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S B F de Silva

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**STUDY OF THE INDUSTRIAL
WASTEWATER TREATMENT PROCESS OF
BIYAGAMA EXPORT PROCESSING ZONE OF
BOARD OF INVESTMENT OF SRI LANKA**

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**Thesis Submitted In Partial Fulfillment of
the Master of Engineering in Environmental
Engineering And Management**

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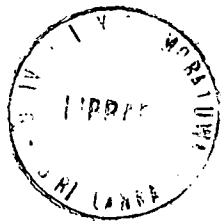
C ABBREVIATIONS

a	-	Percent of removed BOD which is converted to solids.
a'	-	Biomass yield co-efficient.
BEPZ	-	Biyagama Export Processing Zone.
BOD	-	Biochemical Oxygen Demand.
BOD _{rem}	-	Biochemical Oxygen Demand Removed (mg/l).
BOD ₅	-	Five days Biochemical Oxygen Demand (mg/l).
BOI	-	Board of Investment
b'	-	Endogenous rate co-efficient, (day ⁻¹)
Cd	-	Cadmium
CEA	-	Central Environmental Authority
COD	-	Chemical Oxygen Demand
Cr	-	Chromium
Cu	-	Copper
CWTP	-	Common Wastewater Treatment Plant
D	-	Axial dispersion co-efficient
DO	-	Dissolved Oxygen
d	-	Dispersion number (dimensionless)
EPZ	-	Export Processing Zone
F	-	A co-efficient that accounts for organic feedback due to anaerobic activity in the deposited sludge layers.
HRAP	-	High-rate algal ponds
K	-	Rate co-efficient
K _d	-	Endogenous decay rate constant (per unit time)
K ₂	-	BOD removal rate (first-order kinetics) (day ⁻¹)



(v)

K'	-	Specific substrate utilization rate (mg/l) ⁻¹ (S) ⁻¹
L	-	Characteristic length of travel (S)
MLSS	-	Mixed Liquor Suspended Solids
N	-	Nitrogen
NAREPP	-	Natural Resources and Environmental Policy Project.
Ni	-	Nickel
P	-	Phosphorus
PAC	-	Powdered activated carbon
PACT	-	Powdered activated carbon treatment
Pb	-	Lead
S	-	Substrate concentration at time t (mg/l)
S _a	-	BOD in the influent (mg/l)
S _e	-	BOD in effluent (mg/l)
S ₀	-	Initial substrate concentration (mg/l)
SS	-	Suspended Solids
T	-	Temperature in °C
TCLP	-	Toxicity Characteristic Leaching Procedure
t	-	Detention time (hours)
USEPA	-	United States Environmental Protection Agency.
V	-	Velocity of flow - through lagoon (m/s)
X _a	-	Quantity of microorganisms present (mg/l)
X _a '	-	Solids under aeration (mg/l)
X _v	-	Volatile suspended solids (mg/l)
Y	-	Percent of sludge under aeration which is oxidized
Z	-	BOD associated with influent solids (mg/l)

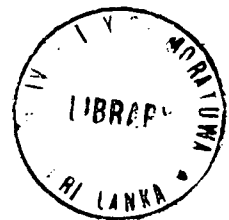


(vi)

Zn	-	Zinc
△ BOD	-	Removed BOD (mg/l)
△ SS	-	Change in solids (mg/l)
θ	-	Temperature correction factor
θc	-	Hydraulic Retention Time



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ABSTRACT

The Biyagama Export Processing Zone (BEPZ) could be recognized as the Sri Lanka's only Industrial Estate designed to accommodate high polluting type industries. Plans are underway to introduce few more industrial estates which could locate high polluting type industries and however it is unlikely that any such project would realize within the very near future. The common wastewater treatment plant (CWTP) of BEPZ has been constructed in 1988 and with the completion of 8 years of operation by 1996 it is high time that the treatment process and the circumstances are reviewed and evaluated in order to arrive at any conclusions and make recommendations based on the system performance. The BEPZ is located upstream of the raw water intake of the Greater Colombo Water Supply Scheme and therefore it is utmost important that the CWTP is operated strictly in compliance with the environmental norms as relevant.

In this study, firstly, an attempt is made to ascertain the overall efficiency of the treatment process of the CWTP. In the next phase a detailed study is carried out to investigate the biological treatment process of the Aerated Lagoon No.1 with different operating sequences of aerators. The study concludes with an effort made to introduce improvements to the present treatment system with a view to enhance the efficiency of substrate removal.

The biological treatment process in the aerated lagoon No.1 performs in compliance to "aerobic flow through" and



consequently the substrate removal efficiency exists within a limited range. Further it has been revealed that the operation of two adjacent aerators simultaneously would yield best performance. Operation of all three aerators simultaneously did not produce satisfactory performance. It has been also identified that the substrate removal efficiency could be enhanced by the conversion of the behaviour in the aerated lagoon to "facultative" type. Based on the findings it is anticipated that by operating a single aerator at a time on either edge of the lagoon would enhance the treatment efficiency because it is evident that a single aerator would be capable of producing aerobic conditions throughout the top layers of the water body while the deeper areas away from the aerator axis could have anaerobicity. In view of the high concentration of the suspended solids found in the treated effluent of the common wastewater treatment plant (due to the fact that the aerated lagoons operate to fully mixed situation) it has been recommended that primary settling be introduced.

