# Analysis Of Heavy Metal in Panjang Island Central Tapanuli Population Zone

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**ABSTRACT:** A research has been conducted to analysethe heavy metals in resident zone around Panjang Island water, Central Tapanuli.The aim is to observe the content of heavy metals Cu, Cr, Pb and Fe in sea water at each data station and the distribution pattern of heavy metals level due to the existence of heavy metals source to resident zone surrounding Panjang Island water. Sea water sampling was conducted at six points. The test of sea water was conducted using Atomic Absorption Spectrometer (AAS) using light adsorption principle by atoms. The result showed that the heavy metals Cu = 0.006 mg/l, Cr = 0.025 mg/l, Pb = 0:13 to 0:20 mg/l, and Fe = 0:19 to 0:42 mg/l. Based on the heavy metals distribution point, Coal ash disposal area to the residential area around Panjang Island have heavy metals level above the average sea water quality standard 0:32 mg/l. The differences metal content in each point due to natural factors such as the direction of sea wave, precipitation and sediment material and anthropogenic factors such as demographic residential waste pollution, industrial and port activity.

**KEYWORDS:** heavy metal, Panjangisland, seawater, AAS

## 1. INTRODUCTION

Panjang island (Figure 1) is one of islands which is located in West Beach Sumatera Island and part of Sibolga city, administratively. Panjang island is located at 1° 45.087 north latitude and 98° 44.857' west longitude, geographically so that be a part of Sibolga sea area or Tapanuli bay.

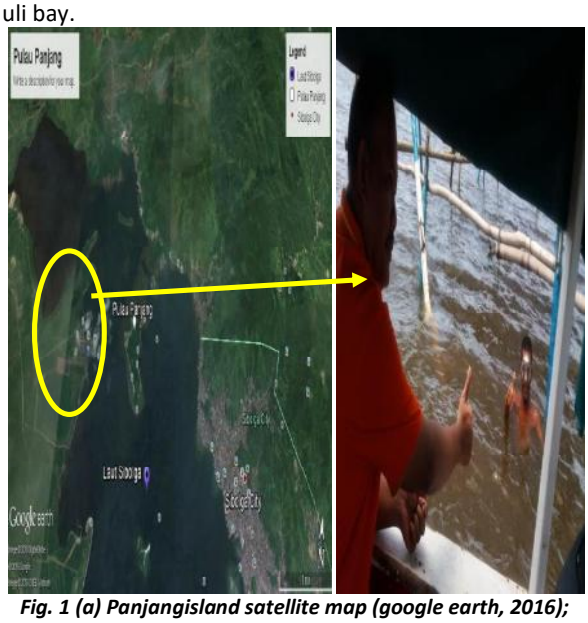


***Fig. 1 (a) Panjangisland satellite map (google earth, 2016); (b) Seawater condition***

The group of Tapanulibay island consist of PoncanGadang island, PoncanKetekislamd, Panjang island, Palak island, Sarudik island and Bangkai island. These islands have abundance of natural resources with high economic value such as coral reef, seagrass, fish and other marine life, as well as sandy beaches [1].

The location of Panjang island which is near with TapianNauli resident affected pollution that come from some factors such as port and household waste causing damage to organisms in the sea. Central Tapanuli statistic data in 2015 mentioned that TapianNauli has 22.741 person with crowding 274 person/ $km^2$ with 240 active industry companies [2].

Pollution potential due to population factor and industry existence such as coal ash area in Nauli, Central Tapanuli need to observe daily for avoid damaging of ecosystem. Heavy metal compound can be found on industries waste. Coal ash waste from Nauli village, central Tapanuli has heavy metal Cr = 38.95 %; Cu = 23.35 %; Fe = 19.77 %; Pb = 10.32 %. Study about hydrogeology in LabuhanAngin Power Station Landfill Station by Sitepu[3] mentioned that topography condition on coal ash be estimated has flat surface with mix between sandy soil and sea sand. Around the location can be found pond and swamp, however do not have channel relation flow to the sea. The fact showed that the volume of water in pond and swamp are not influenced by tidal.

When the underflow is calm which is the Sibolga water condition changed the color from blue become green as though look like muddy water with float sediment so that resist sun penetration process and coral reef is bleaching then die. Climatology data showed that the highest temperature of Tapanuli bay surface is happened in 1998, about 29,89$^0$C. This problem decreased coral reef as many as 1 mm (10,5%) than last year [4]. The fact of resident and industries existence in Panjang island need to analyse to make sure heavy metal pollution sources for monitoring the quality of Panjang island water based on heavy metal level in the seawater [5].

**LITERATUR REVIEW**

The coast area usually has ecologist pressure such as pollute that came from human activities. So much materials of pollutes in coast area is one of serious threats for water organisms [6]. The existence of heavy metal in seawater and beach come from many resources such as mining, household, agriculture waste and industries waste. Heavy metal is non degradable by organisms in environment and accumulated to environment then settled on beneath the water and shape complex compound with organic and inorganic material by adsorption and combination.

