

LAPURAN PROJEK TAHUN AKHIR
KURSUS DIPLOMA LANJUTAN KEJURUTERAAN AWAM
KAJIAN KEJURUTERAAN
INSTITUT TEKNOLOGI MARA
SHAH ALAM

DESIGN OF SEWAGE TREATMENT PLANT:
USING 'BIOTREAT' MODEL

BY

KAMAL BAHARIN BIN SAIDIN

AND

MOHAMAD FAKRI ABD. RAHMAN

SYNOPSIS

The main object of researched on waste treatment is to control and reduce the environmental pollution. It is important that the methods evolved are within the economic means of the community served.

It is generally recognised that some form of biological treatment provides the most economical solution for treatment of domestic waste waters and industrial effluents. In this respect, we made use of the biological treatment model 'Biotreat' as a design aid for a full range of biological processes employing suspended growth in a completely-mixed reactor. 'Biotreat' is capable of describing the overall reaction that occurs at a selected solid retention time so that mass balances of substrate, biological sludge, oxygen consumption and nutrient requirements can be made.

In our study we compared actual measured BOD removal efficiencies to that of the 'Biotreat' values. Studies were carried out at Pantai Sewage Treatment Plant, Wardieburn Housing Estate and ITM Package to make comparisons of these values. Only aerated lagoons, oxidation ponds and activated sludge process were being studied. From the results obtained, it was found that the treatment plants have very much lower efficiencies compared to the 'Biotreat' values.

This is mainly due to the fact that not enough input datas were entered and hence gave inaccurate results. It is hoped that further studies on 'Biotreat' model will be carried out in future since it is an effective tool as an aid in the design of sewage plants.

ACKNOWLEDGEMENT

The students are very much indebted to their supervisor, Encik Ruslan bin Hasan for his invaluable advice and guidance throughout the course of this experimental project.

The students would also like to thank Puan Saidah Nasir for typing this experimental project report.

Most of all the student would like to further their thanks to each individual who has given efforts, cooperations, ideas and encouragements directly and indirectly to make this project a success.

TABLE OF CONTENTS

	<u>Page</u>
Synopsis	I
Acknowledgement	II
Table of Contents	III
List of Tables	V
CHAPTER 1 - Introduction	1
CHAPTER 2 - Background	2
2.1. Biochemical Operation	2
2.2. Criteria for Classification	2
2.2.1. The Biochemical Environment	2
2.2.2. Nature of Biochemical Transformation	6
2.2.3. Reactor Configuration	7
2.3. Pantai Sewage Treatment Works	7
2.4. Oxidation ponds, Wardieburn Housing Estate Kuala Lumpur	8
2.4.1. Pond Layout and Design	8
2.4.2. Operating Results and Observation on the Results	9
2.5. Sewage Treatment Plant in I.T.M.	10
2.5.1. Packaged Sewage Disposal Plant	10
2.5.2. Principal of the Package Sewage Treatment	10
2.5.3. Application	12
2.5.4. Condition of the Package Treatment Plant	12
2.6. Proposed Sewage Treatment Plant at Butterworth and Bukit Mertajam	13
2.6.1. Survey on Domestic/Industrial Sewage in the Project Area	13
 <u>CHAPTER 3</u>	
3.0. Multi-Process Biological Treatment Model	14
3.1. 'Biotreat' Assumptions and Concepts	14
3.2. Development of 'Biotreat'	16
3.2.1. Process Kinetics	17
3.2.2. Suspended Solids Balance	18

	<u>Pages</u>
3.3 Generalized Equation	22
3.3.1 Empirical Formula for Cell Material	24
3.3.2 Chemical Composition of Electron Donor	25
3.3.3 Composition of Electron Acceptor	28
3.3.4 Determination of f_s	28
3.4 Determination of the Quantity of Terminal Hydrogen Acceptor needed	31
3.5 Determination of Quantity of Nutrient Needed	32
3.6 Custom Reaction	33
3.7 Two-Step Reactions	34
3.8 Coefficient Evaluation	35
3.9 Use of BIOTREAT	38
3.9.1 First data line: NC, NA, ND, MIN, MAX, INC, ND2	38
3.9.2 Second data line: TEMP, KS, B, K, Y, K2, Y2	40
3.9.3 Third data line: Q , S^o , X_d^o , X_r^o , X_{in}^o , MLSS, θ	41
3.9.4 Fourth data line: COD, ON, OC, W	43
3.9.5 Fifth data line: CARBO, PROT, FAT, UNK.	43
CHAPTER 4	
4.0 'BIOTREAT' Program	45
4.1 Output	54
4.1.1 Results	59
CHAPTER 5	
5.0 Discussion and Conclusion	64
5.1 Comments	65
Appendix	68
Notation	100
References	104