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ANTHROPHEGENIC CAUSES ANALYSIS ON HEAVY METAL POLLUTION IN RIVER WATER AND SEA WATER IN MIDDLE TAPANULI REGENCY NORTH SUMATERA

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ABSTRACT

The research of human activity analysis on heavy metal pollution in river water and sea water parameters in Middle Tapanuli North Sumatera has been done. River water and sea water parameter measurement parameters of river water and sea water as much as 5 locations in terms station point value DO, BOD, arsenic, cadmium, timbale and copper, Fe. Parameters tests was carried out in BTKLPPM Medan with methods / tools titrimetric and ICP. Testing of heavy metals on coral reefs by atomic absorption (AAS). The analysis results of river water quality in 5 points station locations have been contaminated with DO and BOD values above the threshold quality standard. There is Cu at the first point station location, Fe at the first and forth point station locations. The analysis results of the of sea water quality in 5 station locations showed that DO values is above the threshold quality standard, BOD at the first and fifth location are above the threshold quality standards. There is Cu at the first, second, forth and fifth point station locations. The analysis results of AAS on coral reef are have heavy metals Cu, as well as the increase in the number of industries that greatly increased during the year.

Keywords: *Parameter river water, sea water parameters, coral reef*

INTRODUCTION

The activity of human resources as the environment possessor on the earth has a big role in environment conservation. The progress that has been reached brought bad impact toward the viability of environment especially to the coral reefs life in Tapanuli Tengah Regency. Based on the provision of Tapanuli Tengah Regent No 421/DKP/Tahun 2007 about marine conservation area in Tapanuli Tengah adjudicating the validity of Undang-undang No 32 Tahun 2004 about the government of Tapanuli Tengah regency that has the authority to manage the coral ecosystem in maritime territory to provide the protection of water resources and the coral reefs. And to find out how far this rule has come to the people and has carried out as the natural resources that is need to be conserved and to be cultivated, the researcher had done direct interview with chief of village, the inhabitants, the fishermen along with the questioners to 50 correspondents including Kolang, Barus, Sarudik, Tukka, Pandan, Sitahuis and Sorkam sub districts showed that 96% of the inhabitants liked the beauty of nature, 60% of the inhabitants knew that there are industries that threw away their waste disposal directly to the sea. The

statistical data showed the number of inhabitants in Tapanuli Tengah regency has been increasing in 25 years since 1988 – 2012 but the distribution didn't even. Considered by the population density, Pandan sub district has the highest number of population that is 1.297 people per km² and the lowest number of population is Kolang that is 42 people per km². With the increasing of population density as well as household activities that's caused the river and sea water become turbid, and so the zooxanthellae cannot photosynthesizing to produce oxygen for the marine biology especially the coral reefs.

Secondary data from Badan Pusat Statistik Provinsi Sumatera Utara shows that the industrial growth is in fourth order that is 11.27 percent. The data shows that the number of industries has increased in 2007 was dominated by plywood industry and the average amount of industries until 2012 were dominantly fish meal, fish marinating, harbors, pertamina, PLTUs, latex factories and ice factories. The flow rate of these industries would increase the level of nutrition and environmental toxic in the river and sea, if the waste disposal of those industries hasn't processed maximally and were thrown away directly to the river and the sea it will add more nutrition and the excessive growth of algae, then the ecosystem will become unbalanced especially the coral reefs.

Coral reefs has formed since thousands even million years ago from the sedimentary of massive calcium carbonate (CaCO₃) (Veron, 2008). Coral reef was created naturally, occupied by thousands of unique flora and fauna of great value. More than quarters of marine species live dependently on good condition coral reefs. Result of Tim (CRITC, 2006) total dissolved oxygen level in Tapanuli Tengah water generally still normal that is 4.25-6.88 ppm with average 6.28 ppm. pH level in the same area is also good that is about 7.6-8.1 with average 7.

