

The physical and chemical characteristics of Asam-Asam River, South Kalimantan

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Abstract: *The aims of the research is to describes the main chemical aspect of Asam-Asam River in South Kalimantan. Water sampled from five zone along Asam-Asam River, and chemical compound of sampled water was analyzed descriptively. Result of the study shows that The sediment texture of Asam-Asam River were dominated by sands, followed by clay and dust. This research found the water sample from zone 2 has the highest organic level (3.64%), followed by zone 3 (2.31%), zone 4 (2.24%), zone 1 (1.70%), and zone 5 (1.28%). The high level of C-organic in zone 2 indicates the high input of organic material in the area, represent the intensive human activity in zone 2. Water pH ranges from 5.55 to 7.75. The lowest pH were recorded from zone 4 (pH=5.5) while the highest pH were recorded from zone 1 (pH = 7.75). The Cadmium level in zone 1 was 0.0010 (mg/gr.), zone 2 was 0.0012 (mg/gr.), zone 3 was 0.0011 (mg/gr.), zone 4 was 0.0011 (mg/gr.), zone 5 was 0.0013 (mg/gr.) and zone 6 was 0.0007(mg/gr.). The highest zinc level was found at sampled water of zone 5 (0.060 mg/gr.), following by zone 3 (0.034 mg/gr.), zone 4 (0.030 mg/gr), zone 2 (0.018 mg/gr.), zone 6 (0.009 mg/gr.) and zone 1(0.005 mg/gr.). The highest lead level was found at sampled water of zone 5 (0.0015 mg/gr.), following by zone 3 (0.0012 mg/gr.), zone 4 (0.0012 mg/gr.), zone 2 (0.0014 mg/gr), zone 1 (0.0012 mg/gr) and zone 6 (0.0009mg/gr.).*

Keywords: *Water pollution, sustainable river management, river quality*

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I. Introduction

River is one of the important ecosystem in the earth. The contribution of river to support human live in the biosphere has been identified crucial. River contains numerous biodiversity, in which it is important to support human live. River is fundamental to the structure of most landscapes in the earth. Rivers, economically, is important space for human. Rivers provides space for aquaculture activity of many local people along the river stream. In many countries, river is part of the human culture. River is an integral part of human daily life, and river contributes to the socio-cultural aspect of many communities in the world. Besides provides resources with high economical value, river is the important corridor movement among local community, both in modern and developing countries. The uses of river for human corridors have been identified important to changes water quality, in which it is important in biodiversity conservation [1] [2].

River is an important ecosystem in Kalimantan Island, Indonesia. Geologically, Kalimantan has abundance wetland and rivers, in which many of them important to support biodiversity n living system in Kalimantan as one of the important biodiversity. Socio-culturally, river contributes to the socio-economical aspect of local community in Kalimantan. In the past, river is an important corridor for local people movement and material transport from place to place. River provides space for community interaction and leads numerous local economic and business connections among local dwellers of the island. River has been contributing to the economic development of many remotes villages in Kalimantan Island. Simply, in the absent of terrestrial road, river contribute to the regional development in Kalimantan [3] [4].

River is home to numerous biodiversity of Kalimantan. Rivers provides habitat for numerous invertebrates, fishes, reptiles and mammals. Rivers support wildlife for the survival of numerous Kalimantan's wildlife. Scholar point out that the conservation of Kalimantan's biodiversity is important, especially to protect future potential bio-resources which area still poor studied [3].

Human impact on river ecosystem has been widely reported influence river ecosystem changes. Forest degradation in the upper area recently has been occurred over the past decades, and it is contribute to the degradation of rivers. Most of the report highlight the river degradation related to the pollution. Rivers disturbance in South Kalimantan has in fact been increasing, especially with the increased human activity along the river sites. There is also contribution of mining activity in river pollution. The contamination of heavy

metals and other chemical compound in water body is crucial environmental issues in Kalimantan [5] [6]. Numerous works has shown that there is generally a rapid pollutant increase in many rivers. A high and continuous pollution may exist where there is high industrial activity [7] [8].

