

PROCESS DESIGN OF ITM OXIDATION POND AND PACKAGED PLANT

RUSLAN BIN HASSAN



BUREAU OF RESEARCH & CONSULTANCY

INSTITUT TEKNOLOGI MARA

40450 SHAH ALAM, SELANGOR

MALAYSIA

1 MAY 1991

CONTENTS

ABSTRACT

1. INTRODUCTION	.....	1
2. OBJECTIVE	.....	1
3. THE TREATMENT PLANTS UNDER STUDY	.....	1
3.1 OXIDATION POND	.....	2
3.2 PACKAGED PLANT	.....	5
4. FIELD RESULTS	.....	7
5. DETERMINATION OF THE KINETIC COEFFICIENTS		
5.1 Monod Equation	.....	10
5.2 K AND K _s	.....	11
5.3 Y, k _a and U _m	.....	11
6. DISCUSSIONS AND COMPARISON	.....	15
7. CONCLUSION	.....	15
REFERENCES	.....	16

APPENDICES

Appendix 1 : ITM Packaged Plant: Principle and Operation

Appendix 2 : Field Data

Appendix 3 : Technical Paper: Application of McCarty's Biotreat Model on a Micro: Proceedings 1st. Regional Conf. on Computer Applications in Civil Engineering.

ABSTRACT

There are several methods used in the design of biological wastewater treatment plants. These include empirical, pilot plants studies and actual field performance. This work concentrates on field data by studying the performance of ITM Oxidation Pond and ITM Packaged Treatment Plant.

Field samples were taken by composite sampling technique. Several kinetic parameters were obtained. These are the Monod parameters, K_s and U_m needed in the formulation for the process design. The simulation made use of Biotreat program.

1. INTRODUCTION

In the design of biological treatment plants, the importance of utilising the bacteria cannot be overemphasised. Many parameters used in the process design are not really representative of the local environments. Since most of the design data are obtained empirically there is need to determine this information by studying the field data and try incorporate these results in the process design of the wastewater treatment plants (which utilise biological population) to be used in this country.

In this research, some operational parameters like flow characteristics and removal efficiencies were made use of in obtaining the process design parameters. These process design parameters were used to assess the performance of the wastewater treatment plants using manual calculations and a BIOTREAT program which was originally developed by Professor McCarty of Stanford University.

2. Objective

The purpose of this research is therefore to determine the process design parameters such as

- (a) kinetic coefficients, U_m , K_s , and
- (b) operational data (pH, inflow and outflow, X)

No bench-scale reactors were used in the laboratory because it is felt that at this stage, the field data were sufficient. The main use of the data are in the design of the values of the detention times in order to meet the performance objective. This done by simulation in the stated program and the results are compared with actual field performance.

3.0 The Treatment Plants under study

Two types of treatment plants are studied. The wastewater treatment plants utilise the suspended growth process of the biological population. The studies were carried out intermittently since 1986 using data from previous years and composite sampling for a period of 3 months (a-day-a-week for every 6 hours). There were many problems during the course of the study period. These are mainly due to non-availability of equipments and maintenance scheduling.

3.1 ITM Oxidation Pond

The pond is situated about 200 metres south of Hostel Delima compound. The pond is fenced allround and there is an oil palm estate about 50 metres from the fence. The oxidation pond started to operate early 1984. The contribution to this pond comes from all eight blocks of Hostel Delima and the three blocks of the dining hall. It

Layout:

It is rectangular in shape (97.53 m by 28.95 m) with rounded corners and has a depth of 2.10 m and the permissible top water level is 1.2 m. There is also a paved road measuring 3.0 m surrounding it (See Figure 1).

Pond base:

The bottom of the pond is impermeable and is made up of 450 mm selected fill materials with black polythene sheeting beneath it.

Embankment:

The embankment slope is 1:1 and is covered by 300 mm thick stone pitching. The purpose of the cover is to protect the slope of the embankment from surface wave action. The stone pitching also stops vegetation from growing and to prevent the breeding of mosquitoes.

Inlet structure:

The inlet structure of the pond consists of a sedimentation cell. It is divided into two compartments. The first compartment is smaller than the second. The size of the first compartment is 15.45 m by 0.6 m and has a depth of 0.81 m. The second compartment measures 15.45 m by 3.0 m with a depth of 3.35 m.

The function of the sedimentation cell is to sediment solids, sludge and scums so that less will enter the pond. The influent pipe to the pond has a diameter of 225 mm and is connected to the second by means of 100 mm diameter cast iron distribution pipe fitted 0.75 m centre to centre.

As the sewage enter the second compartment, some of the suspended solids will settle down to form a sludge layer while the rest will enter the pond via openings 150 mm by 225 mm located 0.6 m below the top water level at a distance of 0.75 m centre to centre.