

# The Impact of Acid Mine Water on Soil Fertility in Cempaka, Banjarbaru District, South Kalimantan, Indonesia

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## Abstract:

Banjarbaru has a topography with variety between 0 – 500m above sea level. the area with altitude of 7-25m above sea level have an indicates that the morphology in this area is very suitable for plant cultivation. Banjarbaru City has a slope of land with varies between 0-15%, but tends to be tilted. The slope usually related with sensitivity to soil erosion. hence soils in the Banjarbaru region are stable with relatively low risk of erosion, good land capability and fine soil textures. in this research the material used was a soil sample taken from several places around the South Kalimantan Province office complex. the samples of soil was taken in this research will be analyzed in a laboratory for getting the physical and chemical properties of the soil. Some chemical properties are determined such C, N, C / N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O, P<sub>2</sub>O<sub>3</sub>, K<sub>2</sub>O, Ca, and KB. The results of laboratory analysis showed the content of some chemical elements contained in the soil consisted of C, N, C / N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O, P<sub>2</sub>O<sub>3</sub>, K<sub>2</sub>O, Ca, and KB. C values range from 0.3 to 2.81, N ranges from 0.04 to 0.18, C / N ranges from 7 to 14., P<sub>2</sub>O<sub>5</sub> ranges from 2 to 21, K<sub>2</sub>O values from 2 to 11, P<sub>2</sub>O<sub>3</sub> ranges from 1 to 8, Ca ranges from 0.12 to 1.66, and family planning ranges from 7 to 54%. based on results showed that most of the land in the study area had a low KB, total P, total K and C-organic, so the area had a low fertility status. The saturation base is always connected as a clue about soil fertility.

**Keywords:** Banjarbaru, Morphology, Slope, Soil Erosion, Soil Fertility.

## I INTRODUCTION

The Banjarbaru region has a varied topography between 0 - 500m above sea level (asl): With a varied landscape shape (morphology). Most of this area is at an altitude of 7-25m above sea level which is around 10,615 Ha or 33.23% of the city area. This height condition indicates that the

morphology of this region is very suitable for plant cultivation. Banjarbaru City has a slope of land that varies between 0-15%, but tends to be sloping. Slope is related to sensitivity to soil erosion, the higher or steep, the more sensitive to erosion.

Table 1  
Kelas Ketinggian dari Permukaan Laut

No.	Kecamatan	Kelas Ketinggian dari Permukaan Laut (Ha)					Luas	
		0-7 m	>7-25 m	>25-100 m	>100-500 m	>500	Ha	%
1	Landasan Ulin	6.526,00	2.790,50	-	-	-	9.317	29,16
2	Liang Anggang	5.250,00	1.540	-	-	-	6.790	21,25
3	Cempaka	30,00	2.218,00	7.840	1.121	-	11.209	35,09
4	Banjarbaru Utara	-	2.240,00	283,00	-	-	2.523	7,90
5	Banjarbaru Selatan	-	1.827,00	280,00	-	-	2.107	6,60
<b>TOTAL</b>		<b>11.806</b>	<b>10.615</b>	<b>8.403</b>	<b>1.121</b>	<b>0</b>	<b>31.945,00</b>	<b>100,00</b>

Sumber: Kota Banjarbaru dalam Angka, 2011

Most of this region has a slope of 0-2%, this condition is very suitable for agricultural cultivation and for urban activities. Slope between 2-8% is in parts of Cempaka, Banjarbaru Utara and Selatan. In this slope class, cultivation activities can still be carried out, but must use

appropriate technology as a form of anticipation of soil erosion. Slope of between 8-15% is in parts of Cempaka. These slope classes each allow for plantation cultivation or forestry of deep rooted plant species.

Table 2  
Kelas Lereng/Kemiringan/Slope Class

No.	Kecamatan	Kelas Lereng/Kemiringan/Slope Class (Ha)				Luas	
		0-2 %	>2-8 %	>8-15 %	>15 %	Ha	%
1	Landasan Ulin	9.316,50	-	-	-	9.317	29,16
2	Liang Anggang	6.789,50	-	-	-	6.790	21,25
3	Cempaka	7.734,00	2.242,00	112,00	1.121,00	11.209	35,09
4	Banjarbaru Utara	2.352,00	171,00	-	-	2.523	7,90
5	Banjarbaru Selatan	1.937,00	170,00	-	-	2.107	6,60
<b>TOTAL</b>		<b>28.129,00</b>	<b>2.583,00</b>	<b>112,00</b>	<b>1.121,00</b>	<b>31.945,00</b>	<b>100,00</b>

Sumber: Kota Banjarbaru dalam Angka, 2011

In general, soils in the Banjarbaru region are stable with relatively low risk of erosion, good land capability and fine soil textures. This is very supportive for urban development and the implementation of urban infrastructure and infrastructure development activities. However, on the other hand it becomes an obstacle for urban development, because the relatively flat topography conditions make the surface water flow slow and has the potential to create inundation both regularly and periodically.

Negative impacts due to diamond mining in the Cempaka region include:

#### 1) Soil pollution

Large holes from the former quarry and piles of soil cause the land around the mine can not be used for agricultural land or farming because it is very difficult to process it. Another thing that causes land to be difficult to cultivate is due to erosion which erodes soil nutrients so that the soil is no longer fertile.