The rapid development of many areas along the river serves both positive and negative impact. Among the negative impact, river pollution has been identified important for the sustainability of human along rivers. The quality of river has correlation with the community health. Rivers is important ecosystem to support fresh water for numerous purposes [7] [8]. Contaminated water therefore influences the health of local community along river. The incident of diseases caused by metals and chemical compound from drinking water has been reported from some area along river in Kalimantan [5] [6].

Human disturbance plays a vital role in the disturbance of river. In Asam-Asam River in South Kalimantan has been influenced by human activity and lead the degradation and low capacity of the river ecosystem to support human live. Along the Asam-Asam Rivers, there are numerous human activity which are potentially contribute to river pollution. As far there are few studies to determine the recent water quality of Asam-Asam River. The aims of the research is to describes the main chemical aspect of Asam-Asam River in South Kalimantan.

II. Methods

Six sampling station were set up along Asam-Asam River. Along the river, there are six sampling location, from upstream to estuary, namely upstream point, coal mining area station, settlement with less population station, plant power area station, high densely settlement station, and estuary station. The human activity of the sampling area were summarized in Table 1.

Table 1. The general situation of sampling sites

Zone	General situation	Human activity
1	Estuary	Traditional activity (i.e. fishing), water were used to support daily life and irrigation. There are also stockpile of coal mining
2	High densely settlement	Traditional activity (i.e. fishing), irrigation and transportation. People use river as waste deposit sites
3	Plant power area (<i>Pusat Listrik Tenaga Uap</i>)	Traditional activity (i.e. fishing), irrigation and transportation. There is also plant power established in the site.
4	Settlement with less population	Traditional activity (i.e. fishing), irrigation, bathing and transportation There are also sand mining
5	Coal mining area	Traditional activity (i.e. fishing), water were used to support daily life and irrigation. There are also stockpile of coal mining
6	Upstream	Traditional activity (i.e. fishing), water were used to support daily life and irrigation

In each station, water was sampled three times in different sites. In each point of sampling, a 100 ml river water were collected. Sample were collected in bottle, labeled and transferred to laboratory. In laboratory, water sample were analyzed for its chemical characteristic using standard methods for chemical water analysis. For the sediment types analysis, 100 gr. sediment were collected. Soil were collected in plastic box and analyzed in laboratory using soil standard analysis.

III. Result and Discussion

Sediment texture

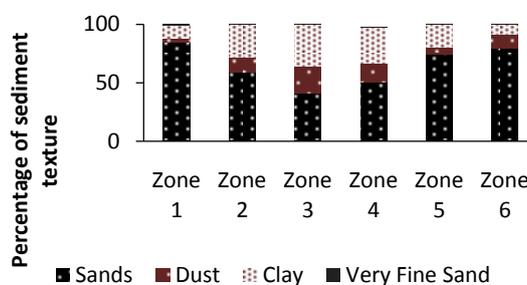


Fig.1 The percentage of sediment texture

The sediment texture of Asam-Asam River were dominated by sands, followed by clay and dust (Fig.1). River substrate is an important factor to determine the biodiversity of river. It has been reported that substrate has direct correlation with benthos composition and distribution [9]. The species of epifauna often

decrease in community level in the small gravel to sand and silt [10]. Scholar found that density of macrozoobenthos has strong relationship with the substrate and organic matter in river's sediment. Substrate often influenced by sedimentation process. Some part of the river often has abundance sands, while in the estuary the dominant part often dominated by mud. The hard substrate is basically important as settling planula sites. Building new colony often require hard substrate which are free or less component of mud [10].

Chemical aspects

Chemical aspects has been reported important for river ecosystem, especially to support river biodiversity. The chemical content, therefore, represent the quality of river.

