypotension (low blood pressure), severe respiratory irritation and dead [24].

Innovation technology can be used for the producer to minimize chlorine as rice bleach is adding a blower to the rice milling unit. The blower consists of coils, fans, and body unit. Blower use after the milled rice and will blow the wind that can separate the rice with bran. The benefit of using the blower in rice milling can increase the nutrient value of rice because with twice the milled rice can produce with a clean standard 4 to 5 times with ordinary Rice Mill [25]. However, this innovative technology has not been entirely used because not produce in general.

Food sampling is done in the small shop, markets, shop and supermarkets in East Surabaya. East Surabaya area was chosen as a place for test food samples food samples containing formalin and chlorine because the region has the largest population among the five areas in the city of Surabaya [26]. If the area has increased population, then the basic human need for food will also increase [27]. Therefore, possible food safety is protected from biological and chemical contamination that can be compromised.

## CONCLUSION

Formalin and chlorine still found on foods in East Surabaya area. Both substances are prohibited by the Government and can cause health problems. Health institutions are advised to conduct regular inspection and investigation of food content. Such activities may be undertaken (cooperated) with The National Agency of Drug and Food Control and other relevant sectors. Also, regular education and coaching need to be done to food vendors to improve their knowledge regarding the use of formalin and chlorine.

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