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ANALYSIS OF HEAVY METAL CONTENT IN SALT (CASE STUDY OF SALT FIELD, LOSARANG DISTRICT, INDRAMAYU REGENCY)

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ABSTRACT

Salt is a staple food needed for human life, especially for industrial and household consumption. The raw material for making the salt comes from sea water which is very susceptible to contamination by contaminants in the form of heavy metals. The presence of heavy metals in salt will be harmful to human health when consumed. The study was conducted to determine the quality of salt free from heavy metal contamination and suitable for consumption. in Losarang District, Indramayu Regency. This research was conducted by descriptive method. Data collection techniques were carried out through observation and interviews. The samples tested were salt produced with TUF technology and Geoisolator. The sampling technique refers to SNI 19-0428-1998 regarding the instructions for taking solid samples where the sample is taken using a spear and inserted into a plastic clip that has been labeled with the name and code. The parameters tested were heavy metals consisting of Lead (Pb), Cadmium (Cd), Mercury (Hg) and Arsenic (As). The method of testing the content of heavy metals in salt in this study used the AAS (Atomic Absorption Spectrophotometer) method which was carried out in the laboratory of PT. Sucofindo Cirebon. The results of the examination of lead in salt were compared with SNI 3556-2016 regarding iodized salt and SNI 7387-2009 regarding the maximum limit of heavy metal contamination in food. The results showed the content for the three heavy metal samples, namely Cadmium (Cd) <0.008 mg/kg; Lead content (Pb) < 0.041 mg/kg ; Mercury (Hg) <0.0002 mg/kg and Arsenic (As) <0.001 mg/kg meet the quality standard for iodized consumption salt (SNI 3556:2016).

Keyword: *Salt, Consumption, Heavy, Metal*.

I. INTRODUCTION

Indramayu Regency is one of the national salt producing centers which is able to provide national salt needs of 8.46% of the total national salt requirement of 3.75 million tons in 2015 (Ardiyanti, 2016). Based on this amount, 647.6 thousand tons (17.3%) is needed for consumption salt and 3.1 million tons (82.7%) is industrial salt (BPS, 2015). The locations of salt production centers in Indramayu are in Losarang District, Kandanghaur, Losarang District, Krangkeng District and Cantigi District. Losarang District is a salt minapolitan location capable of producing 60.04% of the total salt production in Indramayu Regency in 2015 amounting to 317,122, 36 tons (DISKANLA, 2015).

Salt production in Losarang District is carried out using several technologies including traditional technology, Thread Filter Technology (TUF), and TUF and geoisolator. Salt production is done by natural evaporation with the help of sunlight.

Salt is one of the complements of food needs that serves as a source of electrolytes for the human body (Sasongkowati, 2014). The raw material for salt production comes from sea water. The sea water is very vulnerable to pollution, especially from heavy metals originating from industry. In 2018 there were 152 companies including food and beverage companies; pharmaceutical and chemical; metal and ceramics ; oil and gas ; car assambling and repair shop ; and agriculture and plantations (DLH, 2018). The construction of factories around the watershed (DAS) causes pollution of the aquatic environment, especially due to contamination of industrial waste in the form of heavy metals. Heavy metals that are often disposed of with industrial waste and will become polluting agents in the environment include: Lead (Pb), Mercury (Hg), Cadmium (Cd), Arsenic (As), and so on (Supenah, *et. al*., 2015).

Heavy metals that enter the environment as a result of the activities of human life, including wastewater from industries related to Pb, Hg, Cd and As from lead ore mining, waste from the battery industry, shipping or port activities. The waste water enters the river waters and is carried to sea waters (Palar, 2012). The heavy metals in seawater eventually enter the pond plots and follow the flow of salt production. Furthermore, it is possible that it is contained in the salt that has been produced.

In a study conducted by Yuyun et al. (2017) quantitative test results obtained for the level of Lead salt at point 2 District Liang is 0.3250 ± 0.0071 mg/kg weight dry and the content of cadmium is 0.1075 ±0.0035 mg/kg dry weight. Lead level salt at point 3 South Totikum District namely 0.2550 ± 0.0071 mg/kg dry weight and cadmium content 0.1025 ± 0.0035 mg/kg weight dry. Salt used in salted fish processing in Totikum District South, Palu city.

Heavy metals pose a significant risk to human health if exposure levels exceed the safe limits for consumption. Previous studies have shown that Pb, Cd, Hg and As have harmful effects on human health even at low concentrations. The presence of heavy metals in food affects human health. The entry of these heavy metals into the body through food can disrupt the nervous system, brain damage, paralysis, stunted growth, kidney damage, bone fragility and DNA damage or cancer (Agustina, 2014).