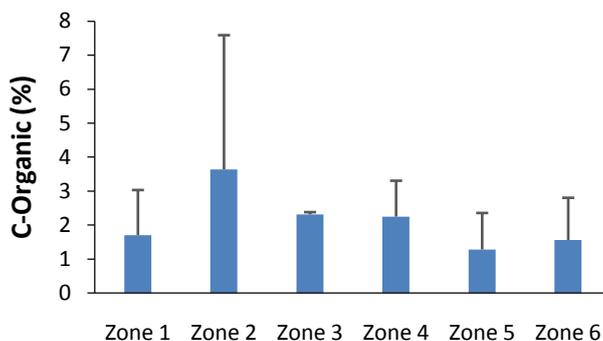


Fig. 2. The content of C-organic of Asam-Asam River

The C organic is important to determine water quality. Organic compound in water quality is the complex of organic materials which area occurs due to the decomposition of organic materials through the process of humification and mineralization. These process often involving contribution of numerous heterotrophic and autotrophic microbes [10] [11]. The organic compound in river increase the growth and activity of microbes in water ecosystem. These lead to the competition between organism in water ecosystem and microbes. This research found the water sample from zone 2 has the highest organic level (3.64%), followed by zone 3 (2.31%), zone 4 (2.24%), zone 1 (1.70%), and zone 5 (1.28%). The high level of C-organic in zone 2 indicates the high input of organic material in the area, represent the intensive human activity in zone 2. The lowest C organic content in Zone 5 indicate the low human impact to river ecosystem. Human activity has been reported contributes to the level of C organic and therefore C organic level can be used as water quality indicator.

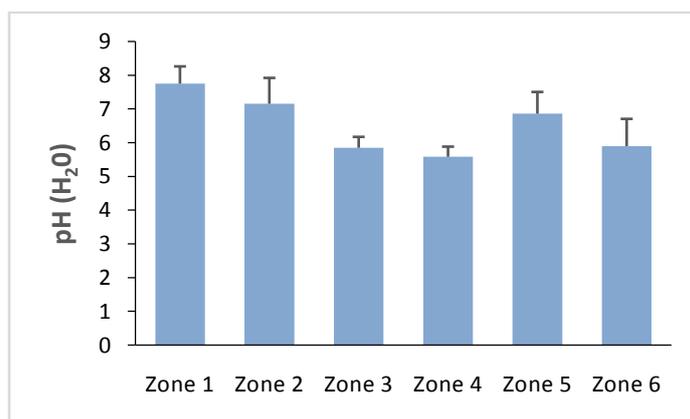


Fig.3. The pH value of water along Asam-Asam River.

According to water health standard released by Ministry of Health (*Peraturan Menteri Kesehatan No. 492/MENKES/PER/IV/2010*), the allowed pH for water conception meets health standart were ranges from 6.5 to 8.5 [12] According to the water pH analysis from Asam-Asam water sample, water pH ranges from 5.55 to 7.75. The lowest pH were recorded from Zone 4 (pH=5.55) while the highest pH were recorded from zone 1 (pH = 7.75). The water quality meet national health standard were found from zone 5 (pH 6.86), zone 2 (pH=7.15) and zone 1 (pH= 7.75). While it is meet to the health standard, the uses of water in Asam-Asam River in zone 5, 2 and 1 still need the comprehensive indicator of chemical parameters.

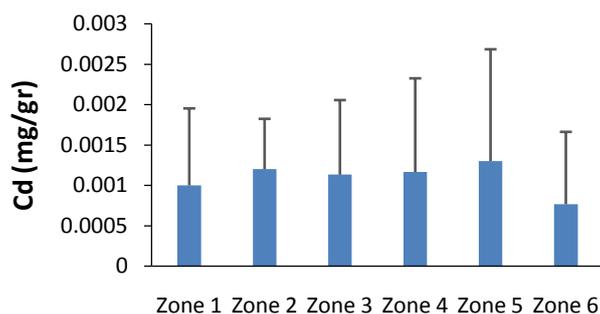


Fig.4. Cadmium level in sampling sites along Asam-Asam River

Cadmium is one of the important pollutants in Asam-Asam River. It has been identified in all sampled site in Asam-Asam River, indicates that rivers has been polluted. The Cadmium level in zone 1 was 0.0010 (mg/gr.), zone 2 was 0.0012 (mg/gr), zone 3 was 0.0011 (mg/gr.), zone 4 was 0.0011 (mg/gr.), zone 5 was 0.0013 (mg/gr.) and zone 6 was 0.0007(mg/gr.). There are some possible sources of cadmium pollution. Cadmium is the toxic materials which are able to triggers numerous serious human diseases. Industrial activity often produce cadmium, in which it is reported influence human health in numerous industrial countries. The regulation of industrial management pollutant therefore important [13] [14]

