

# Water Quality of Sinamar River Lima Puluh Kota District West Sumatera Based on Structure of Microalgae Periphyton as Bioindicator

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**Abstract**—Sinamar River is one of the rivers in Lima Puluh Kota District, that have important functional. This river is used as irrigation, bathing and washing, and husbandaries. There are many human activities as long as this river such as residents, industries, tradisional markets, and agricultural. The objective of this study is to know the level of Sinamar River pollution based on microalgae periphytons communities. The samples was taken in 8 stations. The result are microalgae periphytones in Batang Sinamar founded 24 spesies, Cyanophyta (3 spesies), Chlorophyta (7 spesies), Chrysophyta (12 spesies), Euglenophyta (2 Spesies). Diversity indeks is about 2,51 – 2,75 and saprophyt index is about 0,9 – 1,3. This is indicated Batang Sinamar contaminated lightly. Based on water quality, Batang Sinamar has DO 6,88 – 8,33 mg/L, BOD<sub>5</sub> 0,14 – 1,60 mg/L, COD 0,8 – 10,4 mg/L, Amoniak < 0,14 mg/L, TSS 0,058 – 0,16 mg/L, and pH 6,52 – 7,37. All of this parameters still in range of Indonesian Government Regulation No 82/ 2001.

**Keywords**—bioindicator, microalgae, periphyton, Sinamar River, Water Quality.

## I. INTRODUCTION

SINAMAR River is one of the rivers that have important functional. This river is used as irrigation, bathing and washing, and husbandaries. In ecology, this river is habitat of local fishes such as *gariang*, *barau*, *bauang*, *mansai*. Their populations more decreasing now. Pollution make water quality decreasing in physi, chemistry and biology. Physic and chemistry research have weakness. It is affected by some factors, one of them is debite. It's different debite in rainy and dry seasons. In example, in dry season the river is look clearly whilst the river is look turbid in rainy season. Nowadays, water quality monitoring focus to biota, it is more explicit to explain the water pollution. Biota will affect directly to along term pollution.

One of biota is periphyton. Periphyton have important functions in aquatic ecosystem and as primer produsen. Periphyton can use as bioindicator, that there is a change in aquatic ecosystem, due to unbalanced ecosystem [1]; [2].

Manuscript received September 14, 2017. This work was supported in part by Indonesian Ministry of Research, Technology and Higher Education and Payakumbuh of Agriculture Polytechnic

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Some organisms of periphyton are tolerant and have different responses to water quality changing.

Microalgae periphyton's abundance can use as bioindikator that there is a water quality changing, due to unbalanced, effect from contaminant. It is base on diveristy, composition, and dominant of periphyton in the river.

The objective of this study is to know water quality of Sinamar River base on structure of microalgae periphyton.

## II. METHODOLOGY

The study has been done from July to September 2017 in 8 stations along as Sinamar River (Figure 1).

Microalgae periphyton has taken by brushed stones or other substrate by wire brush. The product from brushes took into sample bottles and given formaline 30%. Water samples have been taken in the same location. The microalgae periphyton and water samples will analyzed in laboratories.

Periphyton will identification and analyzed the diversity by using Shannon-Wiener Index:

$$H' = \sum_{i=1}^s (P_i \log_2 P_i)$$

Description:  $H'$  = Shannon-Wiener Indeks,  $P_i = n_i/N$ ,  $n_i$  = number of individual spesies- $i^{\text{th}}$ ,  $N$  = total number of individual.

Saprobic index waqs determined using the following formula :

$$X = \frac{C+3D-B-3A}{A+B+C+D}$$

Description:  $X$  = saprobic index,  $A$ = number of organisms Cyanophyta,  $B$  = number of organism Euglenophyta,  $C$  = number of organisms Chrysophyta,  $D$  = number of organisms of Chlorophyta.

## III. RESULT AND DISCUSSION

The identification of periphyton in Sinamar River have founded 24 spesies. Cyanophyta 3 spesies, Chlorophyta 7 spesies, Bacillariophyta 12 spesies, and Euglenophyta 2 spesies. The list of periphyton is presented in Table 1.