Result of Heni Susiati research (2008) in Jepara showed that there are Cu, Cr, Zn and Fe metals in the coral reefs caused by mining, motor vehicle, factories pollution that went through rainfall and rivers. Metals that contained in food are come from contaminated zooplankton. According to Burke, 2012 pollution that comes from river can threat 45% coral reefs and the coastal construction threats more than 30% of coral reefs.

METHODOLOGY

The provision of environmental ministry number 51 yr. 2004 about standard quality of sea water by adjudicating the implementation of article number 4 government rule number 19 yr. 1999 about pollution control and/or sea damaging. Parameter of sea water has taken in 5 station point near industrial zone and coastal residence Tapanuli Tengah Regency. The data of sea parameters were observed chemically that is OD, BOD, and also the metals that contained such as arsenic, cadmium, plumbum and cuprum, Fe. Sea water testing was done in

BTKLPPM Medan. BOD and OD were measured by Titrimetric, for the metals contained were determined by ICP instrument.

There were 5 rivers that's has been taken sample that flowing into the sea. Water samples were also done in BTKLPPM Medan by instrument SNI 06-6989.14-2004. Cu, Cd, Pb, As level were measure by ICP instrument, and Fe level by spectrometer. The ICP (Inductively Coupled Plasma) work principle is designed to produce plasmas; it's needed the argon gas current, high frequency magnetic field, spark generator and the medium where plasmas were produced. Plasmas forming depend on magnetic field that's strong enough. With RF generator as the voltage power to turn on the plasmas and argon gas. This voltage was transferred into the plasma through load coil. When the gas went into the plasmas then atom excitation will occur that's generated back to its normal condition by radiating energy on certain wavelength. Wavelength of each element has different properties. Energy intensity that's emitted in wavelength proportional with concentration from the elements in analyzed samples.

Atomic absorption analysis (AAS) in coral reefs started in coral sample from Milling with ball mill for an hour, and then it's sieved and weighed obtained 0.527 gr, after that added nitrite acid (65%) 5 ml, heated until it dissolved and then left until the sample gets normal temperature. The next step is adding nitrite acid (5%) 50 ml, stir until it homogeny and sieved. The sample then was absorbed into the nebulizer, turned into aerosol with using pressured air, and broke again with using flow spoiler so that it produces particles that are smaller and finer, particle that went through will be mixed with oxide gas and fuel.

RESULT AND DISCUSSION

Human Activity. Human activity observed by population density, according to statistical data in regency level (BPS Sumatera Utara) is known that population growth in Tapanuli Tengah regency has been increasing. In diagram 1 shows inhabitants in Tapanuli Tengah regency in 25 years since 1988-2012 but the distribution didn't even. Considered by the population density, Pandan sub district has the highest number of population that is 1.297 people per km² and the lowest number of population is Kolang that is 42 people per km². With the increasing of population density as well as household activities that's caused the river and sea water become turbid, and so the zooxanthellae cannot photosynthesizing to produce oxygen for the marine biology especially the coral reefs.

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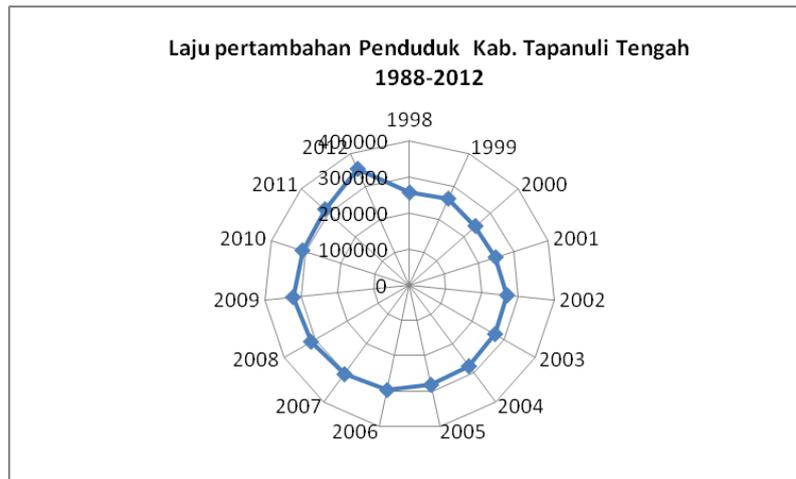