#### 2) Water pollution

The use of acidic liquid in the separation of

diamonds with mud causes water pollution throughout the mine site and even pollutes river water around the mine. Hakim (1986) stated that the size of the CEC was influenced by the nature and characteristics of the soil, namely: soil pH, texture or amount of clay, and types of clay minerals, and organic matter. Yulius et al. (1985) states that base saturation illustrates the proportion of base relative can be exchanged on soil colloids. In soils in areas that have experienced further weathering, most of the exchange complexes on the colloidal surface are occupied by the Al cation. Furthermore it was

stated by Judge et al. (1986) that the KB percentage is the ratio between the number of milliequivalents of base cations and those of CEC, if the soil KB is classified as low, then the Al cation is the dominant cation that is absorbed on the colloidal surface [1-5].

The study area is a former diamond mine 10 years ago, where the current condition is the office complex of the South Kalimantan provincial government. The purpose of this study was to determine the impact of acid mine water on the level of soil fertility in Cempaka, Banjarbaru, South Kalimantan [1-3].



Fig.1. Location map of study area

## II METHODOLOGY

The research methods used are: descriptive qualitative and quantitative descriptive. According to Sugiyono (2003), quantitative research is a study by obtaining data in the form of numbers or qualitative data that is explored. While in qualitative research the data collected is in the form of words, sentences, schematics, charts, sketches and drawings or photographs [6-9].

The main material used in this study is soil samples taken from several places around the office complex area of South Kalimantan Province. Soil samples that have been taken are then analyzed in

a laboratory to determine the physical and chemical nature of the soil. Some chemical properties are determined, among others: C, N, C / N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O, P<sub>2</sub>O<sub>3</sub>, K<sub>2</sub>O, Ca, and KB[4-6].

## III RESULTS

Soil fertility can be defined as a soil condition where the water, air and nutrient systems are in a fairly balanced state and available according to the needs of plants, both physical, chemical and biological soil. The state of soil physics includes effective depth, texture, structure, moisture and

soil air system. Soil chemical conditions include soil reaction (soil pH), CEC, KB, organic matter, abundance of nutrients, nutrient reserves and availability of plant growth. Whereas soil biology, among others, includes the activity of microbial remodeling of organic material in the process of humification and binding of air nitrogen.

Based on the results of laboratory analysis shows that the content of some chemical elements contained in the soil consists of C, N, C / N, P<sub>2</sub>O<sub>5</sub>, K<sub>2</sub>O, P<sub>2</sub>O<sub>3</sub>, Ca, and KB. C values range from 0.3 - 2.81, N range from 0.04 - 0.18, C / N range from 7 to 14., P<sub>2</sub>O<sub>5</sub> ranges from 2 to 21, K<sub>2</sub>O values from 2 to 11, P<sub>2</sub>O<sub>3</sub> ranges from 1 to 8, Ca ranges from 0.12 to 1.66, and family planning ranges from 7 to 54%.

The total P in the research area is relatively low. This is because the area is poor with P elements and low soil pH. As stated by Munawar (2013) that in acid soils (low pH), soluble P will react with Al and Fe and other hydroxides to form relatively less soluble Al-P and Fe-P compounds, so that P cannot be absorbed by plants.

The results showed that most of the land in the study area had low KB, total P, total K and C-organic, so that the area had a low fertility status. Base saturation is always connected as a clue about the fertility of a soil. The ease in releasing ions that are absorbed to the plant depends on the degree of base saturation. Soil is very fertile if base saturation is > 80%, moderate fertility if base saturation is between 50 - 80% and not fertile if base saturation is < 50%.

#### IV CONCLUSION

Based on the results of research that has been done, it can be concluded that:  
1) C values range from 0.3 - 2.81, N range from 0.04 - 0.18, C / N range from 7 to 14., P<sub>2</sub>O<sub>5</sub> ranges from 2 to 21, K<sub>2</sub>O is valued from 2 to 11, P<sub>2</sub>O<sub>3</sub> ranges from 1 to 8, Ca ranges from 0.12 to 1.66, and birth control ranges from 7 to 54%.  
2) The total P in the research area is low. This is

because the area is poor with P elements and low soil pH.

3) Most of the soil in the study area has a low KB, total P, total K and C-organic, so the area has a low fertility status.

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No.	Terdapat contoh kering 105 C										
	Bahan organik %		HCl 25% mg/100 g		Olsen		Bray 1 Morgan		Nilai Tukar Karbon (NH4-Acetate IN, pH7) cmole/kg		K8%
	Walkley & Black (Keldahl)		C/N		K2O P2O5		P2O3 ppm P2O5 ppm K2O ppm		Ca		
	C	N									
	1	1.57	0.11	14	14	3	8	2.8	23	1.66	4.03
2	1.7	0.12	14	8	3	1	2.4	22	0.22	0.98	12
3	0.3	0.04	8	2	2	1	0.6	14	0.16	0.34	16
4	0.93	0.08	12	2	3	1	0.4	23	0.12	0.41	11
5	1.4	0.11	13	10	2	6	6.5	22	0.9	1.56	32
6	2.81	0.18	16	21	6	3	2.6	58	1.49	3.27	41
7	2.29	0.15	15	7	4	3	3.6	36	0.28	0.93	11
8	1.45	0.11	13	9	11	5	6.5	110	0.76	1.85	30
9	1.15	0.09	13	7	2	2	3.7	21	0.41	1.93	43
10	1.77	0.13	14	12	2	5	7.9	15	0.93	2.10	32
11	0.27	0.04	7	2	1	1	0.2	14	0.18	0.45	14
12	1.24	0.10	12	10	2	1	0.8	20	0.16	0.45	7
13	1.05	0.09	12	5	3	2	2.4	19	0.16	0.69	15
14	1.27	0.10	13	6	2	2	3.2	22	0.27	0.69	14