

The AAS Method for Arsen Analysis in Cabbage in the Area of Sinabung Post Eruption

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Abstract: Sinabung erupts will emit hot clouds. Flowing lava will bring considerable heat. Negative Impact after the eruption of this mount is the exposure of cauliflower plants around the eruption site by Arsenic. This study aims to determine of Arsenic from various types of cabbage (white, purple, green) exposed to the Sinabung area after eruption using the Atomic Absorption Spectrophotometry (AAS) method. The sample used is stem from white, purple, and green cabbage. Preparation of green cabbage samples in analytical laboratory Universitas Sumatera Utara. Sampling uses simple random sampling technique. Process of destruction have been developed and analysis using the Atomic Absorption Spectrophotometry (AAS) method used standard solution at 0.05, 0.10, 0.150, 0.20, and 0.250 $\mu\text{g} / \text{mL}$. The wavelength used is 193.7 nm. The results of the analysis showed that the amount of Arsenic contained in white, purple and green cabbage stems was 0.0072, 0.0043, and 0.0082 $\mu\text{g} / \text{mL}$ respectively.

1 INTRODUCTION

Mount Sinabung is a Pleistocene to Holocene stratovolcano. It is located in a relatively cool area on a fertile plateau with mountains bounding the north. The summit crater of the volcano has a complex, longer form due to vents migrating on the N-S line. The 2460 meter high andesitic to dacitic volcano comes from the Sunda Arc, which is created by the subduction of the Indo-Australian Plate under the Eurasian Plate. The Andaman Islands are on the North-Northwest bound of the arc while the Banda Arc is on the East. Sinabung has a total of four volcanic craters, one of them being active currently (Endang Tri Wahyuni, Sugeng Triyono, 2012).

The various activities of Mount Sinabung certainly have positive and negative impacts on the population around Mount Sinabung. There are negative impacts that can be directly felt by residents around Mount Sinabung, for example when Mount Sinabung erupts it emits hot clouds and lava which flow with enough heat / energy. Gray-white volcanic dust has covered the forest, villages and surrounding agricultural land, so it is necessary to examine the danger of volcanic dust to the health of local resi-

dents of agricultural crops and livestock of local residents, agricultural crops and livestock. Volcanic dust after the eruption of Mount Sinabung produces Arsenic and various heavy metals that have an impact on the quality of agricultural products including cabbage (Nain Felix Sinuhaji, 2011).

Arsenic is the most toxic chemical and metalloid found in nature and is an important element of concern because it can cause toxicity and carcinogens, even at low concentrations (López et al., 2012). Exposure to arsenic in humans can be in inorganic and organic forms. The presence of arsenic in the environment can occur as natural substances and contamination from human activities. Arsenic can be found in water, air, food, and soil including from volcanic eruptions, contamination from mines, use of pesticides and fertilizers. The toxicity of arsenic has been widely known, but depends on the form of organic or inorganic arsenic compounds (Hazimah dan Nurlinda Ayu Triwuri, 2018).

Inorganic arsenic is soluble in water or in the form of gases and exposed to humans, other than that it is the most toxic element and is found in soil, air and water. Natural arsenic is produced from volcanic eruptions that can release around 3000 tons

every year and can react with halogens, concentrated peroxide and hot alkalis. The compounds of arsenic with oxygen, chlorine and sulfur are called inorganic arsenic, while the compounds of arsenic with carbon and hydrogen are called organic arsenic. Arsenic compounds are used in insecticides and as doping materials in semiconductors. Arsenic is also used to harden some lead metals (Joshi et al., 2016). Base on research conducted by the USA Organic Trade Association (2015) stating that rice, food and organic food does not guarantee that organic products do not have and are not exposed to arsenic. However, many people do not know this, even believing that organic food and food have nutrients and advantages for health and are free of arsenic compared to inorganic food. This assumption is very wrong, because organic food still contains arsenic levels as in organic rice. A study conducted by Xue, et al. (2010) to determine the amount of arsenic daily intake in the community in America, obtained total levels of arsenic exposure through food by 0.38 $\mu\text{g} / \text{kg}$ body weight / day. These results were 14 times higher than the amount of arsenic exposure from drinking water. From the results obtained it can be concluded that Americans are more exposed to arsenic through food than through drinking water (Joshi et al., 2016). Exposure to arsenic in humans has caused many diseases in humans that have occurred and have been evaluated by countries throughout the world. These adverse effects on health have led countries such as Canada to increase safety of exposure to arsenic in drinking water by reducing arsenic requirements in drinking water from 50 $\mu\text{g} / \text{L}$ to 25 $\mu\text{g} / \text{L}$ (Mukherjee et al., 2006).