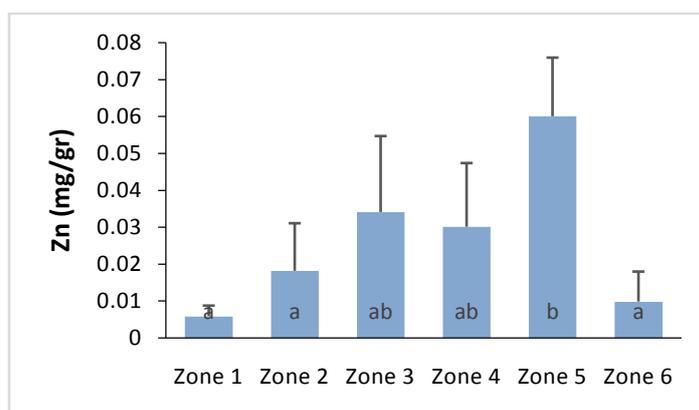


Fig.5. Zinc level in sampling sites along Asam-Asam River

The highest zinc level was found at sampled water of zone 5 (0.060 mg/gr.), following by zone 3 (0.034 mg/gr.), 4 (0.030 mg/gr.), 2 (0.018 mg/gr.), 6 (0.009 mg/gr.) and 1(0.005mg/gr.). Zinc in river water ecosystem often come from a combination of human activity. Zn is a pollutant with low solubility in aqueous solution, and mostly occurs in river environment as an impact of human activity. The intensive human activities such as mining activities along the could be possible reason for Zn pollution in Asam-Asam River. Zn is also possible released from human settlements along the river [14] [15] [16]. Therefore the management to manage human activity and settlement along the Asam-Asam River is important.

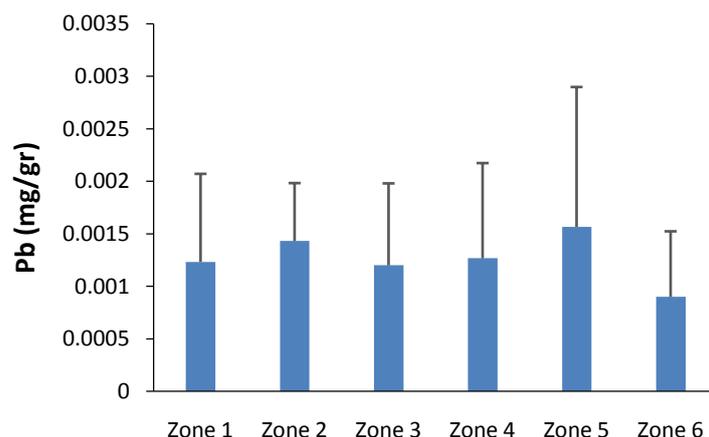


Fig.6 The level of lead in sampling sites along Asam-Asam River

The highest lead level was found at sampled water of zone 5 (0.0015 mg/gr.), following by zone 3 (0.0012 mg/gr.), 4 (0.0012 mg/gr.), 2 (0.0014 mg/gr.), 1 (0.0012 mg/gr.) and 6 (0.0009 mg/gr.). The trend of lead level along Asam-Asam River were similar to the zinc level. Lead has been identifies as dangerous pollutant in river ecosystem. Lead is the serious contaminant in river ecosystem, in which intensive human activity, industrial and settlement mainly contribute to the river pollution by Pb [16]. The existence of Pb in water of Asam-Asam River should become intensive monitoring program, especially to provide basic data and information related to the effort to provide water with free Pb.