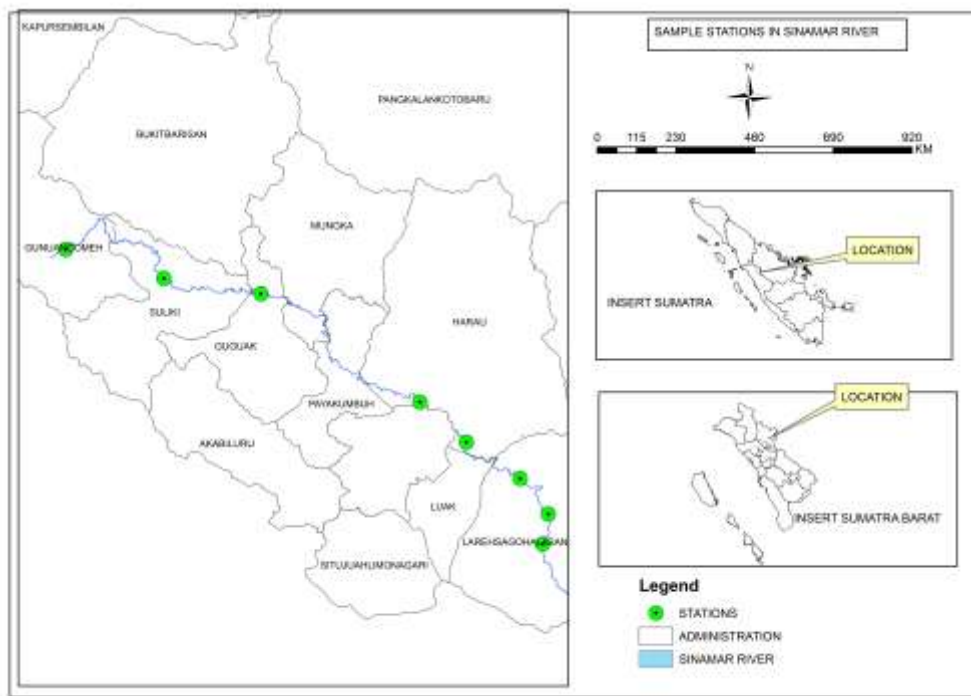


FIG 1. SAMPLE STATIONS AT SINAMAR RIVER

TABLE I:  
PERIPHYTON IDENTIFICATION IN SINAMAR RIVER

No	Taksa	Stations							
		1	2	3	4	5	6	7	8
<b>Cyanophyta</b>									
1	<i>Oscillatoria</i>	v	v	v	v	v	v	v	v
2	<i>Lyngbia</i>	v	v	v	v	v	v	v	v
3	<i>Haphalosiphon</i>	v	-	-	-	-	v	-	-
<b>Chlorophyta</b>									
4	<i>Oedogonium</i>	v	v	v	v	v	v	v	v
5	<i>Spyrogyra</i>	v	v	v	v	v	v	v	v
6	<i>Cladophora</i>	v	-	v	v	v	v	v	-
7	<i>Closterium</i>	v	v	v	v	v	v	v	-
8	<i>Desmidium</i>	v	v	v	v	-	-	-	v
9	<i>Scenedesmus</i>	v	-	-	v	-	v	-	-
10	<i>Cosmarium</i>	v	-	-	v	v	-	-	v
<b>Chrysophyta</b>									
11	<i>Synedra</i>	v	v	v	v	v	v	v	v
12	<i>Frustulia</i>	v	-	v	v	-	-	-	v
13	<i>Cymbella</i>	v	v	v	v	v	v	v	v
14	<i>Navicula</i>	v	v	v	v	v	v	v	v
15	<i>Eunotia</i>	-	-	v	-	v	v	-	-
16	<i>Pinnularia</i>	v	v	v	v	v	v	v	-
17	<i>Gomphonema</i>	v	v	v	-	v	v	v	-
18	<i>Nitzchia</i>	-	v	v	v	v	v	-	v
19	<i>Fragillaria</i>	v	v	v	v	v	v	v	v
20	<i>Diploneis</i>	v	v	v	v	v	v	v	v