Pollution of heavy metal such as copper (Cu), chromium (Cr) can be happened by some medias like air, soil, plant, water even food. Heavy metal like Lead (Pb) is persistence and toxics and could be accumulated in food chain. Thereby also Cu, even though be needed in less for metabolism activity but could accumulate in organism body if the concentrate in the water is high [7]. Based on minister of Environmental regulation of Indonesia number 51 year 2004 about heavy metal level based on organic chemistry threshold test with Spectrophotometry method is Lead (Pb) = 0.005 mg/l; Copper (Cu) = 0.05 mg/l; and Chromium (Cr) = 0.002 mg/l.

Water pollution have to be controlled for avoid a serious problem for life even around nature such as do analysis for substance in the water. Spectrometry is a substance quantitative analysis method that be measured by light radiation or

absorbed by the atomic species in the free state. One part of spectrometry is known as Atomic Absorption Spectrophotometry (AAS).

## 2. RESEARCH METHOD

Samples of seawater have conducted on March 26, 2016 in Panjang Island Water. Previously, coordinate gridding has been done at some data collection point for determine data collection stations (Figure 2).

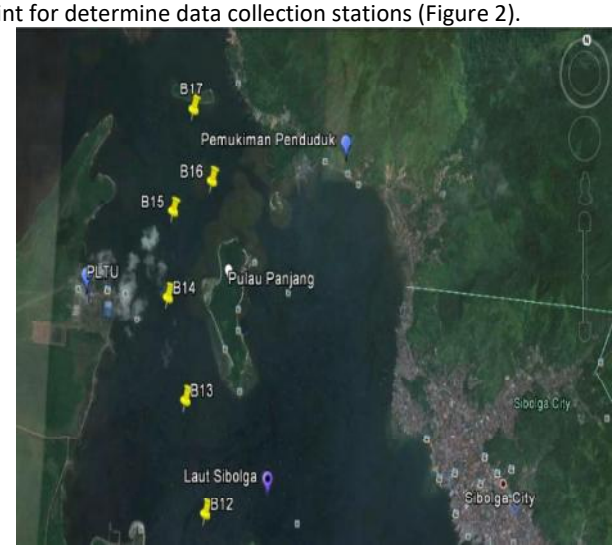


***Fig. 2 Gridding point for seawater samples***

The seawater samples from each datum collection point are put in bottles of 500 mL and coded to facilitate the process then packed for tested process. The testing of heavy metal composition is done at Testers Research and Industry Standardization Testers Laboratory Medan. The testing of metal composition be done with Atomic Absorption Spectrometry (AAS) method which is based on energy absorption by gas neutral atoms, therefore needed heat. Preciously, research procedures are summarized in the flow diagram in Figure 3 as follows:

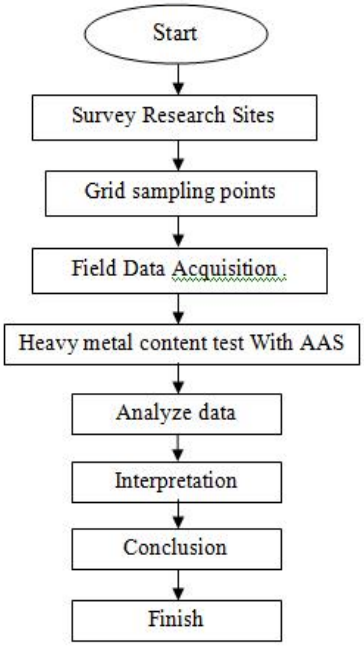


***Fig. 3 Research flow diagram***

## 3. RESULT AND DISCUSSION

The study site is divided become six station and each coordinate for those site showed on Table 1.

***Table 1: The Stations Of Seawater Sample Study Site***

| Station number | Sample code | Studi Site | |
|---|---|---|---|
| | | Resident Zone | Panjang Island |
| **1** | B12 | ± 3,5 km | South |
| **2** | B13 | ± 3,2 km | Westsouth |
| **3** | B14 | ± 2,8 km | West |
| **4** | B15 | ± 2,5 km | Northwest |
| **5** | B16 | ± 2,1 km | North |
| **6** | B17 | ± 1,7 km | North |

From Table 1 above known that if the station number is bigger, the distance is closer with resident and coal ash area at LabuhanAngin. The result of heavy metal composition from six station study site and Table 2 showed it.

***Table 2: Heavy Metal Composition Of Seawater Sample***

| Station | Metal Composition (AAS method) | | | |
|---|---|---|---|---|
| | Fe | Cu | Cr | Pb |
| **1** | 0,33 | <0,006 | <0,025 | 0,13 |
| **2** | 0,34 | <0,006 | <0,025 | - |
| **3** | 0,42 | <0,006 | <0,025 | 0,20 |
| **4** | 0,26 | <0,006 | <0,025 | - |
| **5** | 0,41 | <0,006 | <0,025 | - |
| **6** | 0,19 | <0,006 | <0,025 | 0,13 |

## 4. DISCUSSION

Based on Table 2 above, heavy metal composition in industry area, resident area and sea area was observed with metal quantity relation graph with study site station showed in Figure 4.

