

DISSERTATION SUBMITTED IN PARTIAL FULFILMENT OF REQUIREMENTS FOR THE AWARD

OF THE MASTER OF ENGINEERING DEGREE IN ENVIRONMENTAL ENGINEERING.

UNIVERSITY OF MORATUWA

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STUDY OF SOME CHARACTERISTICS OF DOMESTIC WASTEWATER



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S U M M A R Y

Wastewater renders a potential threat to the environment. The types of wastes are many and different like domestic, agricultural, industrial, hospital, radioactive wastes, etc. Among these, the problem due to domestic wastewater will be encountered at all places where human beings dwell and this causes a great hazard. The domestic waste which is devoid of celluloid matter that is non-biodegradable, is amenable to bio-chemical treatment. This type of treatment activated by bacteria is very economical, especially in tropical countries. It depends highly on the environmental conditions of the locality.

Thus the basic treatment Parameters like B.O.D., Conc. of S.S., K_1 , etc., will vary from place to place and the values given in text books for these parameters could not be accepted for Sri Lanka blindfold, without proper verification. With this in view, Samples of raw wastewater from the Wellawatte and Bambalapitiya pumping stations of the Colombo Municipality were collected and tests were performed to ascertain the values of these parameters.



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The daily values $B.O.D._5^{20}$ and the corresponding values of the Conc. of S.S. and the inter-relationship between $B.O.D._5^{20}$ and Conc. of S.S. were studied for a week. Then long term tests of the B.O.D. were carried out to ascertain the K_1 and L_0 values and the ratios of $B.O.D._5^{20}/L_0$ & dissolved $B.O.D._5^{20}$ / total $B.O.D._5^{20}$. This was carried out in the form of four trials, two with unfiltered wastewater samples & another two with filtered wastewater samples collected from Wellawatte and Bambalapitiya, amounting to a total of eight Tests.

All this will be useful parameters for the design of treatment plants for domestic wastewater. The de-oxygenation rate was assumed to follow the 1st order kinetics and this was later verified statistically by calculating the coefficient of correlation of the line of regression.

In these Tests, no chemical inhibitors of nitrification were used, but possible experimental procedure was adopted to minimize the effect of nitrification and if the sample showed any signs of nitrification on a particular day, then the reading was rejected and calculations were based on the other readings.

The Tests were carried out as per Standard Methods(15th edition) for the examination of water and wastewater by A.W.W.A. and the GEMS guide of the W.H.O. on testing B.O.D., but with suitable procedural modifications pertinent to the facilities of testing, to minimize possible errors.

It was found that there was no sign of nitrification upto the 10th day in any of the samples tested. The daily variation in the $B.O.D._5^{20}$ value was not very high and there was no statistically significant difference with respect to $B.O.D._5^{20}$ between Wellawatte and Bambalapitiya samples. The same was the case with the daily variation of the Conc. of S.S. Even though, of not much significance, the variation of $B.O.D._5^{20}$ with Conc. of S.S. could be expressed in the form $B.O.D._5^{20} = A + B \times \text{Conc. of S.S.}$, where B was found to have a common value of 1.3 for Wellawatte and Bambalapitiya, whereas the respective values of A were 75 and 100. The values of $B.O.D._5^{20}$ and Conc. of S.S. were 245.8 mg/l & 122.3 mg/l respectively, and these were within the respective ranges though on the lower side. An estimated value of the per capita B.O.D. for the Bambalapitiya tributary was 37.0 grammes/head/day. This too was on the low side. The average K value (base 10) of 0.21 obtained was higher, though within the expected range, due to the presence of less complex organic molecules and more fibrous & cellulose matter in the waste. The ratio of $B.O.D._5^{20}/L_0$ of 77.3% obtained was correspondingly higher, whereas the ratio of Dissolved/Total $B.O.D._5^{20}$ of 46% appeared to be satisfactory. In general, all the test results were found to be within reasonable limits.