Arsenic compounds in inorganic forms are more toxic than organic. Arsenic is carcinogenic because long-term exposure can result in an increased risk for various carcinomas including the skin, bladder, lungs, kidneys, liver and prostate. The effects of arsenic are related to changes in gastrointestinal, cardiovascular, hematological, pulmonary, neurological, immunological, reproductive and long-term effects of arsenic can cause cancer (Joshi et al., 2016). According to the International Agency for Research on Cancer (IARC), arsenic is included in the first class as a carcinogen and states that arsenic can cause lung, skin and bladder cancer in humans without a minimum threshold where small amounts of arsenic can be harmful to human health (López et al., 2012).

Evi Ekayanti Ginting (2018) has examined the analysis of metal arsenic (As) in rice. The results showed that the highest levels of arsenic metal in rice circulating in the city of Medan were 3.71 mg / kg in brown rice, 3.40 mg / kg in brown rice, 0.33 mg / kg

in white rice and 0.13 mg of black rice / kg. (Ulfa, 2015). Ridwan, M. H. (2012) analyzed Arsenic (As) metals in spinach showing the results that in Green spinach (*Amaranthus tricolor*) a concentration of 0.35 mg / kg was obtained While the red spinach (*Blitum rubrum*) obtained a concentration of 0.40 mg / kg. Arsenic (As) compounds are thought to be exposed to cabbage farmers who are exposed to the eruption of Mount Sinabung. In this study, purple, green and white cabbage leaves were analyzed using the Atomic Absorption Spectrophotometry (AAS) method.

2 MATERIALS AND METHODS

2.1 Collecting and Preparation Sample

In this work, the population was green cabbage vegetables in the area after the eruption of Mount Sinabung. Sampling uses simple random sampling technique (random sampling). In this method the sample members choose directly from the entire population without being calculated based on the population because they consider having the same number to be chosen. So this way is considered a large group, while samples are taken to represent the population. 100 g of cabbage is washed with running water and drained dry. Then blend until smooth.

2.2 Destruction Process

The white, purple, and green cabbage @0.5 g) put into the vessel, added 5 mL of 65% HNO_3 and 3 mL of 37 % HCl. Then let stand for 10 minutes so that the sample dissolves. Vessel is inserted into the microwave at 180°C for 30 minutes until destruction occurs perfectly which is marked by obtaining clear liquid. Then the destruction results are cooled and put into a 50 mL volumetric flask and filled with demineralized acua to 50 mL and filtered used Whatmann paper No. 41.

2.3 Calibration Curves Used AAS Instrument

The standard Arsenic solution (1000 $\mu\text{g} / \text{mL}$) was piped 10 mL and then put into a flask measuring 100 mL and filled to the mark line with aquadest (concentration 100 $\mu\text{g} / \text{mL}$). Then piped 5 mL and then put it in a flask measuring 500 mL and filling it up to the mark line with aquadest (Concentration of 1 $\mu\text{g} / \text{mL}$). Retweeted (0. 0.5; 1; 1.5; 2; 2.5) mL was put into a flask measuring 100 mL and filled to the

mark line with aquadest until concentration (0; 0.005; 0.01; 0.015 ; 0.02; 0.025) $\mu\text{g} / \text{mL}$) and measured the absorbance by atomic absorption spectrophotometer at a wavelength of 193.7 nm. The absorbance value and concentration will be plotted to obtain the calibration curve and then calculated the regression equation.

2.4 Determination of Arsenic Levels

The solution of the destruction of the sample, HCl, NaBH₄, is flowed by the pump to manifold to mix and forward to the coli (circle) to form a hydride. Steering is measured using an atomic absorption spectrophotometer at a 193.7 nm wavelength equipped with Vapor Hydride Generation Accessories.

3 RESULTS AND DISCUSSIONS

The results of the study of Arsenic levels exposed to white, purple, and green cabbage are as follows Figure 1.