In order to ensure that the salt produced, especially iodized consumption salt, is free from heavy metal contamination and is suitable for consumption, it is necessary to test the quality of the salt.

II. LITERATURE REVIEW

Salt is a national strategic commodity that maintains food security and fulfills national nutrition. The function and role of salt with other basic needs has an important role. Salt is a food and raw material for industry containing mineral elements needed by humans, one of which is Sodium and Chlorine (NaCl). The existence of salt as an industrial raw material is absolutely necessary where salt is an important raw material for the processed food industry, chemical or pharmaceutical industry, leather tanning industry and food oil drilling industry, as well as for households, absolutely necessary for every household in society (Rismana, 2014).

In producing salt one of the technologies used is Thread Filter Technology (TUF) and Geoisolator. Filter Thread Technology (TUF) is carried out by engineering plots of land so that they form threads and install filters on each water channel that connects one plot to other plots. Meanwhile, salt production with geoisolator technology is carried out by coating the bottom of the crystallization table with a geomembrane so that the quality of the salt produced is free from dirt/not mixed with the soil in an effort to avoid direct contact

between the bottom of the salt crystallization table (soil) and seawater to be crystallized.

he raw material for making salt comes from sea water which is flowed into the crystallization table plot. It is very susceptible to heavy metal contamination including Lead (Pb), Cadmium (Cd), Mercury (Hg) and Arsenic (As).

Lead (Pb) is one of the metals that is toxic to humans, originating from food, drink or through inhalation from the air, dust contaminated with Pb, skin, eye and parental contact. If it accumulates in the body, it has the potential to be toxic to living things. One of the impacts caused by Pb is dental caries to osteoporosis (Moelyaningrum, 2016)

In addition, if the salt contains high Pb and is consumed by living things, especially humans, it will be very dangerous because of the persistent nature of Pb in the environment and high toxicity of lead Pb. In the human body, Pb can inhibit the activity of enzymes involved in the formation of hemoglobin (Hb) and a small portion of Pb is excreted through urine or feces. Others accumulate in the kidneys, liver, nails, fat tissue and hair (Widowati et al., 2008). Pb exposure in children will be more dangerous. Lead poisoning that occurs in children will cause a decrease in IQ and concentration of attention, difficulty reading and writing, hyperactivity and behavioral disorders, impaired growth and function of vision and movement, hearing loss, anemia, damage to the brain, liver, kidneys, nerves and digestion, coma, convulsions or epilepsy (Moelyaningrum, 2010).

Cadmium (Cd) is a soft, bluish-white inorganic metallic element and is toxic. Mild cadmium poisoning can cause nausea, vomiting, diarrhea, liver injury and even kidney failure. Meanwhile, severe poisoning can cause kidney, liver, brittle bones and damage to blood cells (Komarawidjaja et. al., 2017).

The presence of mercury (Hg) in the body can cause skin rashes, fatigue, headaches, disability, and even damage to brain function and DNA (Agustina, 2014: Widyaningrum and Suismono, 2007). Mercury (Hg) can also cause tremors, Parkinson's disease, eye disorders, nervous disorders and even death (Linder, 2010).

Arsenic (As) contamination is thought to cause various health effects such as intestinal and gastric irritation, decreased white blood and red blood cell productivity, skin changes and lung irritation. Arsenic is said to also provide an opportunity for cancer to develop more quickly, especially the development of skin cancer, lung cancer, liver cancer and spleen cancer. Furthermore, it is said that contact with high levels of arsenic can cause infertility and miscarriage in women. Other disorders are skin disorders, decreased resistance to infection, heart problems and brain damage in both men and women. Finally, even arsenic can damage DNA (Agustina 2014).

Table 2.1. Iodized Salt Quality Requirements

No.	Parameters	Requirements (mg/kg)
1.	Cadmium (Cd)	0,5
2.	Lead (Pb)	10,0
3.	Mercury (Hg)	0,1
4.	Arsenic (As)	0,1

Source : SNI 3556-2016

III. METHODOLOGY

The research was conducted in Losarang sub-district, Indramayu district, Cemara Kulon village and Krimun. The research was conducted in Losarang District, Indramayu Regency. This research was conducted by descriptive method. Data collection techniques were carried out through observation and interviews. The samples tested were salt produced with TUF and Geoisolator. The sampling technique refers to SNI 19-0428-1998 regarding the instructions for taking solid samples where the sample is taken using a spear and inserted into a plastic clip that has been labeled with the name and code. The parameters tested were heavy metals consisting of Lead (Pb), Cadmium (Cd), Mercury (Hg) and Arsenic (As). carried out in the laboratory of PT. Sucofindo Cirebon. The results of the examination of lead in salt were compared with SNI 3556-2016 regarding iodized salt and SNI 7387-2009 regarding the maximum limit of heavy metal contamination in food.