Figure 1. Population growth in Tapanuli Tengah

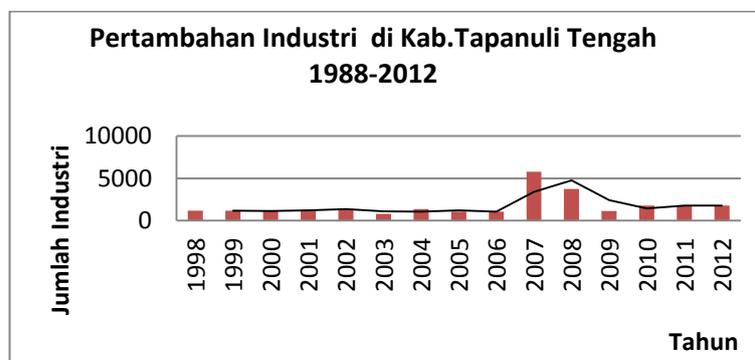


Figure 2. Industry growth rate

River water analysis. From the river analysis shows the level of BOD from all five rivers pass through standard quality 2 mg/l, the highest level was in Baiyon and the lowest in Sarudik, as well as DO level for all five rivers less than minimal standard quality 6 mg/l. Cu and Fe contained have passed standard quality in Sarudik river. Pb level in Sarudik and Sibuluan river had the highest amount while the As and Cd contained in all five rivers were still under the standard quality.

