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PERFORMANCE OF SOME BIOLOGICAL TREATMENT PLANTS FOR INDUSTRIAL WASTE WATER TREATMENT

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During the 12 years of its existence Environmental Engineering Consultants (EEC) has designed and commissioned a large number of Industrial Wastewater Treatment Plants. The primary purpose of this paper is to present data on some of the Biological Treatment Plants which have been in operation for the last 5 years in various industries around the country.

TREATMENT PROCESSES

Basically Industrial Wastewater Treatment Processes can be divided into 2 groups, namely Primary and Secondary.

Primary Treatment generally consists of Equalization, Neutralization, Clarification and Chemical Treatment if necessary. Secondary Treatment generally consists of Biological Treatment Unit Processes.

The purpose of Primary Treatment is to prepare the wastewaters for subsequent Biological Treatment. Equalization for example results in a generally uniform quantity and quality of wastewater entering into the Biological Units. Neutralization similarly ensures a proper pH for the biomass. In addition to this, the Primary Treatment Processes like Chemical Precipitation or Chemical Coagulation would result in removal of pollutants which may inhibit Biological Process. The Primary Treatment Processes would also result in removal of Suspended Solids, Oil and Grease and some incidental reduction in organics (Biochemical Oxygen Demand). The removal of organics through Chemical Coagulation is especially significant for industrial wastewaters which contain a major portion of the organic load in the form of colloidal or suspended matter. Typical examples are Milk Processing or Food Canning wastewaters.

The Biological Treatment Processes generally employed in the treatment of industrial wastewaters are either aerobic or anaerobic. The processes may also be divided into those employing suspended biomass as against those employing biomass attached to a fixed surface. In general all the Biological Treatment Units employ a mix culture with one or more groups of microorganisms predominating depending upon the major organic component of the wastewater.

TREATMENT PLANT

The basic Treatment Plant Process Flow Diagram employed in the present discussion is presented in Figure 1. Biological Treatment Process employed in all these treatment plants is that of Extended Aeration which results in an aerobically stabilized sludge.