A C K N O W L E D G E M E N T.

I am grateful to Prof. D.S.Wijeyasekera and Prof. B.L.Tennekoon of the University of Moratuwa, Sri Lanka for providing the necessary facilities to carry out the Project Work.

Mrs. Niranjini Ratnayake, my Project Supervisor enabled me to formulate, set about and carry out the Project work. I am grateful to her for extending to me invaluable guidance.

I am thankful to Dr. (Mrs.) T.R. Marpitiyarachi and Mr.S.Pathinathar of the Academic Staff of the University of Moratuwa and Mr. M.Ponnambalam, Deputy Commissioner of the Occupational Health Division of the Department of Labour for the constructive criticisms and suggestions rendered by them.

I am also thankful to Prof. R.Pitchai, W.H.O. Consultant for his valuable suggestions.

I am thankful to Messrs. Laxman Ratnayake and J.M.S.J.Bandara, Lecturers in Civil Engineering for their kind services.

I am grateful to Mr. K.G. Samarakera, Deputy Director of Buildings, Mr. K. Maheswaran, Asst. Director (Electrical & Mechanical), and Mr. K.G.J.A.E. Fernando, Superintendent Engineer (Water Supply & Sewerage) of the Department of Buildings, without whose permission and consent the above Project work would not have been carried out. I sincerely thank Mrs. Renee Mahalingam and Messrs. T. Balasubramaniam and S.S. Sabanesan, Engineers attached to the Water Supply & Sewerage Division of the Department of Buildings for their kind services.

I am very much thankful to Mrs. Jayasekera and Mr. Devarajan, Engineers of the Colombo Municipality for their kind permission to collect Wastewater samples from the Colombo Municipality.

My thanks are also due to Mrs. Vaidyanathana, Bacteriologist attached to the National Water Supply & Drainage Board, Sri Lanka.

I am grateful to Mrs. Hilda Mendis, Technician attached to the Environmental Engineering Laboratory of the University of Moratuwa, for the provision of timely assistance to carry out the project work in the most expedient manner.

I extend my sincere thanks to Messrs. V.Senthivetpillai, R. G.Selvadurai, T. Jasotharan and S. Thayalaseelan for their generous assistance.

I am grateful to my sister, Miss. S. Nahananthini, who was promoting my aspirations all the time to carry out the project work to completion.

I am thankful to Mr.C.S.J.Fernando of the Department of Buildings for kindly consenting to typewrite the project work.

The services rendered by Messrs. Somaratne and Justin of the University of Moratuwa are also appreciated.



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N O T A T I O N S.

A.T.U.	Allyl Thio Urea.
B.O.D.	Biochemical Oxygen Demand.
D.F.	Dilution Factor.
D.O.	.....	Dissolved Oxygen.
I.D.O.D.	.....	Initial Dissolved Oxygen Demand.
k_1	.....	Deoxygenation Rate Constant - Base e.
K_1	.....	Deoxygenation Rate Constant - Base 10.
L	.....	Total Ultimate Biochemical Oxygen Demand.
L_0	.....	1st Stage Ultimate Biochemical Oxygen Demand.
mg/l	.....	Milligramme per Litre.
m.l.	.....	Milli-Litre.
N	.....	Number of Samples in a Population.
pH	.....	Hydrogen Ion Index.
s	.....	Standard Deviation of sample.
S.S:Conc.	.....	Suspended Solids Concentration.
T	.....	Temperature.
t	.....	Time in Days.
t'	.....	Student's Score Value.
E.C.M.P.	.....	2 Chloro - 6 - (Trichloromethyl) Pyridene.
V	.....	Number of Degrees of Freedom.
\bar{X}	.....	Mean Value.
y	.....	Biochemical Oxygen Demand Utilized.
y'	Biochemical Oxygen Demand Remaining.
δ	Coefficient of Correlation.
σ	Standard Deviation of population.



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