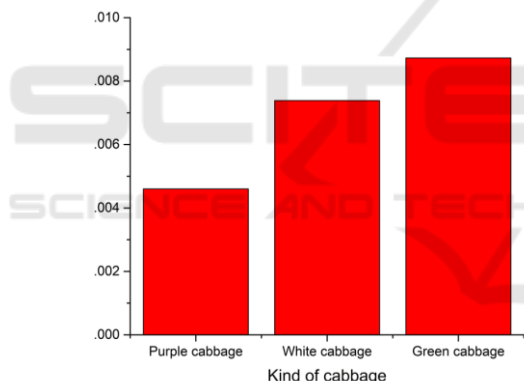


Figure 1: Arsenic concentration in cabbage.

Standard Solution Absorption Measurement Results on Metal Arsenic (As) nn Wavelength of 193.7 nm are follows Table 1 and the last square equation at Figure 2.

Table 1: Standard solution Absorption at 193,7 nm.

No.	Concentration ($\mu\text{g} / \text{mL}$)	Absorbantion (A)
1	0.05	0.0121
2	0.10	0.0221
3	0.15	0.0320
4	0.20	0.0412
5	0.25	0.0522

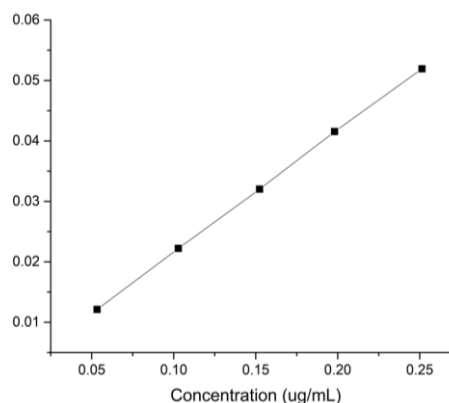


Figure 2: Concentration vs Absorbantion.

This research was conducted with analyze the metal content of arsenic (As) in white, purple, and green cabbage found in Mount Sinabung post eruption using atomic absorption spectrophotometry (AAS). Advantages of the method Atomic Absorption Spectrophotometer (SSA) compared with ordinary spectrophotometer that is specific, low detection limit of solution the same can measure different elements, measurements directly towards the sample, output can be read directly, enough economical, can be applied to many types of elements, limit levels Determination of area from $\mu\text{g} / \text{mL}$ to %. The purpose of destruction is done is to overhaul the organic compounds contained within sample, so that it will be obtained last simpler compound the remaining HNO₃ is removed by means of heated on a hot plate inside fume hood to prevent inhalation of NO₂ (poisons). Then sample that has been destroyed diluted with distilled water until 50 mL, then filtered using Whatman filter paper no. 41. Until a clear solution is obtained. Filtrate obtained is used for analysis of arsenic metal content using a spectrophotometric device atomic absorption at length wave 193.7 nm (As).

Cabbage are a great source of vegetable protein and many contains vitamins A, B and C, especially in the seeds. Several types of cabbage which is cultivated among green cabbage, compost beanspurple cabbage, and white cabbage. Cabbage have important potential in the framework fulfillment of nutrition, foreign exchange earnings, improvement of community welfare, and improvement in farmer's income. The results of the eruption of Mount Sinabung emitted smoke thick black with sand, and volcanic dust covering thousands of hectares of farmers' crops which are under a six kilometer radius covered in sand dust. Volcanic dust causes many farmers' plants on the slopes of the mountain to die and be damaged. It is

estimated that an area of 15341 hectares of displaced agricultural crops from Mount Sinabung is threatened with crop failure and one of which is the exposure of arsenic specific metals.

4 CONCLUSIONS

Arsenic from various types of cabbage (white, purple, green) exposed to the Sinabung area after eruption using the Atomic Absorption Spectrophotometry (AAS) method was determined. Atomic Absorption Spectrophotometry (AAS) method was applicated used standard solution at 0.05, 0.10, 0.150, 0.20, and 0.250 $\mu\text{g} / \text{mL}$. The wavelength used is 193.7 nm. The results of the analysis showed that the amount of Arsenic contained in white, purple and green cabbage stems was 0.0072, 0.0043, and 0.0082 $\mu\text{g} / \text{mL}$ respectively.

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