21	<i>Surirella</i>	v	v	v	v	v	-	v	v
22	<i>Neidium</i>	-	-	-	v	-	v	v	-
<b>Euglenophyta</b>									
23	<i>Euglena</i>	-	-	v	-	v	-	-	-
24	<i>Phacus</i>	v	v	-	-	-	-	-	v

We can see at Table I, there are many Chrysophyta (diatoms) founded in Sinamar River. These genera are susceptible to environmental change such as physis, chemistry and biology. This changing can come from the people activities like farmings, industries and residents. Wastes from these activities is removed into river and have impact to periphyton. The blooming diatoms have been founded in many research like [2], [3], [4], [5], [6], [7]. Ekwu and Sikoki [2] said the diatoms present indicates there is high silica in the river. In this study, we didn't see silica concentration.

We founded several spesies that indicated the Sinamar River has been contaminant. There are *Lyngbia*, *Oscillatoria*, *Cymbella* dan *Pinnularia*. These spesies life from lightly ( $\alpha$ -mesosaproba) to heavy contaminant (polisaproba). We suggest that they presented have describe that Sinamar River has been contaminant.

Diversity index are decreasing from station 1 to station 8. In the upstream (station 1) the diversity index is 2,75 and in the downstream (station 2) decreasing into 2,51. It is mean the periphyton's diversity is decreasing in the downstream. Diversity index indicates the periphyton's diversity, the higher diversity that means the water quality in the good condition.

The diversity index and saprophyte index are present in Table II.

TABLE II:  
PERIPHYTON'S DIVERSITY INDEX AND SAPROPHYTE INDEX

Stations	Diversity Index	Saprophyte Index	Water Quality Criteria
Station 1	2,75	1,00	Lightly contaminant
Station 2	2,61	0,87	Lightly contaminant
Station 3	2,69	1,00	Lightly contaminant
Station 4	2,63	1,31	Lightly contaminant
Station 5	2,61	1,00	Lightly contaminant
Station 6	2,59	0,89	Lightly contaminant
Station 7	2,55	0,87	Lightly contaminant
Station 8	2,51	0,86	Lightly contaminant

The saprophyte indeks is about 0,86 – 1,31. This indicate is The Sinamar River has lightly contaminant.

Physic and chemistry water quality parameters has presented in table III.

DO is about 6,72 to 8,33 ppm. These are high concentrations. This indicates the river in a very good condition. And then we see BOD<sub>5</sub> is low, about 0,27 – 1,60 ppm. COD is low too. According to Indonesian Government's Regulation (IGR) no 82/2001, these parameters still in range of it.

The other paramters, Nitrate, Amoniac, and Phospate are low, still in the range. Also do TSS and pH.

All of paramaters are in the good condition. It can be taking the water sample in the rainy season. It can be bleaching and make the value is low.

We can see there is opposite between physic and chemistry, and biology. It is confirm that the periphyton give a clearly result than others..

TABLE III:  
WATER QUALITY OF SINAMAR RIVER

Stations	Parameters							
	DO (ppm)	BOD <sub>5</sub> (ppm)	COD (ppm)	Nitrate (ppm)	Amoniac (ppm)	Phospate (ppm)	TSS (ppm)	pH
1	8,33	0,27	- <sup>*)</sup>	0,06	<0,014	1,43	-	7,32
2	7,53	0,14	-	0,15	<0,014	0,07	-	7,37
3	8,02	1,08	2,4	0,05	<0,014	0,35	-	7,31
4	7,04	1,60	-	0,57	0,045	1,18	0,074	6,52
5	6,88	0,64	0,8	0,66	<0,014	0,86	0,091	6,56
6	6,72	0,80	10,4	0,61	<0,014	0,70	0,163	6,76
7	6,88	0,48	7,2	0,49	0,035	0,55	0,058	6,65
8	7,04	0,48	5,6	0,55	0,079	0,49	0,090	6,79

Description: \*) = not detected / very small

#### IV. CONCLUSION

The conclusion is Sinamar River has been lightly contaminant according to periphyton's structure.

#### ACKNOWLEDGMENT

The authors would like to thank to Indonesian Ministry of Research, Technology and Higher Education and Payakumbuh Agricultural Polytechnic.

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