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RESULTS AND DISCUSSION

Table 1 identifies the average of temperature is 27-280C by which the optimum temperature enables phytoplanktons to life in water is 200C-300C. This shows that the temperature of the area is still in safe limit/suitable for the growth of microorganisms in water. The color of the agricultural, settlement, and outlet areas is dark brown. This is caused by dirt materials contaminating the areas. On the contrary, the color of the areas at where the Eichhornia crassipes live is greenish brown due to the ability of the plants to absorb the pollutants and the plants also belongs to hyper accumulator. Those areas tend to smell unpleasant. In fact, the highest level of turbidity and sedimentation lay on the settlement and industrial areas. It is quite reasonable since the outlet is an area where water of all areas empties into. But, the settlement and industrial areas need controlling as well. Meanwhile the sedimentation does not take place in the water sources due to the stream causing the deposited materials get away from the site. The sediment measurement made from 1993-2003 reports a total rate of deposition of 9.75 million m3. The drift materials and oil residue are commonly found in the settlement and outlet areas. This needs controlling since those materials may carry both organic and inorganic pollutants which are potentially causing problems in the future.

Table 1. Data of the physical analysis of water in Rawa Pening

Parameter	Water quality standards	Water sources	*Eichhornia crassipes*	Agricultural areas	Settlement and industrial areas	Outlet
temperature		27^0C	27^0C	28^0C	28^0C	27^0C
color		brownish	greenish brown	dark brown	dark brown	dark brown
odor		unpleasant	unpleasant	unpleasant	unpleasant	unpleasant
turbidity	5^+ - 25^+	6^+	7^+	7^+	8^+	8^+
sediment		negative	much	much	much	much
drift material		negative	not much	not much	much	much
Oil residue		negative	negative	negative	positive	positive

Source: the analysis results
note: 5^+ = pure, 6^+ = quite turbid, 7^+ = turbid, 8^+ = very turbid

Table 2 indicates that the average of chemical elements still in safe limit. The Na tends to exceed the agricultural standards but the phosphate exceeds the standards. According to Fardiaz (1992), one of the chemical substances forming detergent and soap from the settlement wastes is Natrium tripolyphosphat and if this substance is related to soil, thus the excessive Na may damage the soil structure (Effendi, 2003). The high PO4 along with N may stimulate the rapid growth of algae and Eichhornia crassipes. The Fe also

exceeds the water quality standards. When the water of Rawa Pening is mainly used for cooking, it may affect the people health. Eventually, those three elements/substances may be taken into account for which the water will be used for.

Table 2. Result of the chemical elements analysis of water in Rawa Pening

Parameters	Agricultural standards (mg/l)	Water quality standards (mg/l)	Water sources (mg/l)	*Eichhornia crassipes* (mg/l)	Agricultural areas (mg/l)	Settlement and industrial areas (mg/l)	Outlet (mg/l)
Na	20	<200	28#)	25#)	30#)	30#)	28#)
NO_3	(-)	10	0.37	0.41	0.44	0.53	0.48
SO_4	(-)	<100	3	3	3	3	2
PO_4	5	0.2	30.76 *)	31.29 *)	30.23*)	31.29 *)	29.73 *)
Ca	(-)	<75	22.58	20.96	23.38	23.38	20.16
Mg	(-)	50	9.75	10,24	9.75	11.21	11.11
HCO_3	(-)		109,8	97,6	108.8	115,9	122
K	(-)	<2000	2	2	4	3	2
CO_3	(-)	(-)	ttd	ttd	ttd	ttd	61
B	1	1	ttd	ttd	ttd	ttd	ttd
Fe	0-20	0.3	0.44@)	0.38@)	0.32@)	0.63@)	0.9@)
CL^-	(-)	<600	12	9	12	11	11
Zn	2	0.05	0.08	0.26	0.19	1.12	1.48
Cd	0.01	0.01	ttd	ttd	ttd	ttd	ttd
Cr	1	0,05	ttd	ttd	ttd	ttd	0,18

Source: the analysis results

Notes: ttd = undetected, * = exceeding the standards, (-) = none of the element standards #) = exceeding the agricultural standards, @) = exceeding the water quality standards

Table 3 indicates that the chemical elements, e.g. pH, TDS, DHL, SAR, RSC, and %Na existing in the water of Rawa Pening still meet the agricultural requirements and water quality standards.

Table 3. The chemical analysis of Rawa Pening

Parameters	Agricultural standards	Water quality standards	Water sources	*Eichhornia crassipes*	Agricultural areas	Settlement areas	Outlet
pH	6sd9	6sd10	7.5	7.7	7.9	7.8	8.0
TDS (mg/l)	2000	1000	147	138	146	156	143
DHL(µmhos/cm)	0-2000	(-)	220	206	248	232	216
SAR (me/l)	>26	(-)	1.24	1.11	1.31	1.27	1.26
RSC (me/l)	>2,5	(-)	-0.14	-0.3	-0.18	-0.18	2.1
%Na (%)	0-60	(-)	39.68	37.91	41.54	39.82	39.81

Source: the analysis results

Notes: (-) = none of the element standards

Table 4. Determination of the water class using Kurlov Classification (Epj)