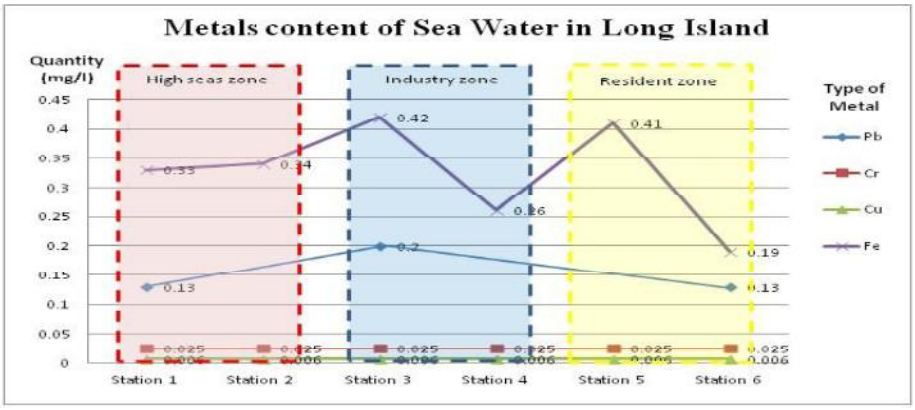


***Fig. 4 Metal composition at each seawater sample station***

Based on Figure 4, known that Iron (Fe) and Lead (Pb) content are dissolved to seawater which is more far from northern part to resident area (sixth station) is higher due to some factors, one of them affected the movement of sea flow direction from south to north that distributed heavy metal is deposited in Tapanuli river bend (Station 1, 2 and 3). The precipitation in river bend due to exiled resident waste (as primary drainage) affected Fe and Pb in resident area (station 4, 5 and 6) known has overload than the standard that is 0.005 mg/l. This case is happened by house waste and industry waste that be carried by sea flow from land. The river that flowed to Tapanuli bay is known such as AekDoras, Sihopo-hopo, AekMuaraBaiyon and AekHorsik. Meanwhile, the Copper (Cu) and Chromium (Cr) content in all station are quite similar.

When the research did, the wave of seawater in Panjangisland is calm. This condition affected heavy metal surrounding Panjangisland is low dilution then Copper and Chromium is also low.

The existence of coal ash area in industry zone is not the source of Metal pollution in Panjangisland. Based on Sitepu[3] mentioned that never happened the intertidal to swamp at coal ash area. Consider about the surface in coal ash disposal are is higher than sea that the topography is 0-2 meters. This statement is more affected with subsurface structure research at coal

ash area Nauli, Central Tapanuli showed that subsurface structure is dominated by clay with resistivity value between 1-100 Ωm. The layer of clay is known as adsorbent toward metal, so it can hold out heavy metal distribution to environmental. The distribution of heavy metal based wind directions

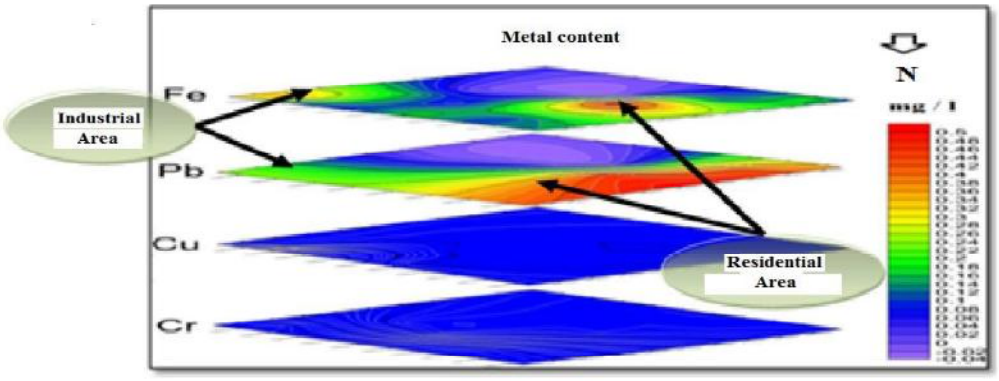


***fig 5. The contour of metal content testing***

Iron (Fe) content in coal ash zone is higher than resident and industry zone. The average of the metal content Fe = 0.21 mg/l. Lead (Pb) content is the highest at resident and industry zone. The average of Lead (Pb) = 0.08 mg/l which that value is higher than the standard of KNLH that is 0.005 mg/l. Copper (Cu) content = <0.006 mg/l and Chromium (Cr) =<0.025 mg/l [8].

## 5. CONCLUSION

Based on result analyse of study site data can be concluded below:

1. The average of heavy metal contents such Cu, Cr, Pb, and Fe from each seawater station are < 0.006 mg/l, < 0.025 mg/l, < 0.08 mg/l, < 0.21 mg/l, respectively.
2. The mapping of pollution source showed that have been happened metal deposited which is come from house waste pollution (anthropogenic factor) surrounding Panjangisland.

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