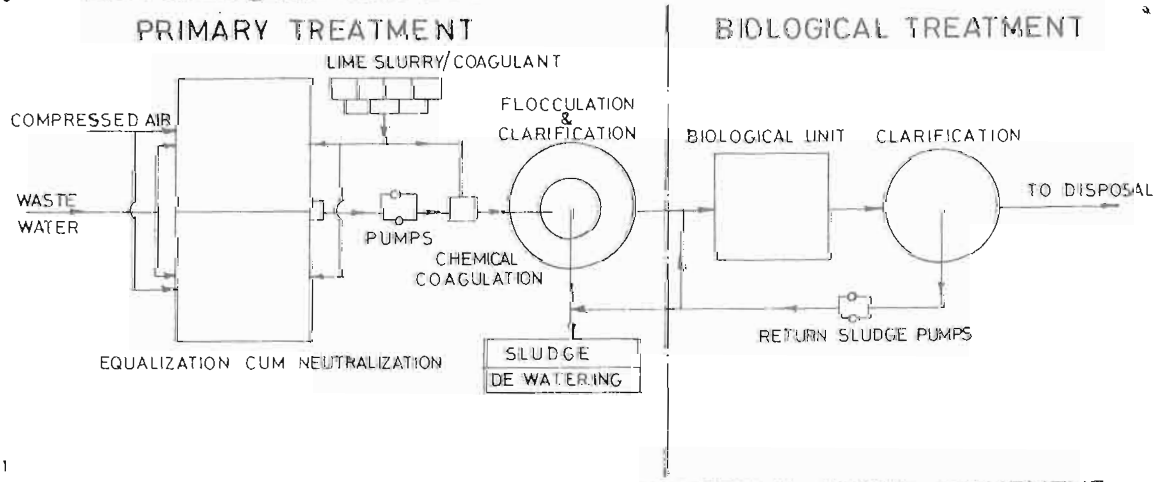

FIG - 1
TYPICAL PROCESS FLOW DIAGRAM FOR INDUSTRIAL WASTE TREATMENT

PERFORMANCE DATA

The data on performance of the various Industrial Wastewater Treatment plants for Industries manufacturing milk products, organophosphorus, pesticides, petrochemical, pharmaceutical and fine chemicals, Synthetic fibres and textiles is presented in Table 1. The data is from actual full scale treatment plants except in the case of the petrochemical plant where the data is based on Pilot Plant Studies treating 1 cum per hour of the wastewaters. All the treatment plants were designed after conducting an extensive laboratory study to determine design concentration of pollutants and design criteria for various unit processes. Based on these data, a detailed Feasibility Report was prepared considering various alternative methods of treatment and selecting the final system based on techno-economic consideration.

The data indicates the design concentration based on which the plant was designed. These concentrations are the 90 percentile values based on laboratory studies.

TABLE 1

Sr. No.	Parameter	* Sample	Unit	Concentration Min.	Concentration Avg.	Concentration Max.	90% of samples were less than or equal to
A.	MILK PRODUCTS (Plant influent - Raw wastewaters)						
1)	pH	(1)		4	-	6	-
		(2)		4.8	-	6.7	-
		(3)		5.0	-	7.4	-
2)	Suspended Solids	(1)	mg/l	-	-	-	1000
		(2)	mg/l	20	190	435	260
		(3)	mg/l	10	45	120	90
3)	Chemical Oxygen Demand (C.O.D.)	(1)	mg/l	-	-	-	4950
		(2)	mg/l	480	1085	2400	1480
		(3)	mg/l	60	155	300	240
4)	Biochemical Oxygen Demand (B.O.D.)	(1)	mg/l	-	-	-	2650
		(2)	mg/l	325	625	1150	780
		(3)	mg/l	10	35	100	80
5)	Oil and Grease	(2)	mg/l	9	44	86	64
		(3)	mg/l	2	10	30	12
B.	ORGANOPHOSPHORUS PESTICIDES (Plant influent - Equalized & Neutralized wastewater)						
1)	pH	(1)		0.2	-	12.7	-
		(2)		8.5	-	11.2	-
		(3)		6.4	-	7.4	-
2)	Suspended Solids	(2)	mg/l	10	125	408	340
		(3)	mg/l	10	43	132	110
3)	Chemical Oxygen Demand (C.O.D.)	(1)	mg/l	-	-	-	1880
		(2)	mg/l	600	1250	2338	2209
		(3)	mg/l	75	175	364	350
4)	Biochemical Oxygen Demand (B.O.D.)	(1)	mg/l	-	-	-	1050
		(2)	mg/l	360	795	1800	1700
		(3)	mg/l	8	23	45	42
5)	Oil and Grease	(2)	mg/l	0	6.4	18.4	16
		(3)	mg/l	-	2	8	5.6
6)	Dissolved Oxygen	(2)	mg/l	-	-	-	-
		(3)	mg/l	1.8	3.0	5.7	4.2
7)	Zinc (Zn)	(2)	mg/l	4.76	5.84	8.3	-
		(3)	mg/l	0.503	0.638	0.82	-

TABLE 1 (Contd.)