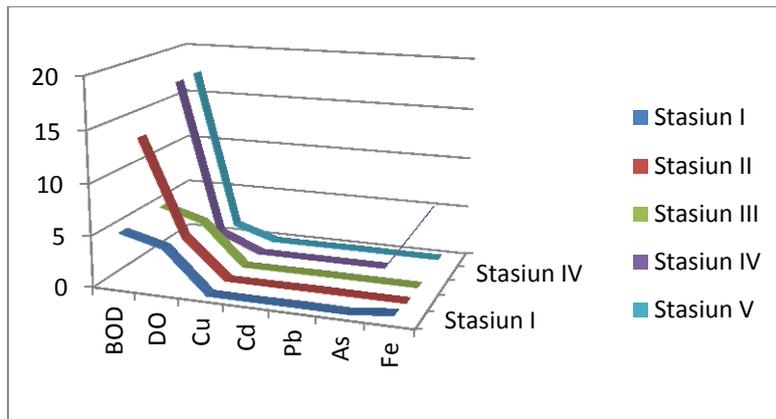


Figure 3. The river parameter analysis



Figure 4. The river water location two

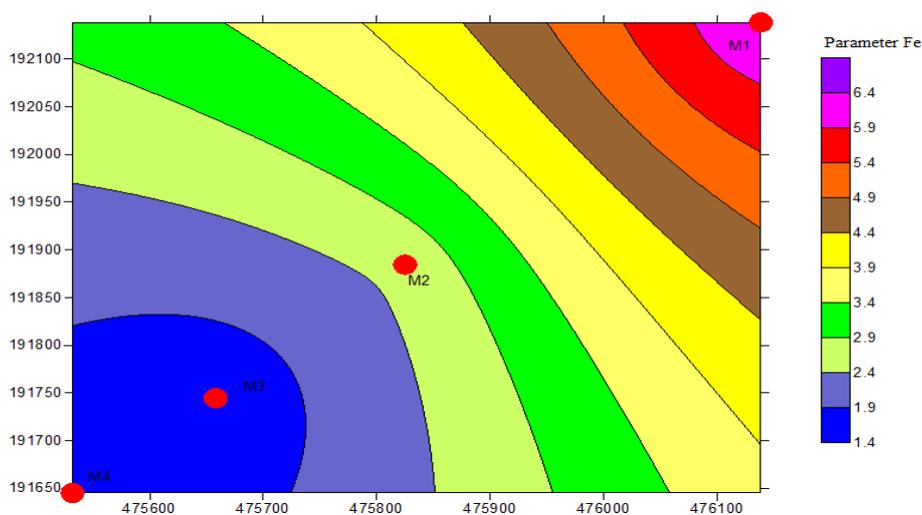


Figure 5. Fe contour river water

Sea Water Parameter analysis. Sea water parameter analysis has shown four location stations from five measurement location station where is around the coast Middle Tapanuli

Regency has already been contaminated with heavy metal copper dan timbel. This case show that has already discarded production result as waste around coast, mining, protect maximally and restore riparian vegetation in the form of vegetation throughout rivers and creeks. As a result these wastes can threaten marine biota.

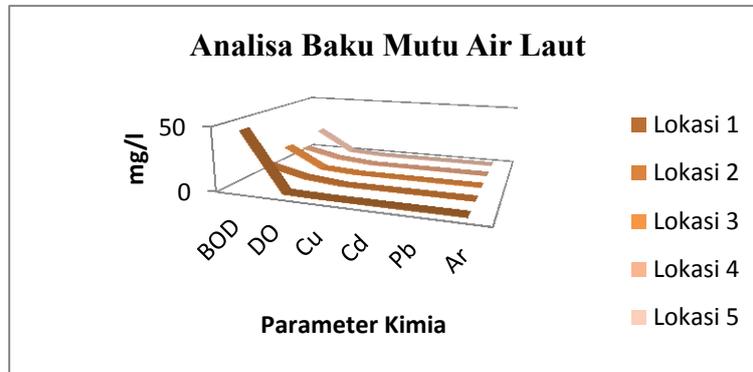


Figure 6. Sea water parameter analysis

Measurement result of Biochemical Oxygen Demand (BOD) that was measureable with minimum BOD is 9,89 mg/land maximum 46,43 mg/l. BOD threshold value that is set for marine biota is 20 mg/l. From sighting point, the first and the fifth locations are category of contaminated water. While area built, it is not maximal within waste processed yet aiming river water and sea water. There is not erosion's manage yet, precipitate and hara element were carried out to coast water pass through agriculture.

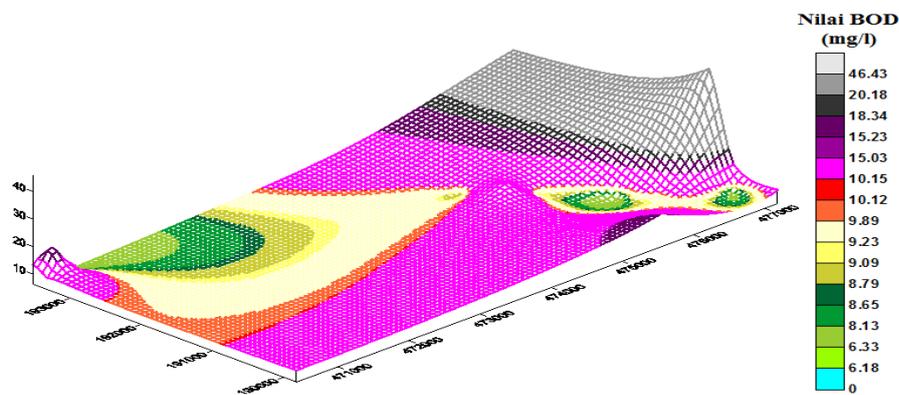


Figure 7.BDO contour of sea water

Measurement result of minimum Dissolved Oxygen (DO) values amount 0.79 mg/l and maximum DO value amount 2.95 mg/l. For the threshold values specified DO marine tourism that is > 5 for aquatic life can survive if there is minimum dissolved oxygen amount 5 mg of oxygen per liter of water (5 ppm). Sea water sampling locations in the five stations around the location of industry and area residents are included in the category of polluted water