IV. RESULT AND DISCUSSION

The stages of the salt production process in Losarang District, Indramayu Regency are the same as salt production in general, which includes the pre-production stage consisting of land drying, land clearing, land mapping, land leveling on land, and making waterways. The stages of the production process consist of the process of flowing and pumping water to the reservoir, the

deposition of water in the peminihan pond (screw pond, bozem pond), the crystallization process in the crystallization pond and the harvesting process and the post-production stage which consists of transporting it to the salt storage area (Suhelmi et al. al., 2013). Heavy metal contamination in salt can occur at any stage of the production.

In accordance with PP number 82 of 2001 concerning Water Quality Management and Water Pollution Control, for people's salt business activities where sea water is the raw material, it is included in class III. Class III water quality studies in Indramayu Regency conducted by the Environmental Service in 2018 showed that the heavy metal content in the waters of the Cimanuk Watershed (DAS) for mercury (Hg) was on average 0.0082 mg/kg and arsenic was 0, 0004 mg/kg. This shows that the water in the Cimanuk watershed for the Hg parameter exceeds the required quality standard.

The results of the study above are significantly different from the results of heavy metal testing in salt conducted in Losarang District. The results of testing the content of heavy oam in salt are presented in Table 2.

Table 4.1. Heavy Metal Content Test Results

No.	Heavy Metal	Requirements (mg/kg)	Result (mg/kg)		
			Sample 1	Sample 2	Sample 3
1.	Cadmium (Cd)	0,5	<0,008	<0,008	<0,008
2.	Lead (Pb)	10,0	<0,041	<0,041	<0,041
3.	Mercury (Hg)	0,1	<0,0002	<0,0002	<0,0002
4.	Arsenic (As)	0,1	<0,001	<0,001	<0,001

Source : Processed primary data.

Based on Table 2, it shows that the heavy metal content in Losarang District meets the quality standard for iodized consumption salt. The results of the heavy metal content test for the three samples were Cadmium (Cd) of <0.008 mg/kg; Lead content (Pb) < 0.041 mg/kg ; Mercury (Hg) <0.0002 mg/kg and Arsenic (As) <0.001 mg/kg. Samples 1 and 2 are salt samples from Cemara Kulon Village, while sample 3 is salt samples from Krimun Village.

These results are due to the fact that salt samples are produced using the TUF and Geoisolator methods where the salt fields are coated with HDPE plastic so that they do not come into direct contact with the soil and use (TUF) where the salt crystallization table is filtered in the form of palm fiber charcoal, zeolite and dacron. It is hoped that pollutants and impurities can affect the quality of salt and the quality of salt. In addition, the geoisolator (geomembrane) as the basis for the crystallization table, as well as the application of enhanced thread technology to Filter Thread Technology (TUF) to increase the quality and quantity by 30-40%. Indramayu Regency has implemented TUF and Geoisolator technology since 2012 (Yasin, 2019; Hoiriyah, 2019).

Research conducted by Mukarom (2020) using 3 types of filter arrangement models used, namely model A (zeolite, coral fragments, coconut fiber, charcoal and sponge), model B (zeolite, coconut fiber, coral fragments and charcoal), model C (coconut coir fiber, charcoal, zeolite and sponge) and control. The results showed that the model B filter was able to reduce polluting metals such as Magnesium (Mg), Calcium (Ca), Copper (Cu), and Lead (Pb) better than other models. In control the content of Pb 1.20 mg/kg, Ca 2.11%, Cu 1.12 mg/kg, and Mg 6.44%. Model B is able to reduce the content of Pb 0.11 mg/kg, Ca 0.01%, Cu 0.15 mg/kg, and Mg 2.26%. In this study, it can be seen that the model B filter is more effective in filtering metals during filtration.

V. CONCLUSION AND RECOMENDATION

The conclusion obtained from the research conducted shows that the salt produced by Losarang District meets the quality standard for iodized consumption salt (SNI 3556:2016). With the results of testing the content of Lead (Pb) <0.041 mg/kg; Cadmium (Cd) of <0.008 mg/kg ; Mercury (Hg) <0.0002 mg/kg and Arsenic (As) <0.001 mg/kg.

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