Sr. No.	Parameter	*Sample	Unit	Concentration Min.	Avg.	Max.	90% of samples were less than or equal to
C.	PETROCHEMICALS (Plant influent - Equalized & Neutralized wastewater)						
1)	pH	(1)		0.4	-	13	-
		(2)		6.2	-	10.2	-
		(3)		7.1	-	7.8	-
2)	Suspended Solids	(1)	mg/l	-	-	-	300
		(2)	mg/l	10	127	850	250
		(3)	mg/l	10	28	60	45
3)	Chemical Oxygen Demand (C.O.D.)	(1)	mg/l	-	-	-	4440
		(2)	mg/l	416	2620	9464	4023
		(3)	mg/l	72	103	170	144
4)	Biochemical Oxygen Demand (B.O.D.)	(1)	mg/l	-	-	-	2500
		(2)	mg/l	360	1487	5690	2550
		(3)	mg/l	15	31	95	50
5)	Chloroform Extractables	(1)	mg/l	-	-	-	114
		(2)	mg/l	9	40	130	71
		(3)	mg/l	6	12	22	15
D.	PHARMACEUTICALS & FINE CHEMICALS (Plant influent - Equalized & Neutralized wastewater)						
1)	pH	(1)		1.4	-	10.2	-
		(2)		6.5	-	7.5	-
		(3)		6.5	-	7.5	-
2)	Chemical Oxygen Demand (C.O.D.)	(1)	mg/l	-	-	-	1730
		(2)	mg/l	40	745	1180	1020
		(3)	mg/l	50	100	195	160
3)	Biochemical Oxygen Demand (B.O.D.)	(1)	mg/l	-	-	-	1200
		(2)	mg/l	215	555	1030	955
		(3)	mg/l	10	60	90	90
E.	SYNTHETIC FIBRE (Plant influent - Equalized & Neutralized wastewaters)						
1)	pH	(1)		7	-	7.5	-
		(2)		5.7	-	7.4	-
		(3)		6.6	-	8.5	-
2)	Suspended Solids	(1)	mg/l	-	-	-	210
		(2)	mg/l	45	155	480	215
		(3)	mg/l	6	30	104	60
3)	Chemical Oxygen Demand (C.O.D.)	(1)	mg/l	-	-	-	1420
		(2)	mg/l	470	1058	4040	1550
		(3)	mg/l	45	210	610	545
4)	Biochemical Oxygen Demand (B.O.D.)	(1)	mg/l	-	-	-	900
		(2)	mg/l	240	595	2600	880
		(3)	mg/l	5	85	230	180
5)	Oil and Grease	(1)	mg/l	-	-	-	180
		(2)	mg/l	17	34	52	-
		(3)	mg/l	0	4	10	-
F.	TEXTILE MILL (Plant influent - Equalized & Neutralized wastewater)						
1)	pH	(1)		-	-	11.0	-
		(2)		6.5	-	11.0	-
		(3)		7.5	-	10.5	-
2)	Chemical Oxygen Demand (C.O.D.)	(1)	mg/l	-	-	-	800
		(2)	mg/l	780	1670	3160	1300

TABLE 1 (Contd.)

Sr. No.	Parameter	*Sample	Unit	Concentration Min.	Avg.	Max.	90% of samples were less than or equal to
		(3)	mg/l	300	800	1860	1080
3)	Biochemical Oxygen Demand (B.O.D.)	(1)	mg/l	-	-	-	600
		(2)	mg/l	375	960	2537	1300
		(3)	mg/l	25	240	700	475

* (1) Design Concentration (2) Plant influent (3) Plant effluent.

COST ESTIMATES

Cost curves have been prepared based on the cost of already constructed Treatment Plants or based on plants for which detailed engineering was completed and where detailed cost estimates were available. These costs curves have a cost basis of 1978 costs and should be used with appropriate escalation factors for present estimates. It should be emphasized that these cost curves will only provide Budgetary Estimates.

ACKNOWLEDGEMENT

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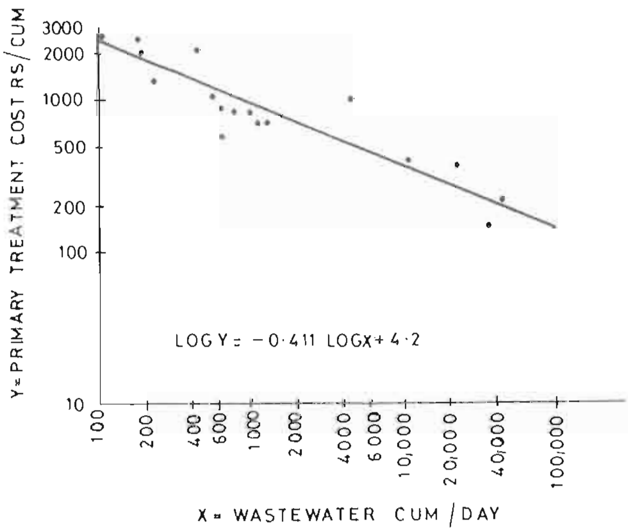

FIG-2.