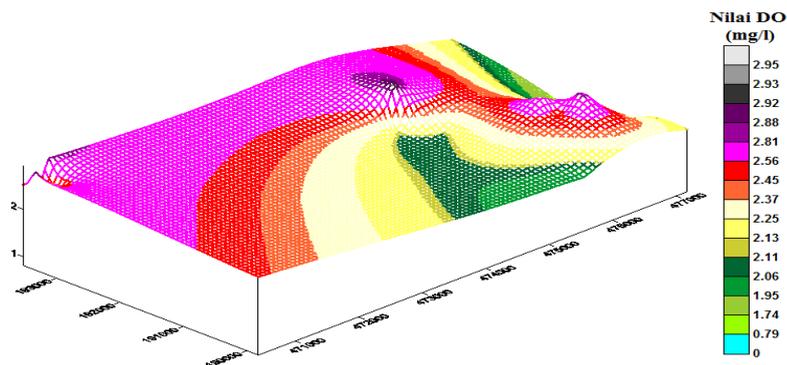


Figure 8. DO contour of sea water

Copper metal content measurement results indicate the minimum value 0.0213 mg /l and maximum 0,0600 mg/l. The value of the threshold levels of copper for the harbor water is 0.05 mg /l. This case shows that the second, the forth and the fifth location V in the category have been contaminated by heavy metals

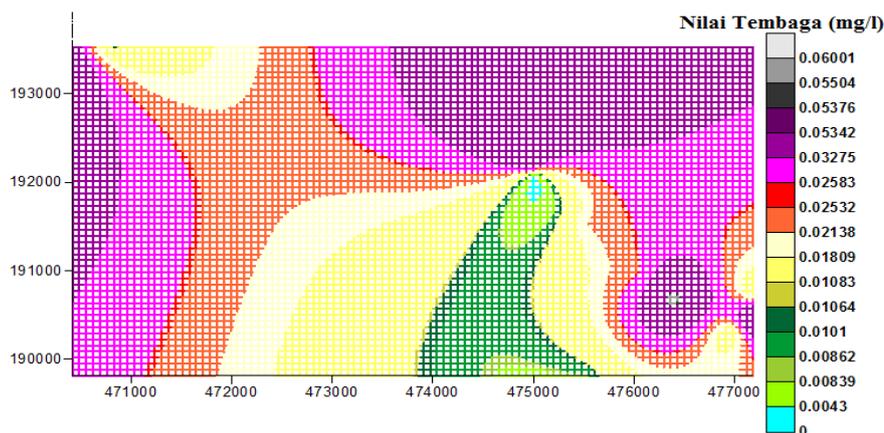


Figure 9. Copper contour in seawater

The results of measurements of cadmium metal content in the industry. The threshold values specified levels of cadmium metal to the port is 0001 mg / l. All measurement stations from I to V are included in the category of water that have not been contaminated by metals.

The results of measurements of plumbum metal content in the industry the minimum value is 0.01331 mg /l and the maximum value is 0.05792 mg /l. Threshold value is 0.005 mg /l. Result of measurement showing thesecond location category polluted waters.

The threshold values for arsenic levels of marine biota is 0.012 mg /l. Data from all points of measurement showed the lowest value is 0.025 mg /l and the highest is 0.0006 mg /l be category of good water and has not been contaminated yet by arsenic