Parameters	Water sources		*Eichhornia crassipes*		Agricultural areas		Settlement areas		Outlet	
	Epj	%	Epj	%	Epj	%	Epj	%	Epj	%
Na + K	1.27	39.69	1.13	37.42	1.4	41.54	1.37	39.83	1.27	39.94
Mg	0.8	25.00	0.84	27.81	0.8	23.74	0.9	26.16	0.9	28.30
Ca	1.13	35.31	1.05	34.77	1.17	34.72	1.17	34.01	1.01	31.76
total	3.2	100.00	3.02	100.00	3.37	100.00	3.44	100.00	3.18	100.00
Cl	0.34	15.53	0.26	13.61	0.34	15.60	0.31	13.72	0.31	13.25
HCO3	1.79	81.74	1.59	83.25	1.78	81.65	1.89	83.63	1.99	85.04
SO4	0.06	2.74	0.06	3.14	0.06	2.75	0.06	2.65	0.04	1.71
total	2.19	100	1.91	100	2.18	100	2.26	100	2.34	100
water classes	alkali-calcium-magnesium-bicarbonate		alkali-calcium-magnesium-bicarbonate		alkali-calcium-magnesium-bicarbonate		alkali-calcium-magnesium-bicarbonate		alkali-calcium-magnesium-bicarbonate	

Source: the analysis results

The determination of water class using Kurlov Classification is presented in Table 4, in which the classification belongs to class alkali – calcium – magnesium bicarbonate. The determination of this class is by using parameter whose percentage ≥ 25%.

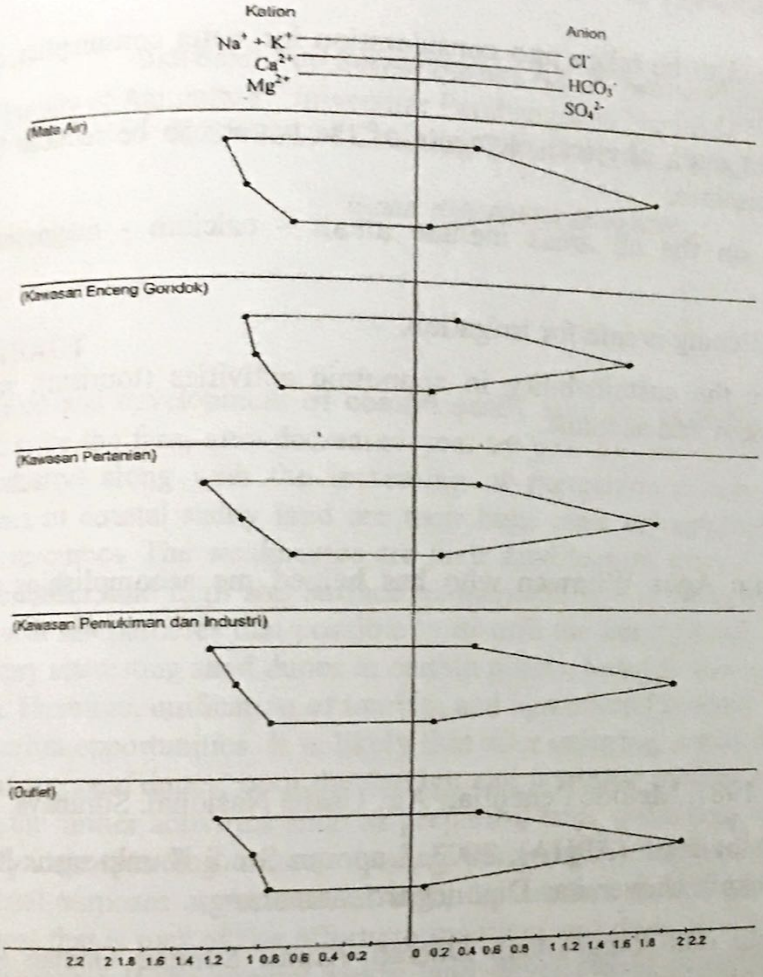

Figure 1. Pattern of the Stiff Diagram of Rawa Pening

By using the pattern of Stiff Diagram, it can be identified the change and the development of water quality in Rawa Pening along with the dominant elements. The water quality in all areas of Rawa Pening shares the same pattern in which the Na+K and HCO3 tend to be high and belongs to areas containing high bicarbonate and calcium – magnesium. The anions and cations in the areas where the Eichhornia crassipes live tend to be low since these aquatic plants are able to absorb pollutant. The pattern of Stiff Diagram can be seen on the Figure 1.

Management of Rawa Pening object tourism that is not properly, could adversely affecting on water quality and causing lowering water quality with other aspects. The

wise choice iskeep ecomony communities running normally, but quality of water keep maintained with perform arrangements.

CONCLUSIONS

1. PO4, Fe and Na need to be taken into consideration for water consumption of the Lake Rawa Pening.
2. The negative impact upon physical elements of the water can be reduced by using Eichhornia crassipes.
3. The water classes on the all areas include alkali – calcium - magnesium bicarbonate.
4. The water of Rawa Pening is safe for irrigation.
5. In order to achieve the sustainability in economic activities (tourism), such reports should be taken into account.

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