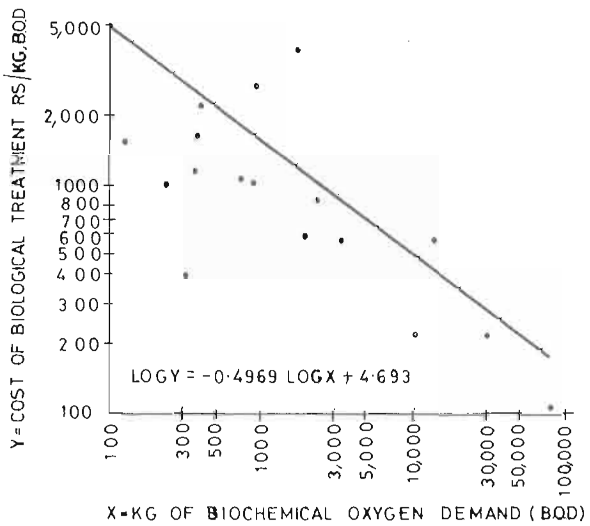

FIG-3

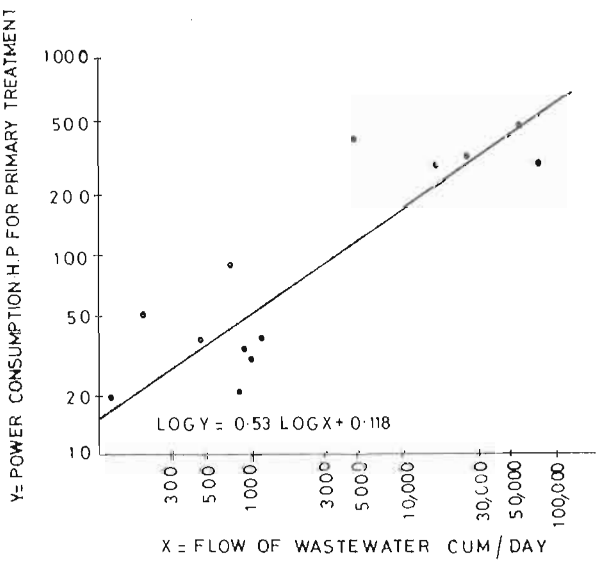

FIG-4

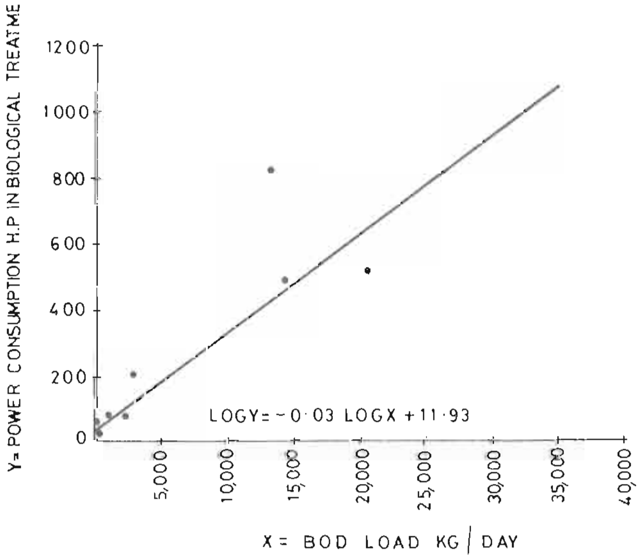

FIG-5