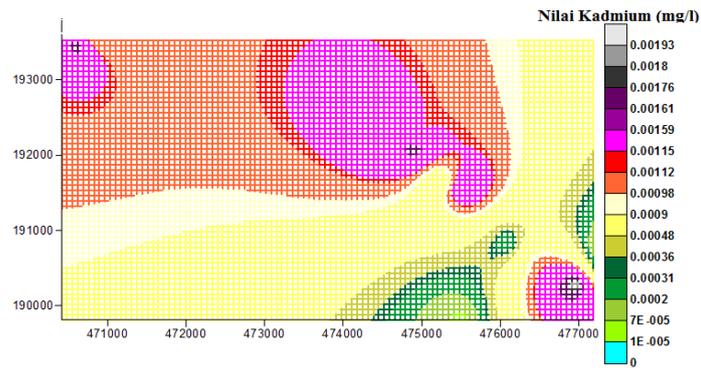


Figure 10. Cadmium contour of sea water

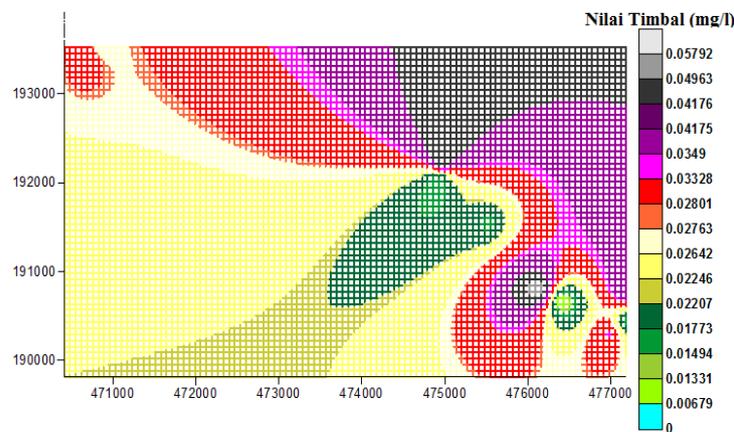


Figure 11. Plumbum contours of sea water

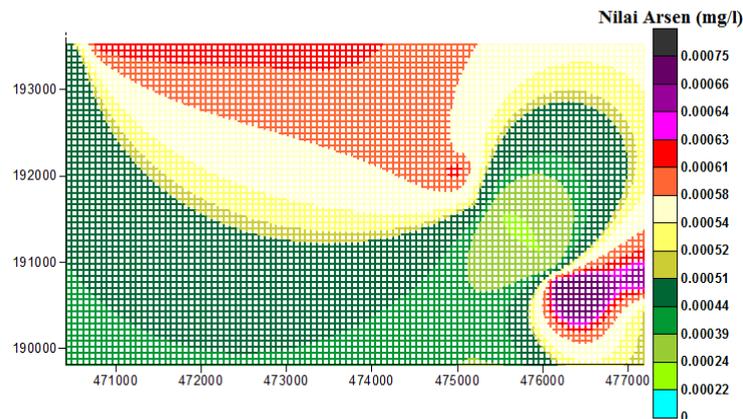


Figure 12. Arsenic contour of sea water

Analysis of heavy metals on coral reefs. Indicator of heavy metal pollution in sea water were analyzed through atomic absorption (AAS), then analyzed contained Cu at 0.684 mg /l, 0.690 mg /l, 0.693 mg /l with the average of measurement 0.689 mg /l. It is predicted that presence of heavy metals, it shows weak watershed management, nutrient additional and eutrophication from agricultural activities that bring sediment and pollutants in large quantities into the rivers and creeks. Pollution in sea water was observed in the industrial area which is not

independent of the number of shipping activity. Expected to optimize water conservation districts Middle Tapanuli that has authority over the management of marine ecosystems, especially coral reef growth.

CONCLUSION

Results of analysis of river water quality in the 5 points station location have been polluted with BOD and DO in the threshold quality standard. There is Cu at the first point of station location, Fe at the first and the fourth point station locations. The results of the analysis of sea water quality at 5 stations location show that the value of DO is above the threshold quality standards, BOD location I and V above the threshold quality standards. It is contained Cu at the station location points I, II, IV and V. The results of AAS analysis on coral reefs there is Cu with the average of measurement 0.689 mg /l.

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