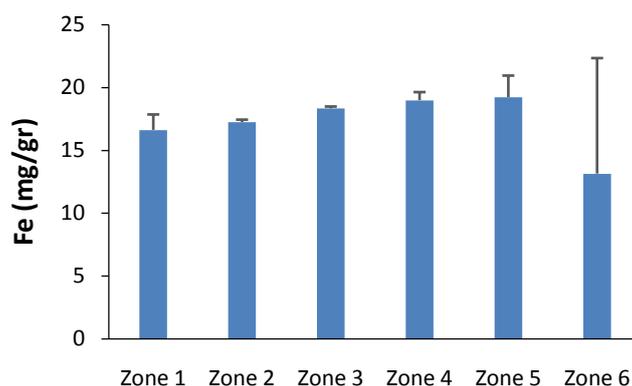


Fig.7 The level of iron in sampling sites along Asam-Asam River

The iron was detected found in Asam-Asam River. The highest level of iron was found at zone 5 (19.2228 mg/gr.), followed by zone 4 (18.9831 mg/gr.), zone 3 (18.3365 mg/gr.), zone 2 (17.243mg/gr.), zone 1 (16.6206 mg/gr.) and zone 6 (13.1432 mg/gr.). In natural water ecosystem, iron present in two form either the insoluble ferric iron or the soluble ferrous iron. The existence of Fe in water ecosystem has been reported as crucial problem which lead t the sustainability of living system. Water with Fe contaminant has been reported has low quality to support human health quality, and therefore problems related to Fe contamination should be overcome. It is especially important in Asam-Asam River [17]

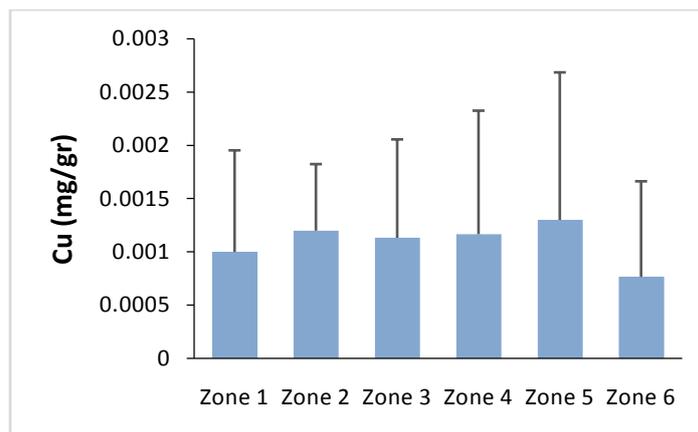


Fig. 8. The level of copper in sampling sites along Asam-Asam River

The highest level of Cu was found in zone 5 (0.025267 mg/gr.). It was followed by zone 2 (0.018833 mg/gr.), zone 4 (0.018433 mg/gr.), zone 2 (0.0174 mg/gr.), zone 6 (0.0114 mg/gr.) and zone 1 (0.0019 mg/gr.). Copper has been reported as serious metal contaminant worldwide as a consequences of intensive human activity and industrial activity along river ecosystem. Scholars point out that dissolved copper ions are removed from solution by sorption to clays, minerals and organic solids [16]

It is clear that Asam-Asam river under disturbance. Disturbance is the alteration of river ecosystem structure arising from the abundance of pollutant and toxic materials. Disturbance can lead to the decrease of water quality, in which it is crucial in human health. In Kalimantan, rivers are one of the important means of local community and mining activity access. In such a case, river planning and management in the perspective of landscapes can reduce Asam-Asam river degradation. The biodiversity conservation in river ecosystem play an important role in management on river, and reduction metals pollution were important aspect [18] [19]. In case of Asam-Asam River, the improvement of management and policy to regulate sustainable activity of human and industry along Asam-Asam River is important. The regulation especially important in the massive human activity in developing countries. The policy should be establish and focus to the comprehensive strategy and effort to minimize pollution risk caused by development of community along the river [20].

IV. Conclusion

Asam-Asam River has been polluted as indicated by physical and chemical water quality assessment. The sediment texture of Asam-Asam river were dominated by sands, followed by clay and dust. The high level of C-organic in zone 2 indicates the high input of organic material in the area, represent the intensive human activity in zone 2. Water pH ranges from 5.55 to 7.75. The highest Cd level was found in zone 5 (0.0013 mg/gr). The highest zinc level was found at sampled water of zone 5 (0.060 mg/gr). The highest lead level was found at zone 5 (0.0015 mg/gr). There is need comprehensive political and regulation to manage Asam-Asam River.

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